

Biodiversity - The variety in nature

Biodiversity is the vast array of all the species of plants, animals, insects and micro-organisms inhabiting the earth either in the aquatic or the terrestrial habitats. This diversity is essential for the long term sustainability of the environment, continuity of life on earth and the maintenance of its integrity.

Types of Biodiversity

Genetic diversity is the amount of genetic variability among individuals of a single species as also between species.

Species diversity refers to the variety of living organisms on earth and has been variously estimated to be between 5 and 50 million or more. Though, only about 1.4 million have actually been described.

Ecosystem diversity relates to the variety of habitats, biotic communities and ecological processes in the biosphere as well as the tremendous diversity within ecosystems in terms of habitat difference and variety of ecological processes.

Some other categories of biodiversity are also known. They are named with reference to a specific ecosystem, species etc.

Agro biodiversity is the component of biodiversity that is directly related to agriculture. It includes crop plants and their wild relatives, livestock and beneficial organisms such as pollinators, decomposers and predators which are normally associated with cultivated areas.

Endemic biodiversity refers to those forms of life that are exclusive to the given geographical area or ecosystem. For the sake of convenience, endemic biodiversity is often assessed within political boundaries. Islands for example are rich in endemic biodiversity.

Introduced biodiversity refers to diversity of micro-organisms, plants and animals that have been accidentally or deliberately transported by humans to landscapes, countries, regions or continents where they never occurred naturally. Disease-causing organisms, weeds, insects, pests and rats are examples of introduced biodiversity.

Microbial diversity refers to the variety in micro-organisms such as virus, bacteria, yeast, amoeba and certain fungi.

Uses of Biodiversity

All forms of life - plants, animals and humans - are so clearly interlinked that any disturbance in one gives rise to imbalance in the other. All life on earth is inter-dependent and man is only a strand in this delicate web of relationships. Our own species is subjected to evolutionary processes as any other life form, and the more we learn about them, the better we will be able to manage ourselves.

The greater the diversity of wild species, the greater is the opportunity for the production of new varieties. Almost all crops and livestock on which we depend for food production are hybrids, the result of cross breeding, originally from wild species. Hybrid species are vulnerable to an epidemic or any abnormal climatic variation, compared to their wild ancestor, which may kill them. Without the wild ancestor, it might not be possible to replace them.

Wildlife act as 'Biological indicators', i.e., they warn us about any potentially dangerous change as they are highly sensitive to environmental changes. For example the first indicator of water pollution is a change in the variety and quality of invertebrate life in the particular aquatic environment.

The medicinal utilities of a variety of species are yet to be identified. The greater the variety of wildlife we conserve, the more will we be able to learn from them.

Loss of Biodiversity

Causes for the loss of variation in flora and fauna have generally been grouped into two categories: natural and man-made

The natural causes include floods, earthquakes, landslides, natural competition between species, lack of pollination and diseases.

The most serious man-made threat to biological diversity are the deliberate destruction of the ecosystem, especially in the tropics and the disappearance of habitats, in the wake of developmental activities like industrialisation, urbanisation, mining, construction of dams, deforestation, grazing, over-exploitation, fire, etc.

India - A country of megadiversity

India is one of the richest nations in terms of biological diversity. There are two factors responsible for this.

- India has a variety of climatic zones which in turn has given rise to different types of vegetation with their inherent wealth of life.
- The existence of islands like the Andaman and Nicobar and Lakshadweep with their own variety of endemic species.

India is among the world's top twelve megadiverse nations. India stands quite high in the wealth of the total number of living species. India's biodiversity is shown in absolute numbers of species and the proportion they represent of the world total in the table overleaf.

Biocultural diversity

Indian biodiversity has been protected through the flourishing of concepts like those of the sacred trees, sacred groves and sacred gardens. Cultures have protected biodiversity by using indigenous knowledge systems.

