BIODIVERSITY:

Biodiversity is the biological variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic, species, and ecosystem level.

The 1992 United Nations Earth Summit defined "biological diversity" as "the variability among living organisms from all sources, including, interalia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems. This definition is used in the United Nations Convention on Biological Diversity.

The United Nations designated 2011–2020 as the United Nations Decade on Biodiversity.[41] and 2021–2030 as the United Nations Decade on Ecosystem Restoration. According to a 2019 Global Assessment Report on Biodiversity and Ecosystem Services by IPBES 25% of plant and animal species are threatened with extinction as the result of human activity. An October 2020 IPBES report found the same human actions which drive biodiversity loss have also resulted in an increase in pandemics.

Scientists have estimated that there are around 8.7 million species of plants and animals in existence. However, only around 1.2 million species have been identified and described so far, most of which are insects. This means that millions of other organisms remain a complete mystery.

Biodiversity is not evenly distributed, rather it varies greatly across the globe as well as within regions. Among other factors, the diversity of all living things (biota) depends on temperature, precipitation, altitude, soils, geography and the presence of other species. The study of the spatial distribution of organisms, species and ecosystems, is the science of biogeography.

Diversity consistently measures higher in the tropics and in other localized regions such as the Cape Floristic Region and lower in polar regions generally. Rain forests that have had wet climates for a long time, such as Yasuní National Park in Ecuador, have particularly high biodiversity.

Terrestrial biodiversity is thought to be up to 25 times greater than ocean biodiversity. Forests harbour most of Earth's terrestrial biodiversity.

Types of Biodiversity

There are the following three different types of biodiversity:

- Genetic Biodiversity
- Species Biodiversity
- Ecological Biodiversity

Species diversity

Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganisms.

Genetic diversity

It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution. That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

Ecological diversity

An ecosystem is a collection of living and non-living organisms and their interaction with each other. Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs. It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

Importance Of Biodiversity

Biodiversity and its maintenance are very important for sustaining life on earth. A few of the reasons explaining the importance of biodiversity are:

Ecological Stability

Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystem supports the services without which humans cannot survive. A diverse ecosystem is more productive and can withstand environmental stress.

Economic Importance

Biodiversity is a reservoir of resources for the manufacture of food, cosmetic products and pharmaceuticals.

Crops livestock, fishery, and forests are a rich source of food.

Wild plants such as Cinchona and Foxglove plant are used for medicinal purposes.

Wood, fibres, perfumes, lubricants, rubber, resins, poison and cork are all derived from different plant species.

The national parks and sanctuaries are a source of tourism. They are a source of beauty and joy for many people.

Ethical Importance

All the species have a right to exist. Humans should not cause their voluntary extinction. Biodiversity preserves different cultures and spiritual heritage. Therefore, it is very important to conserve biodiversity.

Threats to biodiversity

The core threat to biodiversity on the planet, and therefore a threat to human welfare, is the combination of human population growth and the resources used by that population. The human population requires resources to survive and grow, and those resources are being removed unsustainably from the environment.

1. Habitat loss:

   Elimination of natural habitat of other species by human —whether it is a forest, coral reef, grassland, or flowing river— leads to death of individuals in the species. Human destruction of habitats (habitats generally refer to the part of the ecosystem required by a particular species) accelerated in the latter half of the twentieth century. Consider the exceptional biodiversity of Sumatra: it is home to one species of orangutan, a species of critically endangered elephant, and the Sumatran tiger, but half of Sumatra's forest is now gone. The neighboring island of Borneo, home to the other species of orangutan, has lost a similar area of forest. Forest loss continues in protected areas of Borneo. The orangutan in Borneo is

listed as endangered by the International Union for Conservation of Nature (IUCN), but it is simply the most visible of thousands of species that will not survive the disappearance of the forests of Borneo.

2. Over- harvesting and over- hunting:

Overharvesting is a serious threat to many species, but particularly to aquatic species. The western Atlantic cod fishery is an example of loss of diversity due to over-harvesting.. While it was a hugely productive fishery for 400 years, the introduction of modern factory trawlers in the 1980s and the pressure on the fishery led to it becoming unsustainable. Whales have slow-growing populations and are at risk of complete extinction through hunting. Also, there are some species of sharks with restricted distributions that are at risk of extinction. The groupers are another population of generally slow-growing fishes that, in the Caribbean, includes a number of species that are at risk of extinction from overfishing.

