

Biodiversity: uses, threats and conservation.

BIODIVERSITY

The term biodiversity refers to the wealth of plants, animals and micro organisms that contain precious genes and formulate delicate ecosystems. **Biodiversity** is the variety and variability of life on Earth. **Biodiversity** is typically a measure of variation at the genetic, species, and ecosystem level.

Definition

- Biodiversity refers to variety and variability among the living organisms and ecological complexes in which occur. This includes diversity within species, between species and of the ecosystem. It is defined as the totality of genes, species and ecosystems of a region.
- Biodiversity or Biological diversity comprises Genetic diversity, Species diversity and Ecosystem diversity (level of biodiversity)

Genetic diversity

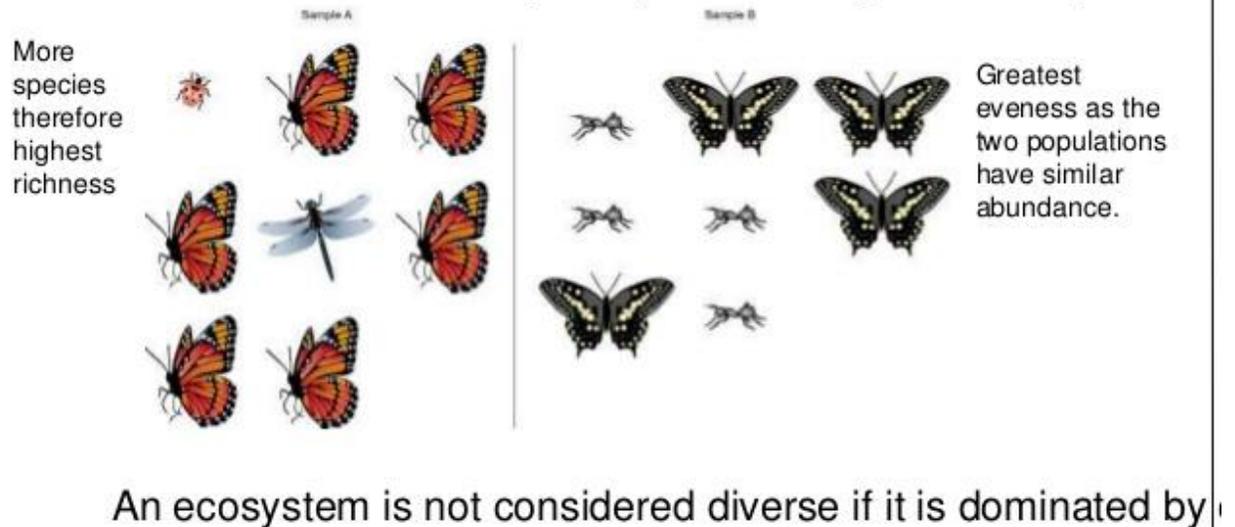
- It refers to the variation of genes within the species stores as immense amount of genetic information. Genetic variation is seen among the individuals **within a species**. For instance, in cattle there are many varieties with respect to colour, milk yield, size or disease resistance.
- The genetic variation may be in alleles, entire genes or in chromosomal structures. It leads to better adaptation of species to the changed environment. New species are formed due to genetic variation.

Species diversity

- It refers to the various species found within a region. Variability found within a species or between different species of a community. **Species diversity is measured by species richness (number of species per unit area) and evenness or equitability** (evenness in the number of individuals of a species).
- In the case of species richness, higher species diversity represents greater species diversity. In the second case, evenness of species represents higher species diversity.

Evenness vs Richness

- Both are a way to measure biological diversity
 - Richness: number of different types of organisms
 - Evenness: how the quantity of each organism compares to



http://www.nature.com/ngture/journal/v405/n6783/images/405212aa_2.jpg

- **Ecosystem diversity**

- It refers to the variations in the biological communities in which the species live. The diversity within a community is called alpha diversity. The diversity between communities is called Beta diversity. Examples are Tropical Rain Forest and Boreal Forest.
- The present diversity has developed over millions of years of evolution and therefore ecological balance should not be disturbed. The diversity of the habitats over total landscape or geological area is referred to as Gamma diversity (or) Landscape diversity. For example Forest ecosystem, aquatic ecosystem, Grasslands, Deserts, mangroves etc.
- *Alpha diversity* refers to the average species diversity in a habitat or specific area. Alpha diversity is a local measure.
- *Beta diversity* refers to the ratio between local or alpha diversity and regional diversity. This is the diversity of species between two habitats or regions. It is calculated by the following equation:
$$\frac{\text{number species in habitat 1} - \text{number of species habitat 2 \& 1 have in common}}{\text{number of sp in H2} - \text{number of sp H1 \& 2 have in common}}$$
- *Gamma diversity* is the total diversity of a landscape and is a combination of both alpha and beta diversity.

