

## **PUC 1<sup>st</sup> Year-Semester-2**

### **Unit No VIII: Biodiversities**

#### **Module No 42: Concept of Biodiversity**

The term biodiversity was coined by W.G.Rosen (1985). Biodiversity refers to the variety of life forms and habitats found in a defined area. United Nations Environment programme (U.N.E.P) defines biodiversity “as the variety and variability of all animals, plants and micro organisms and the ecological complexes of which they are a part”. This includes diversity within species, between species and of ecosystems. Conservation and sustainable use of biodiversity is fundamental to ecologically sustainable development. Biodiversity is part of our daily lives and livelihood and constitutes resources upon which families, communities, nations and future generations depends. All the basic needs of life namely food, clothes, shelter, medicines and clean atmosphere are, in fact, assured by the biodiversity around us. This indeed makes biodiversity as an important subject of study in academic institution. Every country has the responsibility to conserve, restore and sustainably use the biological diversity within its jurisdiction. Biological diversity is fundamental to the fulfillment of human needs.. Loss of biodiversity has serious economic and social costs for any country. The loss of a biological species poses a threat to our food security, environmental stability and sustainable development. The loss of every gene, species or ecosystem limits our options for the future development. Biodiversity and man’s life are so interlinked that it is difficult to think of man’s existence in the world sans biodiversity. Global biodiversity is the product of millions of years of organic evolution.

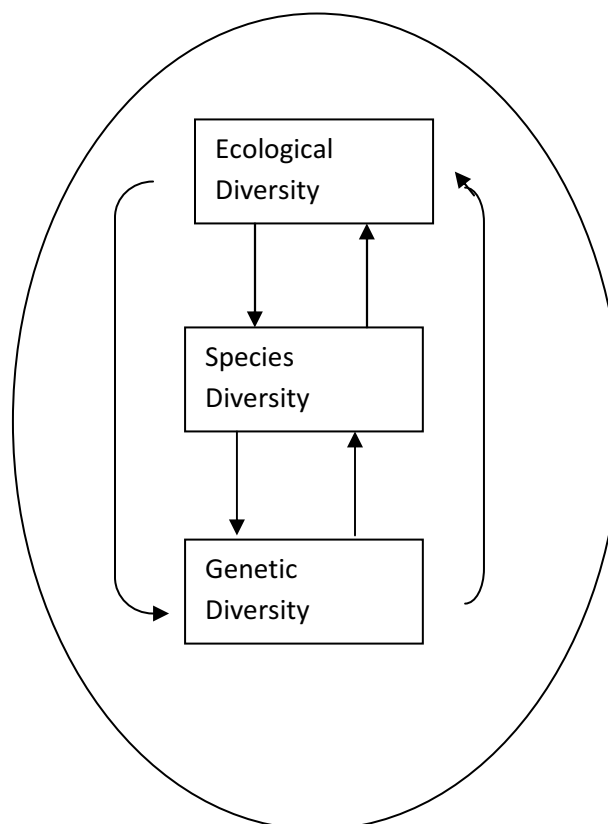
The year 2010 has been declared as the International year of Biodiversity. Govt. of India passed Biodiversity Bill in December 2003. It seeks checking of biopiracy. India has a great wealth of biodiversity in its forests, wetlands and marine areas. It has a great diversity in climate, topography and geology hence very rich in biodiversity. The Ministry of Environment and Forests, Govt of India (2000) records 47,000 species of plants and 81000 species of animals. This is about 7% and 6.5% respectively of global flora and fauna.

## Levels of Biodiversity

The definition refers to the whole variety of life on earth. Biodiversity represents the totality of genes, species and ecosystems of a region. Biodiversity is said to have three (hierarchical) levels. They are

1. Ecological (Ecosystem) diversity- The diversity of ecological complexes or biotic communities found in a given area
2. Species diversity- species diversity refers to variety of species in a region. With increase in area, number of species increase and with this the number of individuals among species may differ. This may lead to differences in evenness which results to change in diversity.
3. Genetic diversity- Genetic diversity refers to variation of genes within species. The genetic diversity within a species is expressed by many terms, subspecies, breeds, races, varieties and forms. This diversity arises from variations in the sequence of four nitrogenous base pairs present in nucleic acids which constitute the genetic code.

