

Unit - 1: Biodiversity and its conservation

Lecture 1

1.1 Definition, concept, levels of biodiversity.

Biodiversity

The word “biodiversity” refers to the variety of living organisms (flora and fauna). Biodiversity or Biological diversity is defined as the variability among all living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part. Wilson, 1988 defined ‘Biological diversity’ or ‘biodiversity’ as that part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plant and animal species at different scales in space i.e. local, regional, country wise and global, and various types of ecosystems- both terrestrial and aquatic-within a defined area.

Levels of Biodiversity: Biological diversity deals with the degree of nature’s variety in the biosphere. This variety can be observed at three levels i.e., genetic, species and ecosystem.

1. Genetic diversity: Genetic diversity refers to the variation at the level of individual genes. Tremendous amount of genetic diversity exists within individual species. This genetic variability is responsible for the different characters in species. Genetic diversity is the raw material from which new species arise through evolution. Today, the genetic diversity is made use to breed new crop varieties, disease resistant crops.

2. Species diversity: The number of species of plants and animals that are present in a region constitutes its species diversity. This diversity is seen both in natural ecosystem and in agricultural ecosystem. Some areas are richer in species than others. For example, natural undisturbed tropical forests have much greater species richness than mono culture plantations developed by the forest department for timber products

3. Ecosystem diversity: There are a large variety of different ecosystem on earth, each having their own complement of distinctive inter linked species based on 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 taluk. Distinctive ecosystems include landscapes like forests,

grasslands, deserts, mountains etc. as well as aquatic ecosystems like rivers, lakes and seas. Each region also has man- modified areas such as farmland or grazing pastures. It refers to the variation in the structure and functions of the ecosystem. It describes the number of niches, trophic levels and various ecological processes that sustain energy flow, food webs and the recycling of nutrients. It has focus on various biotic interactions and the role and functions of keystone species.

Methods of measuring Biodiversity: There are three perspectives measuring of diversity at the level of community. These are alpha diversity, beta diversity and gamma diversity

1. Alpha diversity indicates diversity within the community. It refers to the diversity of organisms sharing the same community or habitat. A combination of species richness and equitability / evenness is used to represent diversity within a community or habitat.

2. Beta diversity indicates diversity between communities. Species frequently change when habitat or community changes. There are differences in species composition of communities along environmental gradients, e.g. altitudinal gradient, moisture gradient, etc. the higher heterogeneity in the habitats in a region or greater dissimilarity between communities exhibit higher beta diversity.

3. Gamma diversity refers to the diversity of the habitats over the total land scope or geographical area. The sum of alpha and beta diversities of the ecosystems is an expression of the biodiversity of landscape, which is considered as Gamma Diversity. Higher diversity at community level provides stability and higher productivity. In temperate grasslands, it has been observed that diverse communities are functionally more productive and stable, even under environmental stresses such as prolonged dry conditions.

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Lecture 2

Values of Biodiversity

Values of Biodiversity Ecosystems and species provide an enormous range of goods and other services immediate as well as long term, material as well as spiritual and psychological - which are vital to our well-being. The values of the earth's biological resources can broadly be classified into

Direct Values: Consumptive and productive uses: **Food Resources:** Grains, vegetables, fruits, nuts, condiments, tea-coffee, tobacco, liquor, oil from plant resources; and meat, fish, egg, milk (and milk products), honey, etc. from animal resources. **Other Resources:** Medicine, fuel, timber, household accessories, fodder, fiber, fertilizer, wool, leather, paint, resin, wax, thatch. **Ornamental plants,** rubber, creams, silk, feathers, decorative items, etc. and **Indirect Values:** Non-consumptive uses and options for the future.

1. Consumptive Use: Man is mostly dependent on plant and animal resources for his dietary requirements. A major share of our food comes from domesticated crops and animals. Still we derive major of food from wild species. A large section of human population is dependent on food, which we gather from seas, and oceans that is harvested from free roaming wild organisms. Seafood is rich in minerals and vitamins and contains up to 60 percent of the protein. Unfortunately, deforestation, hunting and clearing of forests, grazing and expansion of agricultural lands removes potentially valuable food species and the wild ancestors of our domestic crops.

