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Biodiversity

Biodiversity is the variety and differences among living organisms from all sources ,including terrestrial, marine, and other aquatic ecosystem sand the ecological complexes of which they area part.

- It Is virtually synonymous with “Life on earth”.
- Biologists most often define "biological diversity“ or “biodiversity“ as the "totality of genes, species, and ecosystems of a region".
- The biodiversity found on Earth today consists of many millions of distinct biological species, which is the product of nearly 3.5billion years of evolution.



Levels or Types of Biodiversity

- **Community and Ecosystem diversity**
(different habitats, niches, species interactions)
- **Species diversity**
(different kinds of organisms, relationships among species)
- **Genetic diversity**
(different genes & combinations of genes within populations)



Ecosystem diversity



Species diversity



Genetic diversity

Community and Ecosystem diversity:

- Ecosystem diversity refers to the diversity of a place at the level of ecosystems. This has 3 perspectives:
- Alpha Diversity: Within community diversity. Alpha diversity refers to the diversity of organisms sharing the same Community / Habitat.
- Beta Diversity: Between community diversity. It refers to the diversity of organisms sharing two habitat.
- Gamma Diversity: Diversity of the habitat over the total landscape or geographical area is called gamma diversity



Temperate Rain forest



Tropical rain forest

Species diversity:

- It refers to the variety of species with in a region.
- Species diversity is an index that in corporates the number of species in an area and also their relative abundance.
- It is generally a much more useful value than species richness.



Genetic Diversity:

- It is a level of biodiversity that refers to the total number of genetic characteristics in the genetic make up of a species.
- It is distinguished from genetic variability, which describes the tendency of genetic characteristics to vary.



Values of Biodiversity

Food:

- About 80,000 edible plants and about 90% of present day food crops have been domesticated from wild.

Drugs & Medicines:

- About 75% of world's population depend on plants and plants extracts

Fuel:

- Forests have been used since ages for fuel wood. Fossil fuels are also products of Biodiversity.

Social Value:

- Many of the plants like Tulsi, Lotus, Peepal etc are considered holy and sacred.
- About 2.1 million species have been identified till date, while many more species are believed to exist.
- India's position is 10th in the world & 4th in Asia in terms of Plant diversity.

Hot-spots of Biodiversity



- A biodiversity hotspot is a biogeography region with a significant reservoir of biodiversity that is threatened with destruction.
- An area is designated as a hotspot when it contains atleast 0.5% of plant species as endemic.
- There are 25 such hotspots of biodiversity on a global level, out of which two are present in India.
- These are: Indo-Burma (earlier The Eastern Himalayas) and The western Ghats & SriLanka..
- These hotspots covering less than 2% of the world's land area are found to have about 50% of the terrestrial biodiversity

Criteria for determining hot-spots:

- No. of Endemic Species i.e. the species which are found nowhere else.
- Degree of threat, which is measured in terms of Habitat loss.
- Indo-Burma (Eastern Himalayas) Hotspot:
 - The hotspot includes all of Cambodia, Vietnam & Laos, and nearly the entire areas of Thailand, Myanmar & Bhutan as well as part of Nepal, far eastern India and extreme southern China
 - In addition, it covers several off shore Islands including Main Islands in the south China Sea and Andaman & Nicobar Islands in Indian Ocean.
- Indo Burma is one of the most threatened biodiversity hotspots, due to the rate of resource exploitation and habitat loss.
- Western Ghats and Sri Lanka:
 - Western Ghats and Sri Lanka, also known as the “Sahyadri Hills” encompasses the montane forests in the south western parts of India and on the neighboring Islands of Sri Lanka.
 - The entire extent of hotspot was originally about 1,82,500 square kms, but due to tremendous population pressure, now only 12,445 square Km or 6.8% is in pristine condition.
 - The important populations include Asian elephant, Indian tigers and the endangered lion tailed macaque.



Threats to Biodiversity



- Extinction is a natural event and, from a geological perspective, routine.
- In last century, human impact has been so severe that thousands of species and varieties are becoming extinct annually.
- Some of the main causes are:

Habitat loss, degradation, fragmentation:

- Habitat loss & degradation are major causes of species extinction, affecting 89% of all threatened birds, 83% of mammals & 91% of all threatened plants assessed globally(IUCN,2000)
- The main causes of habitat are agriculture activities, Mining, development of human settlement, industry etc.

