Department of zoology

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Course name-Ecology and applied zoology

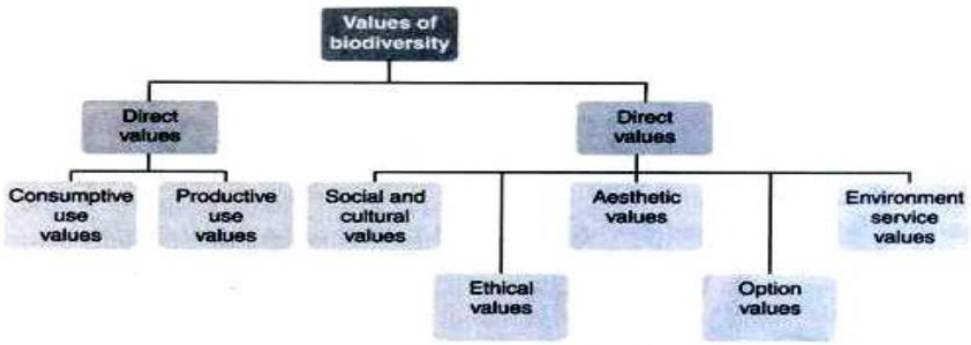
Biodiversity and its importance

The earth holds a vast diversity of living organisms, which includes different kinds of plants, animals, insects, and microorganisms. The earth also holds an immense variety of habitats and ecosystems. **The total diversity and variability of living things and of the system of which they are a part is generally defined as biological diversity, i.e. the total variability of life on earth.** In other words it also refers to the totality of genes, species and ecosystems in a region. Biodiversity includes diversity within species, between species and of ecosystems. It can be partitioned, so that we can talk of the biodiversity of a country, of an area, or an ecosystem, of a group of organisms, or within a single species. The term biodiversity, the short form of biological diversity, was coined by Walter G. Rosen in 1985, however the origin of the concept go far back in time. Perception of biodiversity varies widely among different segments, such as biologists, sociologists, lawyers, naturalists, conservationists, ethnobiologists and so on. Thus, biodiversity issues have been unifying force among people of various professions and pursuits.

Biodiversity represents the very foundation of human existence. Besides the profound ethical and aesthetic implications, it is clear that the loss of biodiversity has serious

economic and social costs. The genes, species, ecosystems and human knowledge which are being lost represent a living library of options available for adapting to local and global change. Biodiversity is part of our daily lives and livelihood and constitutes the resources upon which families, communities, nations and future generations depend. Biodiversity can be set in a time frame so that species extinctions, the disappearance of ecological associations, or the loss of genetic variants in an extant species can be classed as loss of biodiversity. Similarly additions to biodiversity includes addition of new elements of life by mutation, by artificial breeding, by biotechnology or by ecological manipulation.

A large number of factors and forces are responsible for the steep decline in the earth's biodiversity during the last century. Most of these are caused due to tremendous increase in human population and this in turn resulted in the overexploitation of certain plant and animal resources for food, medicine, skin, fur, tusks, musk, etc., habitat loss and fragmentation, land use change and pollution. Concerns have been raised about the loss of biodiversity especially after the United Nations Conference on Environment and Development (UNCED) held at Rio de Janeiro in 1992, where loss of biodiversity was recognized as one of the most important problem of this century. The primary reason for the concern is the realization that biodiversity is being lost even before its size is known.



Values of Biodiversity

Importance

(1) Economic importance: Biodiversity is beneficial in following ways

(i) Plants: Plants forms the basis of biotic existence. They produce food not only for themselves but also for all other organisms, including man. Plants provide provide timber, paper, gums, resins, drugs, tannins, fibers (cotton, jute), rubber, vegetable oils, sugar, tea

coffee, condiments, fuel, wood alcohol, charcoal and dry fruits. Plants also release oxygen, check soil erosion, provide shelter to animals and microorganisms, prevent floods and advancement of deserts and control climate. Plants also decorate our land and provide pleasing greenery.

