Q. BIODIVERSITY AND ITS LEVEL.

ANSWER:

The term "Biodiversity or Biological Diversity" is the sum of all the different species of plants, animals, fungi and microbial organisms that live on Earth, including the various ecosystems in which they live on. Biodiversity also includes the genetic information that these organisms contain.

In another way:

"Biodiversity is the variety and variability of life on Earth."

Levels of Biodiversity:

Biodiversity is divided into three levels:

- Genetic Diversity
- Species Diversity
- Ecological Diversity

1. Genetic Diversity

It is basically the variety of species expressed at the genetic level by each individual in a species. No two individuals belonging to the same species are exactly similar.

All species on Earth are somewhat related through genetic connections. And the more closer a species is related to another, the more genetic information the two species will share. The closest relations of an organism are members of its own species. Members of a species share genes. Genes are the bits of biochemical information that partly determine how an organism looks, behaves, and lives.

For example, in the species of human beings, each human shows a lot of diversity in comparison to another human. People living in different regions show a great level of variation.

2. Species Diversity

It is the biodiversity observed within a community. It stands for the number and distribution of species. The number of species in a region varies widely depending upon the varied environmental conditions.

A wide variety of species exists in an environment. And that's what is referred to as species diversity. Species are the standard measure of biological diversity in light of the fact that they are the basic units of biological classification.

The number of various species in a given ecosystem or environment is described as Species Richness. The total number of species in the world is about 10 million. However, only 1.75 million species have been named scientifically to date.

Some regions have many species. Tropical North and South America, for example, have approximately 85,000 flowering plants. Tropical and Subtropical Asia have at least 50,000 while tropical and subtropical Africa has about 35,000.

3. Ecological Diversity

It defines the diversity observed among the ecosystems in a particular region. Different ecosystems like mangroves, rainforests, deserts, etc., show a great variety of life forms residing in them.

Ecological or ecosystem diversity is the variety of ecosystems in an area. It involves the complex network of various species present in the ecosystems and

the dynamic interactions between them. An ecosystem is made up of organisms from several different species living together in an environment and their connections through the flow of nutrients, energy, and matter.

An ecosystem can cover a small area, like a pond, or a large area, like an entire forest. The primary source of energy in virtually every ecosystem is the sun whose radiant energy is transformed into chemical energy by the plants.

Hence, an ecosystem is a collection of living components and non-living components that are connected by energy flow. It is difficult to measure ecological diversity because every ecosystem on earth merges into the surrounding ecosystems.

Q. Different Types of conservation.

Answer:

There are two types of biodiversity conservation methods:

- ***In-situ* conservation**
- ***Ex-situ* conservation**

1. In situ Conservation-

***In-situ* conservation** is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species. This process protects the inhabitants and ensures the sustainability of the environment and ecosystem.

Or

In situ conservation refers to the conservation of species in their natural ecosystem or natural habitat. It involves protecting and maintaining the natural environment or ecosystem so that all constituent species are conserved. The

factors that endanger the existence of species in the environment are eliminated by an appropriate mechanism.

In situ conservation is advantageous in several ways, including the following:

- It is an economical and convenient way of conserving biodiversity
- It provides a way for preserving numerous organisms at the same time
- In a natural habitat, living organisms have the opportunity to adapt to different environmental conditions as well as to evolve into a better life form.

However, in situ conservation is not without a shortcoming. It requires an extensive area, which can be difficult due to increasingly growing demand for space. In situ conversation of biodiversity can be done in protected areas such as:

- National parks
- Sanctuaries
- Biosphere reserves

National park

National park and nature reserve is the area selected by governments or private organizations for special protection against damage or degradation with the objective of biodiversity and landscape conservation. National parks are usually owned and managed by national or state governments. A limit is placed on the number of visitors permitted to enter certain fragile areas. Designated trails or roads are created. The visitors are allowed to enter only for study, cultural and recreation purposes. Forestry operations, grazing of animals and hunting of animals are regulated and the exploitation of habitat or wildlife is banned.

A national park is an area dedicated for the conservation of wildlife along with its environment. A national park is an area which is used to conserve scenery,

natural and historical objects. It is usually a small reserve covering an area of about 100 to 500 square kilometers. Within biosphere reserves, one or more national parks may also exist. Currently, there are 104 national parks in India.

Name	**State**
Kaziranga National Park	Assam
Gir National Park	Gujarat
Bandipur	Karnataka
Dachigam	J & K
Kanha	M.P
Periyar	Kerala
Ranthambore National Park	Rajasthan

Sanctuary

A wildlife sanctuary is an area which is reserved for the conservation of animals only. Currently, there are 551 wildlife sanctuaries in India.