Poaching of Wildlife:

- Poaching is another threat that has emerged in recent decades as one of the primary reason for decline in number of species.
- Wildlife is sold and traded in many countries for live specimens, folk medicines, furs, Skin, and other products such as Ivory, horns etc amounting to millions of dollars.

Man –wildlife conflicts:

- The conflict between man and wildlife started with the evolution of man, but intensity increased due to the activities of modern man
- Due to the lack of stable food and disruption of movement, wild animals came out of forest area and attack the agricultural field and humans and in turn got killed by the humans.



Endangered Species:



- According to The International Union of Conservation of Nature and Natural Resources (IUCN), the species that considered in imminent danger of extinction and whose survival is unlikely, if factors causing their decline continue to operate.
- Out of about 47,000 species of plants in our country, 7000 are endemic
- India contains 172 species of animals considered globally threatened by IUCN, or 2.9% of the world's total number of threatened species.
- These include 53 species of mammals, 69 birds, 23 reptiles and 3 amphibians
- As many as 3,000-4,000 higher plants may be under high degree of threat in India
- Thus Indian subcontinent has about 62% endemic flora, restricted mainly to Himalayas, Khasi Hills & Western Ghats.
- A large number out of a total of 81,000 species of animals in our country is endemic. About 62% amphibians and 50% lizards are endemic to western Ghats.
- Golden monkey, Nilgiri langur, Indian wolf, Red fox, Himalayan brown bear, Great Indian one-horned rhinoceros, White-winged wood duck, Black-necked crane, Indian peafowl, Gharial, Indian egg-eating snake, Indian salamander etc. are some examples of endemic animal species of India.

Conservation of Biodiversity:

- The convention on Biological Diversity held in June, 1992 stressed the need of the conservation of Biodiversity for sustainable development and perpetuation of human beings on earth.
- Conservation is defined as “ the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintain in gits potential to meet the needs and aspirations of the future generations”.
- The two basic approaches to wildlife conservation in protected habitats are:
 - 1) **In-situ conservation and**
 - 2) **Ex-situ conservation.**



In-situ conservation:

- It simply means conservation of species in its natural ecosystem or even in manmade ecosystems.
- This strategy emphasizes protection of total ecosystem through a network of “protected area”.
- Protected Areas: an area of land and / or sea specially dedicated to the protection and maintenance of biological diversity and managed through legal effective means.
- There are different categories of protected areas which are managed with different objectives. These include; Biosphere reserves ,National parks, Wild Life Sanctuaries etc.
- At present we have 11 major biosphere reserves, 80 National parks, 420 wildlife sanctuaries in our country covering 4% of the geographic area.
- The JIM CORBETT National Park was 1st national park established in India.
- What is Difference among Biosphere reserves, National parks, Wild Life Sanctuaries ?

Examples of Biosphere reserves of India:

- 1.Nilgiri-5,520 sq.km2.Nanda Devi-5,860.69 sq. km3.Manas-2837 sq. km4.Gulf of Mannar-10,500 sq. km5.Great Nicobar -885 sq. km6.Panchmarhi-4,926.28 Sq Km
- Examples of some National park in India1.Kaziranga-Assam, GirNational Park-Gujarat, Periyar-Kerala, Sariska-Rajasthan
- Examples of some Wild Life Sanctuaries of India:1.Ghana Bird sanctuaries2.Hazaribaghsanctuaries3.Aboharwild life sanctuaries4.Jaldaparawild life sanctuaries5.Mudamalaiwild life sanctuaries

Ex-situ conservation:

- It is defined as “the conservation of component of biological diversity (Sample of genetic diversity, particularly of endangered species) outside their natural habitats”.
- It involves maintenance and breeding of endangered plant and animal species under partially or wholly controlled conditions. E.g. Zoos, Botanical Gardens, Aquaria, Nurseries, DNA bank, Seed bank, Gene bank etc.
- There are more than 1500 Botanical gardens in the world containing more than 80,000 species.
- There are more than 800 zoos around the world with about 3,000 species of mammals, birds, reptiles and amphibians.
- In India, we have many gene bank. The important ones are:
- National Bureau of Plant genetic Resources (NBPGR),
- New Delhi:
- Agricultural and horticultural crops and their wild varieties are preserved by cryo-preservation of seeds (at -196°C in Liquid Nitrogen), pollen etc.
- National Facility for Plant Tissue Culture Repository
- (NFPTCR) at NBPGR Campus New Delhi:
- It has been set up for the development of a facility of conservation of varieties of crop plants/ trees by tissue culture.