2. Productive Use: Trade and commerce industry is very largely dependent on forests. Besides, timber, firewood, paper pulp, and other wood products, we get many valuable commercial products from forests. Herbs of medicinal value. Rattan, cane, sisal, rubber, pectins, resins, gums, tannins, vegetable oils, waxes, and essential oils are among the products gathered in the wild form forest areas. Like Himalayan forests serve as a storehouse of medicinal herbs, which are presently being used to cure many diseases. Many wild species e.g. milkweeds, etc. are also being investigated as a source of rubber, alkaloids, and other valuable organic chemicals.

3. Medicine: Many medicinal and aromatic plants are being exploited in the wild to tap their potential for different ailment cure in the field of drug extraction e.g. Hippophae rhamnoides,

Ephedra Kerardiana. Dactylorhiza hatageria etc. Besides, they are being cultured in plantations and protected in wild to encourage in-situ and ex-situ conservation viz. Valley of flowers, Rohtang in Kullu, Lahu & Spiti Valley. Animal products are also sources of drugs, analgesics pharmaceuticals, antibiotics, heart regulators, anticancer and ant parasite drugs, blood pressure regulators, anticoagulants, enzymes, and hormones.

4. Ecological Benefits: Man cannot have control over nature in the wild. It can only put “pressure on resources and pollute environment. Then what makes environment act as a self-replenishing system with respect to resource generation and self-cleanliness. To answer this comes into picture the role of biological communities. The processes of soil formation, waste disposal, air and water purification, nutrient cycling, solar energy absorption, and management of biogeochemical and hydrological are all beyond the scope of man’s control. Non-domestic plants, animals, and microbes do this favor to mankind by maintaining ecological processes at no cost. These also serve as a library of gene pool. Wild species of plants and animals exercise control over disease-carrying organisms and in suppressing pests. Food chain explains how nature keep a control over population of organisms wherein organisms of small size and larger in number are consumed by organisms large in size and smaller in number to next higher tropic level. Hence, preservation of natural areas and conservation of wild species should be encouraged and practiced to restore the biological wealth.

5. Aesthetic Use: Wild species of plants and animals have always appealed man’s psyche. Human society has evolved from his early habitat in the forests, which abounds in flora and fauna. Till date his instinct to observe nature in the wild calls him from socially and culturally an evolved society, as tourist from far and wide places. Thousands of tourists visit national park, sanctuaries and forests throughout the country and especially in mountainous areas. A glance of temperate grasslands perhaps the most beautiful landscape pleases and comforts man. All domestic plants have evolved from wild ancestors and food gathering is no longer a necessity for man but still thousands enjoy hunting, fishing and other adventurous outdoor activities that involve wild species. Such environment and playful exercise gives man an opportunity to renew his pioneer skills, and be at mental ease after leading a hectic day in today’s life. Man enjoys his surrounding by decorating it with images of wild animals and plants.

6. Cultural Benefits: A particular species or community of organisms may have emotional value for a group of people who feel that their identity is inextricably linked to the natural

components of the environment that shaped their culture. This may be expressed as a religious value, or it may be a psychological need for access to wildlife. In either case, we often place a high value on the preservation of certain wild species.

7. Optional Values: This refers to the use of various species for the benefit of mankind, sometime in future. The hunt for various species under the scope of biotechnology is already underway for finding solutions to various environmental problems. The environmental issues being addressed to be: pollution as a major problem, ways to fight various disease viz., cancer, diabetes etc., AIDS and others. Indirect Values Non-consumptive uses and options for the future: 1. Carbon fixing through photosynthesis, which provides the support system for species. 2. Pollination, gene flow, etc. 3. Maintaining water cycles, recharging ground water, protecting watersheds. 4. Buffering from climatic extreme conditions such as flood and drought; 5. Soil production and protection from erosion; 6. Maintaining essential nutrient cycles, e.g. carbon, nitrogen, and oxygen and others. 7. Absorbing and decomposing pollutants, organic wastes, pesticides, air and water pollutants; 8. Regulating climate at both macro and micro levels; 9. Preserving recreational, aesthetic, socio-cultural, scientific, educational, ethical and historical values of natural environments.