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USES OF BIODIVERSITY

- Biodiversity is very essential for the health of biosphere and it provides the raw materials for man in order to make him adapt to the changing environment.
- Man derives many direct and indirect benefits from the living things. Biodiversity provides ecological services also. The uses of biodiversity are as follows.

Consumptive use value

- It includes food, medicine, fuel, fibre, timber, clothing, etc. 80,000 species are edible wild plant species. 90% of the crops have been domesticated from wild tropical plants. 75% of the world population depends upon plants for medicines.
- For instance, penicillin from a fungus name *Penicillium*, quinine from a plant namely, *Cinchona*, tetracycline from a bacterium and cancer-curing drugs like vinplastine and vinchristine from a plant namely, *Catharanthus roseus* (Nithyakalyani) are obtained.

Productive use value

- The products are commercially usable
- The wild gene resources are traded to introduce desirable traits in the crops and domesticated animals.
- Productive uses of biological resources are fuel, timber, musk, tusk, ivory, honey, fibre, gums, resins, medicines, silk, wool etc.

Social value

- Biodiversity in India is related to our religious, cultural and spiritual uses.
- Many plants like Tulsi, Pipal, *Hibiscus* and *Datura* are considered to be sacred.
- Peacock, cow, snake, bull and owl have a place in our spiritual areana.

Ethical value

- We must protect every life. It is based on the concept 'Live and let live'
- We must enjoy watching all animals-Kangaroo, Giraffe, Zebra etc., though they are not useful to us directly. We should not cage birds for our pleasure and pastime.

Aesthetic value

- Biodiversity provides us a good deal for fun and recreation. This type of tourism is known as ecotourism which generates 12 billion dollars as income per year.
- If we have a lion in a zoo we get about Rs . 2 crores as income per year. But if we kill the lion we get only Rs. 50,000/-
- A teak fetches Rs. 50,000/- if cut down; but it lives, its value is priceless by way of its ecological role.

Option values or unknown benefits

- We must try to explore the potentials of biodiversity for future benefit of mankind. We must protect the biodiversity in order to find out drugs to fight diseases like cancer and AIDS.

Biodiversity in India

- In India biodiversity is rich due to favourable climate and natural environmental conditions. India has 8.1% of the world's total biodiversity in contrast to her 2.4% of the world area. India occupies seventh position of plant rich nations(megadiversity countries). The first position is occupied by Mexico. There is enormous loss of biodiversity and one of the root causes identified for the loss is the wrong model of development we have followed so far. The development has centered on the following:
 - Commercial and monocultural agricultural practices.
 - Large scale industrial expansion
 - Increasing the consumption of goods and benefits through exploiting natural resources without giving importance of sustainability.
- The man-made communities have replaced the natural communities in order to protect life on earth. Man must learn to control and adjust the balance in nature that are altered by his activities.
- **Biodiversity in MP**

The central Indian State of Madhya Pradesh is one of the richest repositories of biological diversity. The State houses a diversity of ecosystems including plateaus, ravines, ridges, valleys, riparian areas and flat plains. With four major forest types, 10 National Park and 25 Wildlife Sanctuaries, the Tiger State houses one of the richest faunal and floral diversity. With about 5000 plant species, these forests are habitat to as many as 500 birds species and 180 fish species. Thousands of rice cultivars, a rich diversity of minor millets, indigenous cattle and poultry landraces like Kadaknath boasts of the agro-biodiversity. Home to six tribes with distinct customs, practices and diverse cultures, the biological diversity sustains livelihoods and ensures food security to two fifth of the State population. Indigenous health systems nurtured by rich traditional knowledge woven around over 1000 medicinal plants contributed significantly to health security in rural areas.

Biodiversity

- Biodiversity is the variety of life found on earth which includes plants, animals and microorganisms as well. India is one of the 17 mega bio-diverse countries of the World. With 2.5% land area of the World, India accounts for 7.5% of World's biodiversity.

Historical Backdrop

- The rising concerns over loss of biodiversity at global level culminated in Convention on Biological Diversity (CBD) in 1992 at Rio-de-Janeiro, Brazil. India being a party to CBD enacted Biological Diversity Act in 2002. The Biological Diversity Act, 2002 has three objectives viz Conservation, Sustainable use of biological resource and equitable sharing

of benefits arising out of use of biological resources.