What is the Goal of Conservation?

- Conservation efforts focus on protecting entire ecosystems as well as single species.
- Protecting an ecosystem will ensure that the natural habitats and the interactions of many different species are preserved at the same time.

Conservation Challenges

- Protecting resources for the future can require people to change the way they earn their living today.
- Conservation regulations must be informed by solid research and must try to maximize benefits while minimizing economic costs.



Values of Biodiversity

There are direct and indirect economic, aesthetic, and scientific reasons for preserving biodiversity.

Direct Economic value:






- Humans depend on plants and animals to provide food, clothing, energy, medicine, and shelter.
- Genetic diversity in species that might be needed in the future is important because...
 - ▮ Most of the world's food crops come from just a few species.
 - ▮ Wild species serve as reservoirs of desirable genetic traits that might be needed to improve domestic crop species (disease- and insect-resistance).
 - ▮ Many of the medicines that are used today are derived from plants or other organisms.
 - ▮ Scientists continue to find new extracts from plants and other organisms that help in the treatment of human diseases.
 - ▮ However, many species of organisms are yet to be identified, especially in remote regions of Earth, so their usefulness in providing extracts or useful genes is unknown.



Why should we protect biodiversity?

Reasons to protect Biodiversity

1. Medicinal
2. Agricultural
3. Commercial
4. Ecological
5. Ethical/Aesthetic

Medicines and Biodiversity: Natural sources of pharmaceuticals			
Plant		Drug	Medical application
Pineapple (<i>Ananas comosus</i>)		Bromelain	Controls tissue inflammation
Autumn crocus (<i>Colchicum autumnale</i>)		Colchicine	Anticancer agent
Yellow cinchona (<i>Cinchona ledgeriana</i>)		Quinine	Antimalarial
Common thyme (<i>Thymus vulgaris</i>)		Thymol	Cures fungal infection
Pacific yew (<i>Taxus brevifolia</i>)		Taxol	Anticancer (especially ovarian cancer)
Velvet bean (<i>Mucuna deeringiana</i>)		L-Dopa	Parkinson's disease suppressant
Common foxglove (<i>Digitalis purpurea</i>)		Digitoxin	Cardiac stimulant

- **Medicinal:** 40% of modern medicines come from plants/animals/fungi, 95% of known plant species have never been tested for medicinal value

2. Agricultural:



- Of 80,000 known edible plants on the planet, we depend on 20 species to provide 90% of global food supply. Corn, rice and wheat are 50% alone!

Loss of Biodiversity in agricultural

- Apples – 14,000 apple cultivars in N. America have been reduced to 11 which supply 90% of our supply
- Coffee – 28% decline in Latin American production as climate change has brought new rainfall and pest patterns



3. Commercial

4. Ecological

5. Ethical/Aesthetic



◦ Why Biodiversity is Important?

The natural environment is the source of all our resources for life. Environmental processes provide a wealth of services to the living world — providing us with air to breathe, water to drink and food to eat, as well as materials to use in our daily lives and natural beauty to enjoy.

Complex ecosystems with a wide variety of plants and animals tend to be more stable. A highly diverse ecosystem is a sign of a healthy system. Since all the living world relies on the natural environment, especially us, it is in our best interests and the interests of future generations to conserve biodiversity and our resources. The benefits and services provided by ecosystems include:

- Generation of soils
- Maintenance of soil quality
- Maintenance of air quality
- Maintenance of water quality
- Pest control
- Detoxification and decomposition of wastes
- Pollination
- Crop production
- Climate stabilization
- Prevention and mitigation of natural disasters
- Provision of food security
- Provision of health care – medicines
- Income generation
- Spiritual and cultural value





THANK YOU...!