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Lecture 3

1.3 Threats to Biodiversity

- Habitat loss
- poaching of wildlife
- Man wildlife conflict

THREATS TO BIODIVERSITY: The biggest reason for the current increase in extinctions is habitat loss. Destruction of tropical forests, coral reefs, estuaries, Marshes, and other biologically rich ecosystems threaten to eliminate thousands or even millions of species in a human-caused mass extinction that could rival those of geologic history. By destroying habitat, we eliminate not only prominent species but also many obscure ones of which we may not even be aware. Over harvesting of food species is probably the most obvious way in which humans directly destroy biological resources. There are many, historic examples of human disturbances of natural systems. Once-fertile areas have become deserts because of unsound forestry, grazing, and agricultural practices. Technology nm” makes it possible for us to destroy vast areas even faster than in the past. Undoubtedly the greatest current losses in terms of biological diversity and unique species occur when tropical moist forests are disrupted. Some of the major causes of threat to biodiversity are explained as follows:

1. Habitat Destruction: Deforestation has been one of the major causes for the depletion of wildlife. With the increase in human population and the growing need for resources, forests were cleared or for agricultural operations, for human habitation and for grazing their livestock. Technological advance and human progress had a direct bearing on the exploitation of natural resources. Forest trees were cut to yield timber for building houses, for making furniture and for collecting wood as fuel. Industries made a heavy demand on forest resources such as wood for paper- making, exploitation of gums and resins, mining of forestland for mineral ores, building materials, etc. Habitat destruction thus has an adverse impact on wildlife as it leads to the loss of an environment, which provides them food and breeding grounds or nesting sites to facilitate rearing of their young ones. Wild animals are left with no alternative but to adapt, migrate or perish. Widespread habitat loss all over the country has diminished the population of many species, making them rare-and endangered. In our race for progress and prosperity we have disturbed the delicate balance of Nature.

2. Hunting and Poaching: Uncontrolled hunting of wildlife for pleasure, food, furs. Skins, horns, tusks, etc. pose a serious threat to the survival of wildlife. In India, the Cheetah was hunted to extinction. The illegal trade in animal skins has been responsible for the destruction of a large number of tigers, leopards, deer, fishing cat, crocodiles and snakes, as well as birds with beautiful plumage. Elephants were hunted for ivory. The rhinoceros was killed for its horns because of the superstitious belief that it contained aphrodisiac properties. There are laws in the country to prevent such illegal trade, but unscrupulous elements, traders and exporters often violate these. Added to this is the practice of trade in exotic mammals, birds and reptiles and use of wild animals in biomedical research.

3. Pollution: Pollution of air, water and soil due to various industrial activities not only affect our health, but the health and well-being of animal population also. Industrial effluents one reaching water bodies adversely affect aquatic life. Pesticides like DDT and Dieldrin are very harmful. These have a major effect particularly sea birds and their eggs. Oil pollution is another serious problem affecting the seas through leakage from cargo ships or accidents. Besides there are other numerous factors that affect wildlife population, which are mostly anthropogenic. Introduction of exotic species, unhealthy agricultural practices, diseases introduced by domesticated animals, silting of rivers, floods and droughts are a few to name some. These all have somehow contributed to the process of endangering animal species.

4. Man and Wildlife Conflict: Man by virtue of his nature is destructive and self-centred despite the fact that he is known as social animal. Until he realizes the need of time no rules and regulations may help. The exploitation of forests and wildlife or rare species for commercial purposes should be stopped. A good tiger skin is worth more than five thousand rupees. The tusks of an elephant and the skin of big cats also fetch a good prize. The horns of rhinoceros carry a highly fancy prize. This high market value has lead to unlimited slaughter of these animals.