- A three tier structure has been established with National Biodiversity Authority (NBA) at the apex, State Biodiversity Board (SBB) at provincial level and Biodiversity Management Committee (BMC) at the local bodies level for achieving these objectives.

M. P. State Biodiversity

- Madhya Pradesh State Biodiversity Board has been constituted by the State Government as per the provisions of Biological Diversity Act, 2002 notified by the Government of India. Madhya Pradesh Biological Diversity Rules, 2004 were notified by the State Government on 17.12.2004 under the provision of Section 63 (1) of Biological Diversity Act, 2002. The notification regarding the constitution of Board was issued on 11th April. 2005. head quarter is in Bhopal (M.P.)

The objectives of the Board are

- Conservation of biodiversity,
- Sustainable use of its components and
- Equitable shearing of benefits arising out of the use of biological resources and associated traditional knowledge.

THREATS TO BIODIVERSITY

- Though the rate of loss of species has been a slow process in the past, the process of extinction has become fast in recent years. It has been reported that approximately 10,000 species become extinct every year. This raises an alarm regarding the threat to biodiversity. IF this trend continues 1/3 or 2/3 of our current biodiversity would become extinct by the middle of the 21st century.

Factors causing loss of biodiversity

- Loss of Habitat
 - Destruction of habitats due to clearing of forests and grasslands for agricultural lands, pastures, settlement areas or project development lead to loss of habitat. These factors are responsible for the disappearance of thousands of species. According to the world Health Organisation (WHO) estimates, about 80% of the population of developing countries relies on traditional medicines, mostly drugs from plants. In order to meet the demand, about 86% of plant collection involves destructive harvesting. Many plants become endangered, besides loss and degradation of natural habitats take place due to overharvesting.
 - The wetlands, mangroves and estuaries with rich biodiversity are under threat. They are destroyed, as if they have no value. For example estuarine ecosystem in Adyar, Chennai has disappeared posing a major treat to nearly 170 species of birds, many of which nest and breed there. Tropical forests disappear at the rate of 0.6% per year in our country. Marine biodiversity is also threatened by human intervention.

- The wetlands in India are distributed in different geographical regions. Most of the wetlands in India are linked with major river systems. India has 27403 wetlands covering 4.1 million . Of these , 2,175 are natural and the rest are manmade. Wetlands occupy 18.4 of the area of our country of which 70% are under rice cultivation. In India, out of an estimated 4.1 million ha of wetlands, 1.5 mha are natural and 2.6 mha are man-made. Wetlands provide food and shelter for mammals and birds.
- Poaching of wild life
 - The illegal commercial hunting is called poaching. There are two types of hunting subsistence hunting (killing animals for food) and sport hunting (killing animals to sell their meat, fur, horns, tusks etc.)
- Man-Animal conflicts
 - Sometimes, wild animals threaten human beings. This leads to conflict between wild life and man. For example elephant in Sambalpur, Orissa killed 195 humans in 5 years. The villagers killed 98 elephants in retaliation and injured 30 elephants.

Causes

- When the habitats of wild animal are destroyed by man, the animals are forced to come out of the forest in search of food to the nearby human settlements and attack human beings when they come in contact with them accidentally.
- When rice, sugarcane , etc., are not cultivated within the sanctuaries, the animals move out in search of food. One adult elephant needs 2 quintals of green fodder and 150 litres of water daily. If this is not available, the wild animals move out.
- The weak and injured animals have a tendency to attack man. A tigress attacks man in order to protect its cubs. Once a tiger tastes the flesh of a man accidentally, it becomes a man-eater.
- When wildlife corridors are converted into human settlements, the path of wild life is disrupted and animals attack the settlements.
- Since the compensation by the government in lieu of crop damage is not enough, the agonized farmers kill the wild animal to protect their crops.

CONSERVATION OF BIODIVERSITY

- The enormous value of biodiversity emphasizes the need to conserve biodiversity. Biodiversity is a natural reservoir with tremendous economic potential.
- Wildlife is a gift of nature to be nurtured. Biodiversity is an important resource for man and nation. So its conservation and rational use are the need of the hour to achieve sustainable development.
- World wide fund for Nature (WWF 1994) works to conserve biological diversity as follows.
 - Creating and maintaining systems of effective and sustainable protected areas.
 - Promoting practices of sustainable development
 - Conserving certain species of special concern.
 - Promoting environmental education to enable people to manage the natural resources sustainably.