**Fig: Inter relationship in biodiversity**



## **Importance of Biodiversity**

Biodiversity has great importance to mankind due to its many uses.

1. **Population balance:** All the living organisms are so closely interlinked (through food chain, food webs, material cycling, energy flow etc) that destruction of one kind of wild life on the earth may upset the ecological balance in nature, resulting in severe consequences. Ex.
  1. The destruction of carnivores will help the increase of herbivores which in turn will affect the forest vegetation. Once the forest vegetation is reduced, herbivores will invade cultivated lands and bring misery to farmers. The reduction in the extent of the forest will affect rains and thereby affect the economy of our land.
  2. The massacre of snakes for the sake of their skins has allowed the rat population to increase to such an extent that these compete with us for our agricultural products
  3. When all the herbivores in a forest are killed, tiger, lions, fox etc. enter human settlements and attack human beings and domesticated species.
  4. Quinine extracted from cinchona is used to treat malaria. If this tree had been eliminated from the earth before man could discover its use in treating malaria, this disease would have finished large population of man on earth.

Thus species of plants and animals keep a check on their numbers through food chains, so the wild life helps to preserve the environment as a self sustaining system.

2. **Essential for evolutionary process:** The rich diversity of organisms today are the products of natural evolution stretching unbroken through 3.5 billion years. Since the evolutionary process is going on and nobody knows which species will give rise to what kind of life in evolutionary process, man's duty is to preserve every species of the earth. We have an evolutionary responsibility to conserve each species for our descendants.

**3. Scientific value:** Wild life act as gene bank for breeding programmes in the field of agriculture, animal husbandry, fishery etc. ex: fruitflies, frogs, rats, rabbit, guinea pig, rhesus monkey and many other wild animals are used as research materials on which drugs are tested before applying to man kind. Plant and animal breeders have been able to produce high yielding disease free and stress resistant varieties of plants and animals. Cross breeding is the base of modern agriculture and economic zoology. To produce high yielding and disease free resistant variety of species, a very wide range of plants and animals has to be analysed and selected. Scientists have been constantly examining the wild relatives of crop plants for the presence of useful genes that can be introduced to breeding programmes. So there is an urgent need to protect wild life for breeding experiments. The wild life acts as a source for new varieties.

#### **4. Drugs and medicine**

Natural flora and fauna are the major sources of medicine for curing various ailments. The Indian system of Ayurvedic medication is entirely dependant on plant biodiversity. Diverse plants have diverse medicinal value and provide useful drugs.

About 75% of world's population depends upon plants or plant extracts for medicines. For example.

1. Morphine (*Papaver somniferum*) is used as analgesic
2. Quinine (*Chinchona ledgeriana*) for treatment of malaria
3. Taxol –extracted from bark of *Taxus brevifolia* is used as anit cancer drug.
4. Penicillin used as anibiotic is derived from a fungus called *Penicillium*
5. Degitalin a drug used for cure of heart ailments is got from *Digitalis*

Twenty five percent of drugs in pharmacy are got from only about 120species of plants. About seventy five percent of anti cancer drugs are derived from plants found in tropical rain forests.

