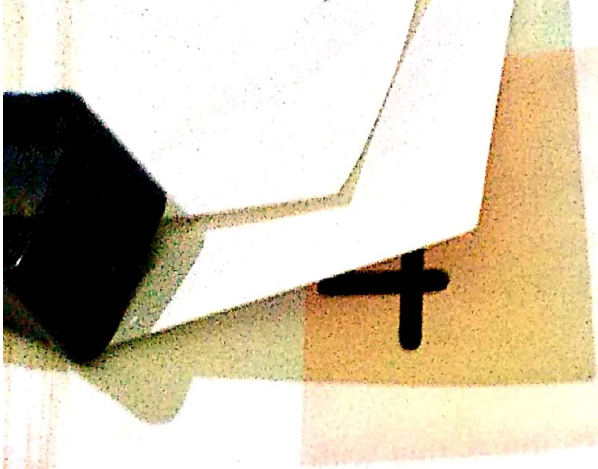

Biodiversity and its Conservation

If we divide the whole earth's mass into 10 billion parts, it is only its one part where life exists and the astounding variety of living organisms numbering somewhere around 50 million species are all restricted to just about a kilometer-thick layer of soil, water and air. Isn't it wonderful to see that so much diversity has been created by nature on this earth from so little physical matter!

Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem complexes in which they occur. From the driest deserts to the dense tropical rainforests and from the high snow-clad mountain peaks to the deepest of ocean trenches, life occurs in a marvellous spectrum of forms, size, colour and shape, each with unique ecological inter-relationships. Just imagine how monotonous and dull the world would have been had there been only a few species of living organisms that could be counted on fingertips!

In the Convention of Biological Diversity (1992), biodiversity has been defined as the variability among living organisms from all sources including *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part.

Levels of Biodiversity

Units of biodiversity may range from the genetic level within a species to the biota in a specific region and may extend up to the great diversity found in different biomes.

GENETIC DIVERSITY

It is the basic source of biodiversity. The genes found in organisms can form enormous number of combinations each of which gives rise to some variability. Genes are the basic units of hereditary information transmitted from one generation to other. When the genes within the

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species show different versions due to new combinations, it is called genetic variability. For example, all rice varieties belong to the species *Oryza sativa*, but there are thousands of wild and cultivated varieties of rice which show variations at the genetic level and differ in their colour, size, shape, aroma and nutrient content of the grain. This is the genetic diversity of rice.

SPECIES DIVERSITY

This is the variability found within the population of a species or between different species of a community. It represents broadly the species richness and their abundance in a community. There are two popular indices of measuring species diversity known as *Shannon-Wiener index* and *Simpson index*.

What is the number of species on this biosphere? The estimates of actual number vary widely due to incomplete and indirect data. The current estimates given by Wilson in 1992 put the total number of living species in a range of 10 million to 50 million. Till now only about 1.5 million living and 300,000 fossil species have been actually described and given scientific names. It is quite likely that a large fraction of these species may become extinct even before they are discovered and enlisted.

ECOSYSTEM DIVERSITY

This is the diversity of ecological complexity showing variations in ecological niches, trophic structure, food-webs, nutrient cycling etc. The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc. Thus, there occurs tremendous diversity within the ecosystems, along these gradients. We may consider diversity in forest ecosystem, which is supposed to have mainly a dominance of trees. But, while considering a tropical rainforest, a tropical deciduous forest, a temperate deciduous forest and a boreal forest, the variations observed are just too many and they are mainly due to variations in the above mentioned physical factors. The ecosystem diversity is of great value that must be kept intact. This diversity has developed over millions of years of evolution. If we destroy this diversity, it would disrupt the ecological balance. We cannot even replace the diversity of one ecosystem by that of another. Coniferous trees of boreal forests cannot take up the function of the trees of tropical deciduous ecosystem diversity has evolved

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VALUE OF BIODIVERSITY

The value of biodiversity in terms of its commercial utility, ecological services, social and aesthetic value is enormous. We get benefits from other organisms in innumerable ways. Sometimes we realize and appreciate the value of the organism only after it is lost from this earth. Very small, insignificant, useless looking organism may play a crucial role in the ecological balance of the ecosystem or may be a potential source of some invaluable drug for dreaded diseases like cancer or AIDS. The multiple uses of biodiversity or biodiversity value has been classified by McNeely *et al* in 1990 as follows:

(*i*) **Consumptive use value:** These are direct use values where the biodiversity product can be harvested and consumed directly e.g. fuel, food, drugs, fibre etc.

Food: A large number of wild plants are consumed by human beings as food. About 80,000 edible plant species have been reported from wild. About 90% of present day food crops have been domesticated from wild tropical plants. Even now our agricultural scientists make use of the existing wild species of plants that are closely related to our crop plants for developing new hardy strains. Wild relatives usually possess better tolerance and hardiness. A large number of wild animals are also our sources of food.