Wildlife sanctuaries aim only at the conservation of species and have the following features:

1. The boundaries of the sanctuaries are not limited by state legislation.
2. The killing, hunting or capturing of any species is prohibited except by or under the control of the highest authority in the department which is responsible for the management of the sanctuary.
3. Private ownership may be allowed.
4. Forestry and other usages can also be permitted.

Name	**State**
Hazaribagh sanctuary	Jharkhand
Ghana Bird sanctuary	Rajasthan
Sultanpur Bird Sanctuary	Haryana

Biosphere reserve

A biosphere reserve is a ecosystem with plants and animals of unusual scientific and natural interest. It is a label given by UNESCO to help protect the sites. The plan is to promote management, research and education in ecosystem conservation. This includes the 'sustainable use of natural resources'. If, for example, fish or trees are taken for human use, this is done in ways which least damage the ecosystem. A biosphere reserve consists of three zones: lithosphere, hydrosphere and atmosphere.

i) Core zone: No human activity is permitted in this zone.

ii) Buffer zone: It surrounds the core area, where a limited access permits to local people for the gathering of resources.

iii) Free zones: It is the outermost zone, which is open to human settlements and resource gathering.

The program is run by UNESCO's Man and the Biosphere Program. It has started a World Network of Biosphere Reserves. The MAB program has built up the World Network of Biosphere Reserves since 1971. Biosphere reserves, exchange knowledge and experiences on new ideas for sustainable development. They are areas used to develop new ways of doing things, test these ways and share the results. The objective is to get a balanced relationship between mankind and nature.

e.g. Sundarban biosphere reserve

2. *Ex Situ* Conservation

The conservation of biodiversity outside of their natural environments or ecosystems is known as ex-situ conservation. It involves conservation of wild and cultivated species as well as genetic resources.

Ex-situ conservation utilizes a wide range of techniques and facilities and it can be accomplished in the following ways:

Zoological park

In zoological parks, live animals are kept for public recreation, education and conservation purposes. Modern zoos offer veterinary facilities, provide opportunities for threatened species to breed in captivity and usually build environments that simulate the native habitats of the animals in their care. Zoos play a major role in creating awareness about the need to conserve nature.

Botanical garden

In botanical gardens, plants are grown and displayed primarily for scientific and educational purposes. They consist of a collection of living plants, grown outdoors or under glass in greenhouses and conservatories. Also, a botanical garden may include a collection of dried plants or herbarium and such facilities as lecture rooms, laboratories, libraries, museums and experimental or research plantings.

OTHER WAY OF EX SITU CONSERVATION:-

- By establishing gene banks, where sperm, ova, and seeds are stored at controlled temperatures and humidity
- Forming zoo and botanical gardens. These can be beneficial for research purposes and for promoting public awareness of various organisms.
- Collecting microbial culture and in vitro plant tissue
- Artificial propagation of plants and captive breeding of animals, with the possibility of reintroducing them back into the wild.

Q. Short notes on seed bank

Answer:

- A **seed bank** stores seeds to preserve genetic diversity; hence it is a type of gene bank. There are many reasons to store seeds.
- One is to preserve the genes that plant breeders need to increase yield, disease resistance, drought tolerance, nutritional quality, taste, etc. of crops.
- This is a kind of ex situ conservation. Many plants that were used centuries ago by humans are used less frequently now; seed banks offer a way to preserve that historical and cultural value.
- Collections of seeds stored at constant low temperature and low moisture are guarded against loss of genetic resources that are otherwise maintained in situ or in field collections.

- Seed banks are considered seed libraries, containing valuable information about evolved strategies to combat plant stress, and can be used to create genetically modified versions of existing seeds. The work of seed banks spans decades and even centuries.

Orthodox seeds

It is the principal conservation method for species producing orthodox seeds that withstand desiccation to low moisture content and storage at very low temperatures. Most arable and forage species, and many tree species, produce seeds in this category.

Recalcitrant seeds

Several important tropical and sub-tropical tree species produce seeds that do not survive desiccation and cannot tolerate low temperatures, and which are therefore not easy to store; these are known as recalcitrant seeds. Techniques exist for storing some recalcitrant seeds, but the seeds are usually short-lived and each species requires its own method.

Principles of seed storage

The underlying principle of successful seed storage is to maintain genetic integrity of accessions as seeds with high viability for long periods. Seeds of the original sample should be stored under the best possible conditions to ensure safe long-term survival, while seeds of accessions that are frequently requested by breeders or other users should be stored in the active collection. Genebanks may maintain both base and active collections or focus on only one. Such decisions are based on the purpose and needs of the genebank and economics of conservation.