(ii) Animals: Animals are consumers and bring about biodegradation of organic compounds. Producers-decomposers food chains can keep an ecosystem self sufficient and viable. However, some animals do play an important role. Earthworms and other burrowing animals make soil porous to facilitate plant growth. Animals also enrich soil with their excreta (urine and faeces). Many insects help in pollination and some birds and mammals aid in dispersal of fruits and seeds. Animals also provide CO_2 to producers. Animals provide a number of useful materials too these include meat, egg, oil, fat, fur, wool, silk, leather, musk, ivory, honey, lac, coccineal (red pigment), hair, feathers, guano, pearls and shells etc. Some act as scavengers. Animals are used for transport and agricultural operations also. Many form nice pets. Some play a role in biological control of pests.

(iii) Microorganisms: Bacteria and fungi act as decomposers in nature. They release inorganic compounds from dead organic matter into the environment for reuse by plants and thereby clear the environment of debris to make room for new life. Some microbes fix atmospheric nitrogen for plants. Certain bacteria help in digestion of food in the animal intestines. Microorganisms are used in industries for the production of vitamins and antibiotics.

(2) Ecological balance: All organisms are adjusted in food chains and interact with their abiotic environment in such a way to keep the natural cycles going and make the ecosystem self sustaining unit. Disappearance of any link in a food chain may upset nature's balance and

create problems e.g" destruction of snakes will increase population of rats which will destroy crops; killing of carnivores will increase the population of herbivores that will damage forests, grasslands or crops; clearance of forests will affect rainfall and thereby entire ecosystem and human economy.

(3) Gene banks: increase in the yield of a crop or an animal products (milk) is not possible merely by providing improved inputs (fertilizers), irrigation and pesticides for a crop, balanced diet and proper care for an animal. A variety of the crops or of the animal that has the genetic potential to respond to the improved inputs is also essential. For producing such favourable varieties, plants and animals breeders select useful genes by screening a wide range of their wild relatives. In such a way new improved varieties of crops and animals can be produced by genetic modifications of their wild relatives. This indicate the need for protecting wildlife for breeding programmes in agriculture, horticulture, apiculture, sericulture, floriculture, animal husbandry and fishery.

As few years back, a grasshopper called brown plant hopper was found attacked the high yielding rice varieties worldwide with few rice varieties having resistance against this pest. These resistant gene from these varieties was then introduced into the varieties that were highly susceptible to the pest. Another use of gene transfer can be found in increasing the shelf life of vegetables such as tomatoes which enhances the life period of tomato after which it deteriorates.