- Food and Agriculture Organisation (FAO) helps to provide policy guidelines which regulate the conservation and sustainable use of biodiversity. The code of conduct for Responsible Fisheries adopted in 1995, provides principles to conserve, manage and sustainable use living aquatic resources. F.A.O encourages all countries to implement this code. A model of Forest Harvesting Practice was published 1996 to encourage improved management to help conserve forests. The codes were developed for the Asia-Pacific and, West and Central African regions.
- The International Plant Protection Convention is to protect plants by setting standards for pest control. This protects biodiversity by preventing pests including invasive alien species.
- In India, Biological Diversity Act 2002, regulates access to biological resources of the country with the purpose of securing equitable share in benefits arising out of the biological resources and knowledge relating to biological resources.
- National Biodiversity Authority (NBA) which was set up under the Biological Diversity Act 2002, deals with requests for access to genetic resources by foreigners. It protects resources and ensures economic benefits to local communities.

Methods of Conservation

- There are two methods of conservation of biodiversity.
 - **In-situ conservation (within habitat)**
 - **Ex-situ conservation (outside habitats)**

Biodiversity and its Conservation Methods

Biodiversity refers to the variability of life on earth. It can be conserved in the following ways:

- In-situ Conservation
- Ex-situ Conservation

In-situ Conservation

In-situ conservation of biodiversity is the conservation of species within their natural habitat. In this method, the natural ecosystem is maintained and protected.

The in-situ conservation has several advantages. Following are the important advantages of in-situ conservation:

1. It is a cost-effective and convenient method of conserving biodiversity.
2. A large number of living organisms can be conserved simultaneously.
3. Since the organisms are in a natural ecosystem, they can evolve better and can easily adjust to different environmental conditions.

Certain protected areas where in-situ conservation takes place include national parks, wildlife sanctuaries and biosphere reserves.

National Parks

These are small reserves maintained by the government. Its boundaries are well demarcated and human activities such as grazing, forestry, habitat and cultivation are prohibited. For eg., Kanha National Park, Bandipur National Park.

Wildlife Sanctuaries

These are the regions where only wild animals are found. Human activities such as timber harvesting, cultivation, collection of woods and other forest products are allowed here as long as they do not interfere with the conservation project. Also, tourists visit these places for recreation.

Biosphere Reserves

Biosphere reserves are multi-purpose protected areas where the wildlife, traditional lifestyle of the inhabitants, and domesticated plants and animals are protected. Tourist and research activities are permitted here.

Also Read: National Parks And Sanctuaries

Ex-situ Conservation

Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems such as zoos, nurseries, botanical gardens, gene banks, etc. There is less competition for food, water and space among the organisms.

Ex-situ conservation has the following advantages:

1. The animals are provided with a longer time and breeding activity.
2. The species bred in captivity can be reintroduced in the wild.
3. Genetic techniques can be used for the preservation of endangered species.

(Also Read: Difference between a wildlife sanctuary and national park)

Strategies for Biodiversity Conservation

Following are the important strategies for biodiversity conservation:

1. All the varieties of food, timber plants, livestock, microbes and agricultural animals should be conserved.
2. All the economically important organisms should be identified and conserved.
3. Unique ecosystems should be preserved first.
4. The resources should be utilized efficiently.
5. Poaching and hunting of wild animals should be prevented.
6. The reserves and protected areas should be developed carefully.
7. The levels of pollutants should be reduced in the environment.
8. Deforestation should be strictly prohibited.
9. Environmental laws should be followed strictly.
10. The useful and endangered species of plants and animals should be conserved in their nature as well as artificial habitats.
11. Public awareness should be created regarding biodiversity conservation and its importance.

Why should you conserve Biodiversity?

It is believed that an area with higher species abundance has a more stable environment compared to an area with lower species abundance. We can further claim the necessity of biodiversity by considering our degree of dependency on the environment. We depend directly

on various species of plant for our various needs. Similarly, we depend on various species of animals and microbes for different reasons.

Biodiversity is being lost due to the loss of habitat, over-exploitation of resources, climatic changes, pollution, invasive exotic species, diseases, hunting, etc. Since it provides us with several economic and ethical benefits and adds aesthetic value, it is very important to conserve biodiversity.

LEGISLATION RELEVANT TO BIODIVERSITY CONSERVATION

1. Fisheries Act 1897.
2. Indian Forests Act 1927.
3. Mining and Mineral Development Regulation Act 1957.
4. Prevention of cruelty to animals 1960.
5. Wildlife protection act 1972.
6. Water (prevention and control of pollution) act 1974.
7. Forest Conservation Act 1980.
8. Air (prevention and control of pollution) act 1981.
9. Environment Protection Act 1986.
10. Biological Diversity Act 2002.
11. Scheduled Tribes and other traditional forest dwellers (recognition of rights) act 2006.