For orthodox seeds, low temperatures and low moisture content are used to extend longevity and reduce regeneration intervals with related risks to loss of diversity and genetic integrity.

Sample size

- The required minimum number of seeds for a genetically homogenous sample is 3000-4000 seeds and for a genetically heterogeneous sample it is 4000-12 000 seeds.

The Importance of Seed Banks

1. **Preservation of Crop Diversity**

This is the most important reason for the storage of seeds. Just as human beings and animals are adapted to different conditions for survival, so are crops. Different types of the same species exist due to this adaptive nature. Therefore, it is of critical necessity that such diversity is preserved.

2. ***Protection from Climate Change***

For a couple of decades now, the world has witnessed radical climatic change that has been accelerated by increased industrial pollution. Crop extinction is inevitable with such extreme changes. If seeds are stored in seed banks, the danger of total elimination of certain species of crops is eliminated.

3. ***Protection from Natural Disasters***

Natural disasters are unforeseen events that could lead to complete annihilation of crops from the face of the earth. The foresight of keeping seeds in a seed bank could save such a situation. Malaysian rice paddies, for example, were wiped out during the 2004 tsunami and international seed banks provided farmers with seeds that helped them start over.

5. Disease Resistance

Crop diseases are highly contagious and very deadly to plants. A serious breakout could completely eliminate crops. Where diseases have ravaged crops and left no traces that farmers could start on, seed banks can intervene and provide them with seeds that will enable them start on a clean slate.

6. Provide seed material for research

Seeds that are stored in seed banks can be made easily available to scientists and researchers who wish to study these seeds especially if such research could lead to improvement of crop production.

Q. CHROMOSOME ABERRATION- (STRUCTURAL)

Answer:

In this category, aberration alters the chromosome structure but do not involve a change in chromosome number. The mechanics signify chiefly a rearrangement through loss, gain or reallocation of chromosomal segments.

However, the structural aberrations of chromosomes can be classified into four common types, which are as follows:

Deletion:

The loss of a chromosome segment is known as deletion or deficiency. The deletion of a portion of chromosome is a very rare event. It produces some striking genetic and morphological / physiological consequences.

Deficiency in chromosome no. 5 creates 'Cri-du-chat' (cry-of-cat) syndrome where the individuals produce a characteristic mewing cry like cat during childhood.

Duplication:

The presence of an additional chromosome segment (as compared to that of normal number) in a nucleus is known as duplication. In this process, a segment of a chromosome is added to another chromosome; the extra part of the chromosome constitute duplication when this extra- chromosome segment is located immediately after the normal segment following the same orientation (i.e. the same gene sequence is maintained), it is called **Tandem duplication**.

When the gene sequence in the extra-chromosome occurs in a reverse order, it is known as Reverse duplication. **The Reverse duplication is almost same as Tandem duplication**, but here the additional segment is inverted in order. For example, the sequence will be e d c in place of c d e. Sometimes, the additional

segment is found to be located in the same chromosome but away from the normal segment: such cases are termed as displaced duplication.

In general, duplications do not produce any drastic consequences as like deletion in terms of phenotype and survival. It has been postulated that the increase in DNA content per cell accompanied the process of evolution; the origin of new genes with distinct functions was possible only for the event of duplication.

Inversion:

When a segment of a chromosome is found to be oriented in reverse direction, it is called inversion. Two breaks are required within a chromosome to get this situation. The segment rotates in 180°.angle and reinserted between the breaks. As a result, the linear order of the genes becomes exactly opposite, in comparison to its normal homologous segment.

Suppose, the normal order of a few genes in a segment of the chromosome is ABCDE (in the original chromosome). If an inversion takes place between B and D (i.e. BCD segment), the order of the genes in the inverted segment will be ADCBE.

However, inversion may be of two types – Paracentric inversion and Pericentric inversion. If the inverted segment does not contain a centromere, it is termed as **Paracentric inversion**. But if it contains a centromere, it is called **Pericentric inversion**.

Translocation:

Integration of chromosome segment into a non-homologous chromosome is known as translocation. It involves the transfer of a segment of chromosome to a different part of the same chromosome or a different chromosome. There are three basic types of translocation—simple, reciprocal and shift.

Simple translocation shows an attachment of a small terminal segment of a chromosome to the end of a homologous chromosome or to a non-homologous chromosome. This attachment is not a fusion at all. In **Reciprocal translocation**, the breakage takes place in two non-homologous chromosomes, and is followed by the reunion of broken segment to the wrong partners. **Shift translocation** requires at least three breaks in the chromosome. Among these, Reciprocal, and shift are the most common types.