Hunting is practiced throughout the world, but hunting practices, particularly in equatorial Africa and parts of Asia, are believed to threaten several species with extinction. Animals are killed not only for food but also for their skins, tusks, bones, horns and other body parts. Tigers, rhinoceros, elephants and many animals have become endangered due to over-hunting and poaching.

3 .Invasive species:

Exotic species are species that have been intentionally or unintentionally introduced by humans into an ecosystem in which they did not evolve. These exotic species often undergo dramatic population increases in their new habitat and reset the ecological conditions in the new environment, threatening the species that exist there. When this happens, the exotic species also becomes an invasive species. Invasive species can threaten other species through competition for resources, predation, or disease. In Lake Victoria, the intentional introduction of the Nile perch was largely responsible for the extinction of about 200 species of cichlids. The accidental introduction of the brown tree snake via aircraft from the Solomon Islands to Guam in 1950 has led to the extinction of three species of birds and three to five species of reptiles endemic to the island. Several other species are still threatened.

4.Climate change:

Climate change, specifically due to anthropogenic activity is recognized as a major extinction threat, particularly when combined with other threats such as habitat loss. Anthropogenic warming of the planet has been continuing emission of greenhouse gases, primarily carbon dioxide and methane, into the atmosphere caused by the burning of fossil fuels and deforestation. It has been estimated that approximately 15 to 40 percent of species committed to extinction by 2050.Climate change alters regional climates, including rainfall and snowfall patterns, making habitats less hospitable to the species living in them. Changing climates also throw off the delicate timing adaptations that species have to seasonal food resources and breeding times. The rate of warming appears to be accelerated in the arctic, which is recognized as a serious threat to polar bear populations that require sea ice to hunt seals during the winter months: Finally, global warming will raise ocean levels due to melt- water from glaciers and the greater volume occupied by warmer water. Shorelines will be inundated, reducing island size, which will have an effect on some species, and a number of species will disappear entirely.

5. Pollution:

The discharge of toxic synthetic chemicals and heavy metals into the environment has a huge impact on species abundance and can lead to extinctions. It’s important to remember that substances that are “natural” can become pollution when they are too abundant in a certain area.

For example, nitrogen and phosphorous are important nutrients for plant growth, but when they concentrate in water systems after being applied as agricultural fertilizers, they can cause “dead zones” that are uninhabitable for fish and other wildlife. Also, carbon dioxide is a “natural” component of the atmosphere but is considered a pollutant when emitted by human industrial activities.Bioaccumulation is an important concept connected with pollution. This is the process of chemicals becoming increasingly concentrated in animal tissues as they move up the food chain. Killer whales provide an example of how bioaccumulation can be a serious problem for biodiversity, and especially for marine mammals.

Conservation of biodiversity:

Conservation of biodiversity is protection, upliftment and scientific management of biodiversity so as to maintain it at its threshold level and derive sustainable benefits for the present and future generation.

There are three major objectives of Biodiversity conservation:

- Preservation of the diversity of species.
- Sustainability of species and ecosystem.
- Maintaining life-supporting and essential ecological processes.

Biodiversity Conservation Methods--

Two types of methods are employed to conserve biodiversity.

- In-situ Conservation
- Ex-situ Conservation

In Situ Conservation--

In Situ Conservation refers to the preservation and protection of the species in their natural habitat. It means the conservation of genetic resources in natural populations of plant or animal species. In situ conservation involves the management of biodiversity in the same area where it is found.
In situ, biodiversity conservation has many advantages

- It preserves species as well as their natural habitat.
- It ensures protection to a large number of populations.
- It is economic and a convenient method of conservation
- It doesn’t require species to adjust to a new habitat.

Different methods of In-situ conservation include biosphere reserves, national parks, wildlife sanctuaries, biodiversity hotspots, gene sanctuary, and sacred groves.
Ex Situ Conservation--

Ex Situ Conservation means conservation of life outside their natural habitat or place of occurrence. It is the method in which part of the population or the entire endangered species is taken from its natural habitat which is threatened and breeding and maintaining of these species take place in artificial ecosystems. These artificial ecosystems could be zoos, nurseries, botanical gardens, etc. The living environments are altered in these conservation sites, so there are fewer survival struggles like scarcity of food, water, or space. Ex-situ conservation of biodiversity consists of breeding and maintenance of endangered species using artificial environments like zoos, nurseries, botanical gardens, gene banks, etc. The competition for food, water, and space among the organisms is low.