Drugs and medicines: About 75% of the world's population depends upon plants or plant extracts for medicines. The wonder drug ***Penicillin*** used as an antibiotic is derived from a fungus called *Penicillium*. Likewise, we get ***Tetracyclin*** from a bacterium. Quinine, the cure for malaria is obtained from the bark of ***Cinchona*** tree, while *Digitalin* is obtained from foxglove (***Digitalis***) which is an effective cure for heart ailments. Recently ***vinblastin*** and ***vincristine***, two anti-cancer drugs, have been obtained from Periwinkle (*Catharanthus*) plant, which possesses anti-cancer alkaloids. A large number of marine animals are supposed to possess anti-cancer properties which are yet to be explored systematically.

Fuel: Our forests have been used since ages for fuel wood. The fossil fuels coal, petroleum and natural gas are also products of fossilized biodiversity. Firewood collected by individuals are not normally marketed, but are directly consumed by tribals and local villagers, hence falls under consumptive value.

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(*ii*) **Productive use values:** These are the commercially usable values where the product is marketed and sold. It may include lumber of wild gene resources that can be traded for use by scientists for introducing desirable traits in the crops and domesticated animals. These may include the animal products like tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, fur of many animals, lac from lac insects etc., all of which are traded in the market. Many industries are dependent upon the productive use values of biodiversity e.g., the paper and pulp industry, plywood industry, railway sleeper industry, silk industry, textile industry, ivory-works, leather industry, pearl industry etc.

Despite international ban on trade in products from endangered species, smuggling of fur, hide, horns, tusks, live specimen etc. worth millions of dollars are being sold every year. Developing countries in Asia, Africa and Latin America are the richest biodiversity centers and wildlife products are smuggled and marketed in large quantities to some rich western countries and also to China and Hong Kong where export of cat skins and snake skins fetches a booming business.

(*iii*) **Social value:** These are the values associated with the social life, customs, religion and psycho-spiritual aspects of the people. Many of the plants are considered holy and sacred in our country like Tulsi (holy basil), Peepal, Mango, Lotus, Bael etc. The leaves, fruits or flowers of these plants are used in worship or the plant itself is worshipped. The tribal people are very closely linked with the wildlife in the forests. Their social life, songs, dances and customs are closely woven around the wildlife. Many animals like cow, snake, bull, peacock, owl etc. also have significant place in our psycho-spiritual arena and thus hold special social importance. Thus, biodiversity has distinct social value, attached with different societies.

(*iv*) **Ethical value:** It is also sometimes known as **existence value**. It involves ethical issues like "*all life must be preserved*". It is based on the concept of "*Live and Let Live*". If we want our human race to survive, then we must protect all biodiversity, because biodiversity is valuable.

The ethical value means that we may or may not use a species, but knowing the very fact that this species exists in nature gives us pleasure. We all feel sorry when we learn that "passenger pigeon" or "dodo" is no more on this earth. We are not deriving anything direct from kangaroo, zebra or giraffe, but we all strongly feel that these species

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should exist in nature. This ... of existence value attached to each species.

(v) **Aesthetic value:** Great aesthetic value is attached to biodiversity. No one of us would like to visit vast stretches of barren lands with no signs of visible life. People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is now known as *eco-tourism*. The "*Willingness to pay*" concept on such eco-tourism gives us even a monetary estimate for aesthetic value of biodiversity. Ecotourism is estimated to generate about 12 billion dollars of revenue annually, that roughly gives the aesthetic value of biodiversity.

(vi) **Option values:** These values include the potentials of biodiversity that are presently unknown and need to be explored. There is a possibility that we may have some potential cure for AIDS or cancer existing within the depths of a marine ecosystem, or a tropical rainforest.

Thus option value is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an effective option for something important in the future. Thus, the option value of biodiversity suggests that any species may prove to be a miracle species someday. The biodiversity is like precious gifts of nature presented to us. We should not commit the folly of losing these gifts even before unwrapping them.

The option value also includes the values, in terms of the option to visit areas where a variety of flora and fauna, or specifically some endemic, rare or endangered species exist.

(vii) **Ecosystem service value:** Recently, a non-consumptive use value related to self maintenance of the ecosystem and various important ecosystem services has been recognized. It refers to the services provided by ecosystems like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of water, their role as carbon sinks, pollutant absorption and reduction of the threat of global warming etc.

Different categories of biodiversity value clearly indicate that ecosystem, species and genetic diversity all have enormous potential and a decline in biodiversity will lead to huge economic, ecological and socio-cultural losses.

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