Policies related to Environment and Bio-Diversity

1. National Forest Policy.
2. National Conservation Strategy and Policy statement on Environment and Development.
3. National Policy and macro-level action strategy on Biodiversity.
4. National Biodiversity Action Plan (2009).
5. National Agriculture Policy.
6. National Water Policy.
7. National Environment Policy (2006).

Major central acts relevant to biodiversity conservation include:

Indian Fisheries Act, 1897, Indian Wildlife (Protection) Act 1972 and Wildlife (Protection) Amendment Act 1993 and 2002., The Environment Protection Act, 1986, The Forest Conservation Act, 1980, Biological Diversity Act, 2002 and Biological Diversity Rules, 2004

Indian Fisheries Act (1897)

The Indian fisheries act highlighted the following:

Prohibition of use of destructive methods of fishing such as dynamiting and poisoning in inland and coastal water. For catching of fish; to put a limit on mesh size, size of fish and catch, and to ban the fish in certain seasons and certain places for a period of 2 years. Protection of fish in selected waters. For any offense imprisonment and arrest without warranty.

The environment protection act (1986)

It authorizes the central government to protect and improve environmental quality, control and reduce pollution from all sources and restrict the setting and or operation of any industrial facility on environmental grounds. Umbrella legislation designed to provide a framework for the coordination of central and state authorities established under the water (prevention and control) act, 1974 and Air (prevention and control) act, 1981, Coastal Regulation, 1991. The central govt. It is empowered to take measures necessary to protect and improve the quality of the environment. It also makes it mandatory to conduct Environmental Impact Assessment (EIA) for specified developmental activities. The national label "ECO MARK" given to environment friendly products.

The Biological Diversity Act 2002 (BDA)

- The biological diversity Act provides for - conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto.

To implement the provisions of the BD Act **National Biodiversity Authority** (under Section 8 of BDA) was established in 2003 at **Chennai**.

Wildlife Crime Control Bureau has been established for the control of illegal trade in wildlife, including endangered species.

Conserving biodiversity: International effort-

World Conservation Union (IUCN)

United Nations Environment Programme (UNEP)

World Conservation Monitoring Centre (WCMC) of the United Nations Environment Programme or UNEP-WCMC is an executive agency of the United Nations Environment Programme, based in Cambridge in the United Kingdom. UNEP-WCMC has been part of UNEP since 2000, and has responsibility for biodiversity assessment and support to policy development and implementation. WCMC monitors the effectiveness of biodiversity conservation efforts especially made by UNEP, IUCN and WWF throughout the world.

The World Wide Fund for Nature (WWF)

Global Environment Facility (GEF)

United Nations Educational, Scientific and Cultural Organisation (UNESCO)

The World Resources Institute (WRI)

Major events

World Conservation Strategy (WCS)

Global Biodiversity Assessment (GBA)

Convention on Biological Diversity(CBD)

Man and the Biosphere Program (MAB)

Recent progresses

Global Biodiversity Challenge

Global Biodiversity Outlook

Biodiversity, the variety of life on Earth, is disappearing at an unprecedented rate. This situation contradicts the international "2010 Biodiversity Target", which aims at significantly reducing the rate of biodiversity loss by 2010. Science and governance for conserving and sustainably and equitably using biodiversity are key elements to decrease the rate of its loss.

Kyoto Protocol -The **Kyoto Protocol** is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew from the protocol, effective December 2012)^[4] to the Protocol.

The Kyoto Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" .The Kyoto Protocol applies to the six greenhouse gases listed in Annex A: Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF₆)

The **Montreal Protocol** is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. It was agreed on 16th September 1987, and entered into force on 1st January 1989.

The **Sustainable Development Goals (SDGs)** are a collection of 17 global goals designed to be a "blueprint to achieve a better and more sustainable future for all".^[2] The SDGs, set in 2015 by the United Nations General Assembly and intended to be achieved by the year 2030, are part of UN Resolution 70/1, the 2030 Agenda.^{[3][4][5]}

The Sustainable Development Goals are:

1. No Poverty
2. Zero Hunger
- 3. Good Health and Well-being**
4. Quality Education
5. Gender Equality
- 6. Clean Water and Sanitation**
- 7. Affordable and Clean Energy**
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
- 10.Reducing Inequality
- 11.Sustainable Cities and Communities
- 12.Responsible Consumption and Production**
- 13.Climate Action**
- 14.Life Below Water
- 15.Life On Land
- 16.Peace, Justice, and Strong Institutions
- 17.Partnerships for the Goals