Advantages of Ex Situ Conservation Include
Essential life-sustaining conditions like climate, food availability, veterinary care can be altered and are under human control.

- Artificial breeding methods can be introduced leading to successful breeding and creating many offspring of the species.
- The species can be protected from poaching and population management can be efficiently done.
- Gene techniques can be applied to increase the population of the species and they can again be reintroduced into the wild.

Biodiversity Conservation Strategies

- Conservation of Ecosystems- The intent of the conservation of biodiversity is to provide long term viability to the ecosystems. It is to make sure that ecological integrity is intact. The landscapes of the region which have undergone historical or evolutionary deterioration can be reinstated. The threats can be removed and the ecosystems should be able to continue with ecological processes.
- Reverse the decline of species- According to this strategy, the aim of conservation is to restore the population of declined species in a particular ecosystem.
- Conservation of all biological aspects- This strategy aims at giving cover and conserving food, livestock, microbial population, agricultural stock including plants and animals.
- Efficient utilization of natural resources.
- Strict laws on deforestation and preventions of deforestation by every means.
- Poaching and killing animals in the wild should be prevented.
- Creating public awareness about conservation of biodiversity and its importance.
- Longer time and breeding activity of the animals are provided.
- The breeding of species in captivity is reintroduced in the wild.
- Genetic techniques are used to preserve endangered species.

Biodiversity hotspots:
the term “Biodiversity hotspots” can be defined as the regions which are known for their high species richness and endemism. According to Conservation International, a region must fulfill the following two criteria to qualify as a hotspot:

1. The region should have at least 1500 species of vascular plants i.e., it should have a high degree of endemism.
2. It must contain 30% (or less) of its original habitat, i.e. it must be threatened.

There are major four biodiversity hotspots in India:

1. The Himalayas
2. Indo-Burma Region
3. The Western Ghats
4. Sundaland

Top 5 Endangered Species of India	
Endangered Animal Species	Endangered Plant Species
The Royal Bengal Tiger	Ebony tree
The Great Asiatic Lion	Indian Mallow
The Snow Leopard	Malabar Lily
Nilgiri Tahr	Assam Catkin Yew
Indian Rhino	Milkwort

Endemic species:

“Endemic species is that ecological state of a species where a species is unique to a defined geographical location.” Endemic species are found in just one region and nowhere else in the world. For example, kangaroos are originally endemic to Australia and are found nowhere else in the world. The cases where they have been spotted outside their natural habitat is due to humans introducing them when the animal was in captivity.

There are also other marsupials that are endemic only to Australia and its surrounding islands. The Tasmanian tiger is one such animal that was endemic to Australia, Tasmania and New Guinea. But now, it is extinct. . In the case of endemic plants, sometimes, species become endemic due to habitat destruction. The Redwood Forest on the West Coast of the United States has become endemic as it is now almost entirely limited to California.

There are several ways in which a species may come to be endemic to a particular area. A broadly distributed population may disappear from several habitats due to changes that have occurred in their natural habitat. The changes could be an influx of predators, human activities, climate change or a combination of these factors.

A list of the endemic species of India is mentioned below:

Asiatic Lion

Known as the Indian Lion and can be only found in and around Gir Forest National Park of Gujarat. These are listed as endangered species. These are one of the five big cats found in India, the others being Indian Leopards and Bengal Tigers.

Hangul, the Kashmir Stag

Found in the dense forests of Dachigum National Park, Kashmir Valley and Chamba district, Himachal Pradesh.

Lion-tailed macaque

It is the rarest, most threatened and endangered primate species found only in the Western Ghats of Southern India.

Purple Frog

The purple frog, also known as the Pignose frog, is only found in the rainforests of western ghats in India. It spends most of its life underground.

Sangai Deer

It is also known as Brow Antlered Deer exclusively found in Keibul Lamjao National Park of Manipur. This park is a marshy wetland located in the southern parts of Loktak lake.

Nilgiri Tahr

It is a wild sheep species, endangered and endemic to the Nilgiri Hills of Western Ghats.

Other endemic species of India include:

- Pygmy Hog, Assam
- Bronzeback Vine Snake, Western Ghats
- Nilgiri Blue Robin, Nilgiri Hills
- Malabar Civet, Western Ghats
- Anaimalai Gliding Frog, Anaimalai Hills
- Namdapha Flying Squirrel, Arunachal Pradesh
- Indian Giant Squirrel
- Bonnet Macaque