Traditional systems like Ayurveda, Siddha, Unani are dependent on medicinal plant sources and have, in turn, helped maintain their diversity as well. Human faith and beliefs have played a significant role in biodiversity conservation in India for centuries and will continue to do so for some time to come.

Comparison between the number of species in India and the World

Group	No. of species in India	No. of species in the World
Mammals	372	4,231
Birds	1175	8,400
Reptiles	399	5,375
Amphibians	181	2,000
Fishes	1693	23,400
Insects	60000	800,000
Flowering plants	15000	2,50,000

Source: Wildlife Institute of India (1993), Biodiversity in India, R.R.Rao (1994)

Biosphere reserves

Biosphere reserves are areas of terrestrial and aquatic ecosystems. Appropriate management mechanisms must be applied for the conservation of the ecosystems to ensure their biodiversity.

Biosphere reserves are designed to bring people and nature together to demonstrate how to both use and preserve nature. There are currently more than 375 biosphere reserves in 85 countries, forming a global network of scientists and natural resource managers working to maintain the long-term survival of fragile ecosystems.

Wildlife and its conservation in India

Wildlife refers to any living organism in its natural habitat. It includes all plants, animals and micro organisms other than the cultivated plants and domesticated animals.

The unabated decline of wildlife in India continued until the late 60's when mounting concern led to a number of conservation steps. The network of national parks and sanctuaries has gradually grown from 10 National Parks and 127 Sanctuaries, covering about 25,000 sq.km. in 1970 to 75 National Parks, 421 Sanctuaries 23 project tiger reserves and 7 biosphere reserves.

Several laws have been enacted in India for the protection of wildlife and its habitats. Some of these are

- Tamil Nadu Wild Elephant Preservation Act, 1879
- The Indian Fisheries Act, 1897
- The Wild Birds and Animals Protection Act, 1912
- The Indian Forest Act, 1927
- Bengal Rhinoceros Preservation Act, 1932
- Elephants Preservation (Bengal Amendment) Act, 1932
- Constitution of India (Art 48-A)
- Bombay Wild Animals and Wild Birds Protection Act, 1951
- Assam Rhinoceros Preservation Act, 1954
- The Prevention of Cruelty to Animals Act, 1960
- The Wild Life (Protection) Act, 1972
- The Forest (Conservation) Act, 1980
- Wildlife (Protection) Amendment Act, 1991

Conservation of Biodiversity

Conservation of biological diversity is essential for the survival of the human race. The advantages of biodiversity conservation are:

- It leads to the conservation of essential ecological diversity and life support systems.
- It leads to the preservation of genetic diversity of plants and animals for better species growth.
- It leads to the maintenance of samples of unchanged biotic community in their natural form for breeding and study purposes.

Biodiversity conservation outside the areas where species naturally occur is known as ex-situ conservation, while conservation in their natural habitat is termed as in-situ conservation. Earlier, biodiversity conservation was limited to saving genes, species and habitats. But now a new conservation philosophy has emerged, based on saving biodiversity.

Species-focussed conservation efforts are essential, but they must be complemented by efforts to conserve habitats and ecosystems in natural or semi-natural states. Indeed, separate international conservation agreements on species, genes and ecosystems tend to raise barriers that hinder the required integrated approach. Moreover, conserving genetic diversity is often the key to maintaining the viability of species population. Four major international moves are afoot to conserve biodiversity.

The World Bank and the United Nations Development Programme (UNDP) have established the Global Environmental facility in 1990 on a three year pilot basis.

The international biodiversity strategy programme organised by the World Resources Institute, the World Conservation Union and United Nations Environment Programme (UNEP) involves more than 40 governmental and non-governmental organisations around the world.

Under UNEP's auspices, more than 150 nations worked to negotiate a 'Convention on Biological Diversity' at the 'Earth Summit', in Rio de Janeiro, Brazil in 1992. This convention seeks to establish a legal framework governing international financial support for biodiversity conservation, the identification of international conservation priorities, and the transfer of technologies for both the conservation and the use of biodiversity.