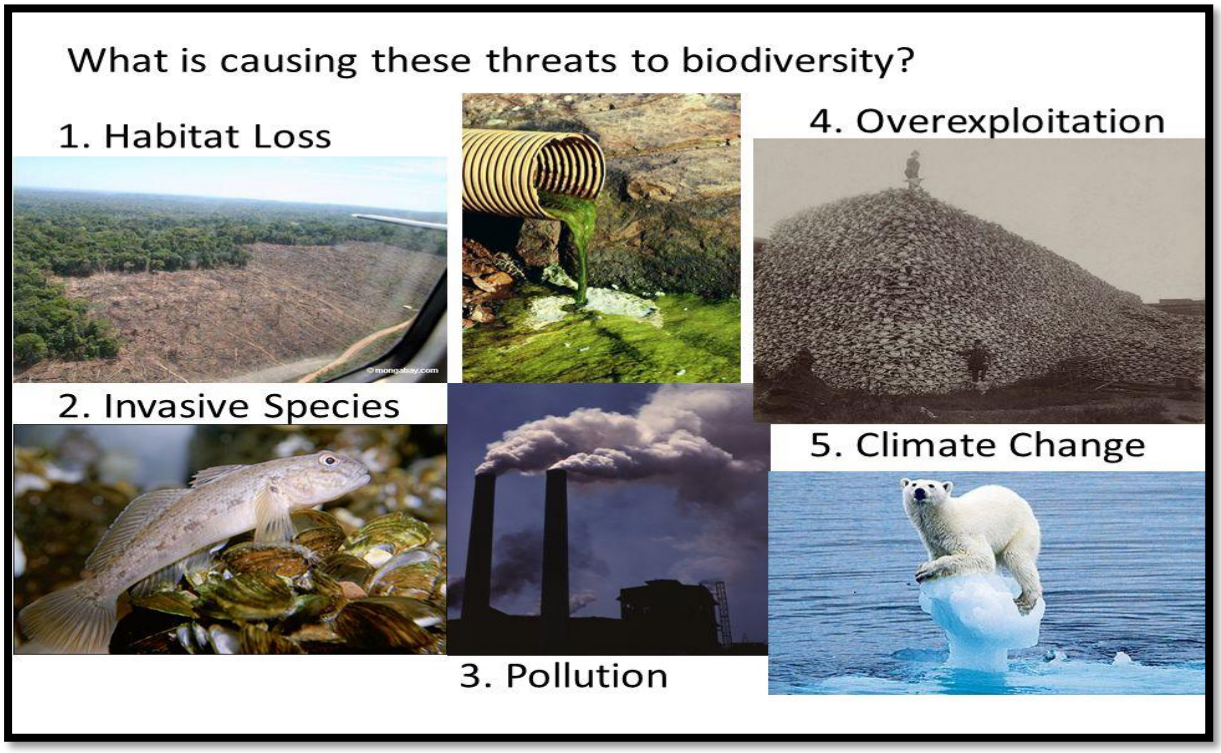
(4) Drugs and Medicine: Biodiversity is a rich source of substances with therapeutic properties. Several important pharmaceuticals have originated as plant-based substances. Examples of plant-derived substances developed into valuable drugs are: Morphine (*Papaver somniferum*), used as an analgesic; Quinine (*Chinchona ledgeriana*) used for the treatment of malaria; and Taxol, an anticancer drug obtained from the bark of the yew tree (*Taxus brevifolia, T.baccata*). Currently, 25% of the drugs in the Pharmacy are derived from a mere 120 species of plants. But, throughout the world, traditional medicines make use of thousands of plant species. Plants can also be used for the manufacture of innumerable synthetic products, called botanochemicals.

(5) Recreational value: Animals provide good deal of fun and recreation to public in circus, zoological parks and aquaria. Visit to gardens, national parks and sanctuaries provide thrill and pleasure and a nice pastime.

(6) Aesthetic value: The beauty of our planet is because of biodiversity, which otherwise would have resembled other barren planets dotted around the universe. Biological diversity adds to the quality of life and provides some of the most beautiful aspects of our existence. Biodiversity is responsible for the beauty of a landscape. People go far off places to enjoy the natural surroundings and wildlife. This type of tourism is referred to as eco-tourism, which has now become a major source of income in many countries. In many societies, the diversity of flora and fauna has become a part of the traditions and culture of the region and has added to the aesthetic values of the place.

(7) Ethical and moral value: It is based on the principle of 'live and let others live'. Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life. All forms of life have the right to exist on earth. Man is only a small part of the Earth's great family of species. Don't plants and animals have an equal right to live and exist on our planet which is like an inhabited spaceship? Morality and ethics teach us to preserve all forms of life and not to harm any organism unnecessarily. Some people take pleasure in the hunting of animals. People also sometimes degrade and pollute the environment by their unethical actions. Through proper education and awareness, the people's conscience against such practices must be raised.

Threats to biodiversity: These are as follows



1. Climate Change

Changes in climate throughout our planet's history have, of course, altered life on Earth in the long run — ecosystems have come and gone and species routinely go extinct. But rapid, manmade climate change speeds up the process, without affording ecosystems and species the time to adapt. For example, rising ocean temperatures and diminishing Arctic sea ice affects marine biodiversity and can shift vegetation zones, having global implications. Overall, climate is a major factor in the distribution of species across the globe; climate change forces them to adjust. But many are not able to cope, causing them to die out. **Solutions:** Individuals can take various steps to fight climate change, such as *reducing their carbon footprints, promoting education* and contacting elected officials. International governments and cities can lead the charge, however, and the 2015 United Nations Climate Change Conference in Paris will hopefully be a turning point.