5. **Food:** Biodiversity ensures food security. One of the most fundamental values of biodiversity is in providing food. Animals and human beings are heterotrophs and they depend on plants for food. It is obtained from sources like livestock, forestry and fish. More than 80,000 species of plants are used as food. Fresh water and marine fishes provide large amount of food. Fresh water fish and other aquatic animals also provide large amount of food to us. Plants provide food not only for themselves but also for other organisms including man. About 20 plant species are used which provide about 85% of world's food. Just three crops i.e., wheat, rice and maize account for about 60% of the calories and about 55% of protein in humans consume come directly from plants virtually 100% of the protein from domesticated animals comes from nine species i.e, cattle, pigs, sheep, goats, water buffaloes, chickens, ducks, geese and turkeys. Only the conservation of biodiversity can ensure global food security for the rapidly increasing human population as well as animal population.
6. **Economic value:** Wild life is a renewable source and is beneficial to man kind in many ways.
  1. Fur, skin and other products like musk, leather, honey, lac, guano, pearls etc. obtained from wild animals are a good source of income for our country
  2. Ivory of elephants, horns of rhino, antlers of deer etc., fetch large amount of money in foreign currency market.
  3. Several wild plants provide useful products like timber paper , gums, resins, tannins, dry fruits, fibres (cotton, jute), drinks (tea, coffee), distillation products like alcohol, acetic acid, oxalic acid, charcoal, medicines etc.
7. **Fuel and wood:** In some developing countries, fuel wood obtained from various forest species is the major source of energy. Wood is also used in making furniture and in manufacturing paper. To ensure the continuous supply of fuel wood and wood on a sustainable basis for human uses, the biodiversity is to be maintained.
8. **Maintenance of water resources:** Biodiversity plays a very significant role in maintaining water resources on our planet. Life cannot exist without

water. Natural vegetation over the water catchments helps in maintaining hydrological cycle and stabilizing water run off on the earth's surface. Conservation of biodiversity acts as a guarantee for maintaining earth's water resources to support life.

**9. Soil formation and fertility:** Biodiversity helps in soil formation. Plant root systems widen the cracks and the crevices of rocks and quicken the weathering processes of rocks to form the parent material of soil. Biodiversity increases soil fertility by adding organic matter. It also increases water-holding capacity of soil and nutrient level and also improves soil structure.

**10. Climate stabilization:** All the biological species respire to produce  $\text{CO}_2$  gas that is released into the air. In addition industries and automobiles add substantial amount of  $\text{CO}_2$  to atmosphere and raises its temperature causing green house effect. But plants absorb  $\text{CO}_2$  gas from atmosphere and use it for food manufacture and thus store chemical energy. Plants help to maintain a stable  $\text{O}_2$ - $\text{CO}_2$  balance in the atmosphere. Plants evaporate excess water through the surface and this water plays a key role in cloud formation and rainfall. Rain water reduces air temperature and eventually helps in climate stabilization by ensuring vegetation cover on earth surface.

### **11. Aesthetic and Ethical value:**

Due to their beauty, many birds, variously colourful butterflies, mammals, green forests etc. have great aesthetic value to human beings. Aesthetic pleasure derived from biodiversity includes bird watching, pet keeping, gardening, wild life sanctuaries etc. Man can feel this difference while he visits an industrial place and when he moves in jungle. He feels pleasure and happiness in natural environment.

### **Threats to Biodiversity**

There are number of causes which are known to cause extinction of Biodiversity. Some important causes are

1. **Destruction of habitats (Habitat loss):** It is the most serious threat to wildlife because it decreases the hiding places of animals and it increases the chances of their predation.

1) **Pollution:** It is one of the major reasons of wildlife decline. Pollution causes adverse breeding potential and increases struggle for existence.

2) **Deforestation:** Forests are the home of wild animals. Wildlife is suffering a lot due to deforestation for establishing industrial estates and housing projects. In order to get more timber, charcoal and firewood man has cut and destroyed many wild plants which form the main food of these animals. Food is one of the major factors of the habitat which controls distribution and numbers of wild animals.

3) Soil erosion

4) Agricultural expansion

5) Overgrazing

6) Increasing Urbanisation

7) Forest Fires – Due to human activities or by chance

8) Development works like dams, reservoirs, roads, railway lines, croplands, industries, mines etc.,

9) Fragmentation is the process of reduction of habitat into smaller and scattered areas. Animals like elephants, lions, bears and large cats require bigger areas to survive and move. Few birds can reproduce only in deep forests. Due to habitat Fragmentation 1) Barriers are created which limit the potential of species for proper dispersal and colonization 2) Leads to formation of smaller populations which are not able to sustain 3) Migratory birds do not move scattered seasonal patches 4) Species become more vulnerable to wind, fire and predators.