The 'Earth Summit' produced "Agenda 21", a plan for action on a number of issues, including biodiversity conservation in the 21st century.

The accepted categories of existence or otherwise of plants and animal species is given below based on the International Union for Conservation of Nature and Natural Resources (IUCN).

Normal species: Species whose population levels are considered to be normal for their survival.

Endangered species: These are species which are in danger of extinction. The survival of such species is difficult if the negative factors that have led to a decline in their population continue to operate. Endangered species include those whose numbers have been reduced to a critical level and those whose habitats are under threat.

Example: Black buck, crocodile, Indian wild ass, Indian rhino, lion tailed macaque.

Vulnerable species: These are species whose population has declined to levels from where it is likely to move into the endangered category in the near future if the negative factors continue to operate.

Example: Blue sheep, Asiatic elephant, Gangetic dolphin.

Rare species: Species with small population that are at present endangered nor vulnerable but are at considerable risk. These species may move into endangered or vulnerable category if the negative factors affecting them continue to operate.

Example: Himalayan brown bear, wild Asiatic buffalo, desert fox and hornbill.

Extinct species: Those species which are not found after searches of known or likely areas where they may occur. A species may be extinct from a local area, region, country, continent or the whole earth.

Example: Asiatic cheetah, pink head duck, dodo

Endemic species: These are species which occur only in a restricted area usually isolated by natural or geographical barriers.

Example: Andaman teal, Nicobar pigeon, Andaman wild pig.

Clothing Vs Biodiversity

Natural selection has always been the theory to determine the species that would live on earth, including humans. This is possible only due to biodiversity i.e. out of the innumerable species on this planet, only those which possess the ability to survive the existing environmental conditions were given the visa to exist. If monoculture is to substitute biodiversity, then natural selection will get transformed into natural destruction, and we are now heading towards that state slowly and steadily.

In cloning technology, photocopies of the animals are produced and the day is not far when the land will be occupied by only a very few species of animals. These clones might substitute the natural species as it has a better chance of survival than the latter, due to the special conditions and care provided by the scientists. This might strongly disrupt the food chain / food web pattern. Genetically engineered clones might be able to resist the power of their predators or may become unpalatable. Once the web gets disrupted, the ecological balance is lost and natural destruction sets in.

Natural destruction need not follow the same pattern necessarily. Once monoculture of clones sets in, a simple outbreak of a disease is enough to wipe out the entire race if the genetic makeup is vulnerable, or in the long run, a natural destructive process might set in which is enough to completely sweep the clones off the stage.

Countries leading in the Diversity of Species

Countries	No of Mammals	No of birds	No of reptiles	No of amphibians	No of angiosperm
Indonesia	515	1519	600	270	20000
Mexico	449	-	717	282	25000
Brazil	428	622	467	516	55000
China	394	1195	-	265	27000
Peru	361	1703	297	251	20000
Columbia	359	1721	383	407	45000
India	350	1200	353	-	-

Source: Global biodiversity strategy, Guidelines for action to save, study and use earth's biotic wealth, sustainably and equitably, World Resource Institute (WRI), the World Conservation Union (IUCN), United Nations Environment Programme (UNEP), 1992.

The future - A bleak and hostile environment

According to Food and Agricultural Organisation (FAO), the closed tropical forests are disappearing at 7.5 mha per year and the open forests at 3.8 mha a year. According to UNEP, roughly 16-20 mha of tropical forests are being burnt or axed each year. i.e. more than the size of a football pitch every second for various developmental activities and for meeting the requirements of food, fodder and fuelwood for the growing human and livestock population.

The rate of deforestation in the tropics is much faster than in other parts of the world and is equivalent to about 21.5 ha/min. In India alone about 1.5 mha of prime forests were felled during the 1980s. This also plays a major role in the loss of biodiversity. This large scale destruction of habitat will ultimately affect the biodiversity making the earth poorer in sustenance for the continued existence of life. A dismal picture indeed if the necessary steps are not taken to arrest the loss in biodiversity.