2. Deforestation and habitat loss

Deforestation is a direct cause of extinction and loss of biodiversity. An estimated 18 million acres of forest are lost each year, due in part to logging and other human practices, destroying the ecosystems on which many species depend. Tropical rainforests in particular, such as the Amazon, hold a high percentage of the world's known species, yet the regions themselves are in decline due to humans.

Solutions: companies and corporations can adopt best practices and refuse to use timber and paper suppliers that contribute to deforestation. In the same vein, conscious consumers can refuse to patronize companies that do, and put pressure on retailers that employ unsustainable manufacturing methods. Individuals can also participate in land preservation through charities and private corporations. Ultimately, however, international governments need to enact stronger, scientific forest protection laws.

3. Overexploitation

Overhunting, overfishing and over-harvesting contribute greatly to the loss of biodiversity, killing off numerous species over the past several hundred years. Poaching and other forms of hunting for profit increase the risk of extinction; the extinction of an apex predator — or, a predator at the top of a food chain — can result in catastrophic sequences for ecosystems. **Solutions:** Conservation and continued awareness surrounding overexploitation, especially poaching and overfishing, are key. Governments need to actively enforce rules against such

practices, and individuals can be more conscious of what they eat and purchase. Other solutions, such as removing Subsidies granted to large-scale fisheries can help, too.

4. Invasive species

The introduction of non-native species into an ecosystem can threaten endemic wildlife (either as predators or competing for resources), affect human health and upset economies. **Solutions:** According to the National Wildlife Federation, solutions include creating systems to prevent introduction of invasive species in the first place, effectively monitoring for new infestations and swiftly eradication newly detected invaders.

5. Pollution

From the burning of fossil fuels (releasing dangerous chemicals into the atmosphere and, in some cases, depleting ozone levels) to dumping 19 billion pounds of plastic into the ocean every year, pollution completely disrupts the Earth's ecosystems. While it may not necessarily cause extinction, pollutants do have the potential to influents species' habits. For example, acid rain, which is typically caused by the burning of fossil fuels, can acidify smaller bodies of water and soil, negatively affecting the species that live there by changing breeding and feeding habits.

6. Man wildlife conflicts

Man wildlife conflict is the negative impact of man’s activities on the habitat and resources of the wild animals due to growing human populations overlap with wildlife territory.

Causes of man-animal conflict

• Habitat fragmentation and shrinking of habitats

• Increased disturbance due to collection of fuel wood, fodder, NTFPs, water etc. from the forests has also increased the incidences of man-animal conflict

• People have to go deeper and deeper, year by year for fetching firewood

• Decreased prey base

Impact of man wildlife conflict

• Injury or loss of human lives or animals

• Crop damage , livestock depredation

• Damage to human property and destruction of habitat

Solution

• Capacity building of forest guards

• Increased vigilance and protection of identified locations using hi-tech surveillance tools

like sensors for knowing Animal movements – Eg. Buxa forest

• Construction ossf highways/railways bypassing wildlife rich areas like Trans-Canada Highway bypassed Banff National park

• Expansion of protected reserves : in-situ and ex-situ habitat conservation measures will help in securing animals their survival and reduced conflict with humans

• Safe animal zones creation: re-locating of animal habitats away from residential and commercial centers will serve to minimize animal-man conflict for illegal and self-interested motives

• Community based rehabilitation measures: making community responsible for resolution of animal-man conflict will aid in decentralized approach of governance for wildlife preservation. For ex it is done Keibul Lamjao National Park, Kaziranga national park, Sundarbans etc;

• Partnering with WWF which provide tailor made solutions to man wildlife conflict with community and species in consideration

• Adequate compensation after rehabilitation – Baiga tribe in Kanha tiger reserve were relocated without proper compensation