**Poaching of wildlife:** Killing of wild life for commercial use is called poaching. Indiscriminate hunting for various uses of animals like food, hide, musk, tusk, horn, fur, plumage, recreation etc. Excessive hunting is known to cause extinction.

**Man – Wildlife Conflicts:** According to the 2003 IUCN (International Union for Conservation of Nature and Natural Resources) world Park congress, Human – Wildlife Conflict (HWC) occurs when wildlife requirements overlap

with those of human populations, creating costs both to residents and wild animals, HWC has been in existence for as long as humans have existed and wild animals and people have shared the same landscapes and resources.

Today, there is no corner of this earth where HWC does not exist in one form or another. In terms of the scale of their impact on humans, it is the smaller animals, occurring in vast numbers, that have created the greatest impact. However, the larger herbivores (Elephant, Buffalo and Hippopotamus), large mammalian carnivores (Lion, Leopard, Cheetah, Spotted hyena, Wild dog), and the Crocodile are traditionally defined as problem causing animals and are responsible for most of the human – wildlife conflicts. The impact of the activities of large mammals on farmers and their livelihood is enormous and even traumatic when people are killed.

Large feline predators (Tiger, Leopard, Lion, Snow leopard) and elephants are the principal sources of conflict. In India, for instance, in the state of Himachal Pradesh, around Kibber wild life sanctuary, wild carnivores, mainly Snow leopard, killed 18% of the total livestock holding in 1995. In the state of Gujarat, in the proximity of Gir National Park and sanctuary, the Asian lion and the leopard hunt preys such as buffalos, cows, pigs and dogs. In the southern state of Karnataka, the overall annual loss due to large tigers and leopards depredation around the Bhadra Tiger Reserve, is reported to be approximately 12% of the total family live stock holding. In addition, elephant damage to crops accounted for the an average loss 14% of the total annual production.

Humans deaths and injuries, although less common than crop damage, are the most severe manifestations of the HWC and are universally regarded as intolerable. Large mammalian carnivores are also responsible for numerous fatal attacks on human.

Primary reason for all these conflicts is fragmentation of the wild habitat. Crop damage is the most prevalent form of HWC. A wide variety of vertebrate pests come into conflict with farming activity including birds, rodents, primates, antelopes, buffaloes, hippopotamus, bush pigs and elephants. Elephants are able to destroy a field in a single night raid. Elephants can damage infrastructures like ponds or tracks in national parks. Another adverse effect of HWC is the killing of



domestic animals by wildlife. Important diseases are known to be transmitted by wildlife to domestic livestock or possibly by man (i.e., rabies).

Drought, floods, civil unrest, natural disasters or war disrupt the normal production and distribution of food, resulting in famines. These factors spur the continuing migration of rural people into areas where resources could be obtained and which are frequently occupied by wildlife. The resultant occupation of the habitat of wildlife animals by humans leads to conflicts.

The growing loss of habitat has led to increasing conflict between humans and wildlife. As wildlife range becomes more and more fragmented and as wildlife gets confined into smaller pockets of suitable habitat, humans and wildlife are increasingly coming into contact and in conflict with each other.

Killing of wild animals in retaliation for HWC is a very common reaction.

Considering the current human population growth rate, the increasing demand for natural resources and the growing pressure for access to land, it is clear that the human wildlife conflict will not be eradicated in the near future and on the opposite, will grow continuously.

### **Short Answer Question**

1. Explain how deforestation is a threat to Biodiversity.
2. What is Bio diversity
3. List some causes of extinction of wild life
4. What kinds of threats to the biodiversity may lead to its loss.

### **Long Answer Question**

1. Write an essay on Man – wild life conflicts.
2. Describe the importance of Biodiversity

### **Multiple Choice Questions**

1. Which of the following is a cause of loss of Biodiversity  
A) Habitat degradation and loss    B) Pollution  
C) Deforestation    D) **All of these**
2. IUCN stands for \_\_\_\_\_
3. Biodiversity Act of India was passed by the parliament in the year \_\_\_\_\_  
(Ans:- 2003)
4. International year of Biodiversity \_\_\_\_\_ (Ans:- 2010)