BIODIVERSITY AND ITS CONSERVATION

1. Biodiversity

It refers to the variety and variability of living organisms on the planet Earth. It can also be defined as the variety of life forms, gene pools and habitats found in an area. The term 'biodiversity' was popularised by socio-biologist Edward Wilson (1992) to describe the combined diversity at all the levels of biological organisations.

2. Levels of Biodiversity

The biodiversity can be described by the following three interrelated components or hierarchical levels of biological organisation

A. Genetic Diversity A single species shows high diversity at the genetic level. Greater the genetic diversity among organisms of a species, more sustenance it has against the environmental disturbances. Genetic diversity within the species creates different sub-species, variety, breed, forms, etc.

B. Species Diversity It is the diversity at the species level or the measure of the variety of species and their relative abundance within a region, e.g. Western Ghats have more amphibian species diversity than Eastern Ghats. The two important measures of species diversity are

- (i) Species richness (the number of species per unit area)
- (ii) Species evenness (the relative abundance of species in an area)

C. Ecological Diversity It refers to the diversity at the ecological level. Due to the presence of more varieties of ecosystems and habitats, i.e. rainforest, desert, wetlands, mangroves, coral reefs, alpine meadows, etc, India has a greater ecological diversity than Scandinavian countries (e.g. Norway).

3. Magnitude of Biodiversity

According to International Union of Conservation of Nature (IUCN) 2004, the total number of plant and animal species described so far is more than 1.5 million. More than 70% of all the species recorded are animals, while plants comprise not more than 22% of the total. Insects are the most species rich taxonomic group in animal kingdom, making more than 70% of the total animals. It means that out of every 10 animals, 7 are insects on the Earth.

4. Patterns of Biodiversity

Biodiversity is not uniform throughout the world. It varies with change in latitudes and altitudes. Following are the patterns of biodiversity

A. Latitudinal Gradients Species diversity decreases as we move away from the equator towards the poles. It means biodiversity is more at lower latitude (equator) than the higher latitude (poles). Thus, the tropics (latitudinal range 23.5°N to 23.5°S) have more species diversity than temperate or polar areas. The various hypothesis for greater biodiversity in tropics are given below

(i) Unlike temperate regions subjected to frequent galaciations in the past, tropics have remained undisturbed.

(ii) Tropical environment is less seasonal than temperate regions and have relatively constant environmental conditions.

(iii) Due to more solar energy in tropics, there is higher productivity which leads to species diversity

B. **Species-Area Relationships** Alexander von Humboldt, observed that within a region, species richness had increased with increasing explored area, but only up to a limit. The relationship between species richness and an area turns out to be a rectangular hyperbola for wide taxonomic variety (e.g. birds, bats, fishes in freshwater).

On a logarithmic scale, the relationship is a straight line and described by the following equation,

Log S = log C + Z log A

where, S = Species richness, A = Area

Z = Slope of the line (regression coefficient)

C= Y -intercept

The value of Z lies between 0.1-0.2, regardless of the taxonomic group or the region.

5. Importance of Species Diversity to the Ecosystem

A stable community shows following characteristics

(i) It does not show too much of variations in the year-to-year productivity.

(ii) It must be either resistant or resilient to occasional disturbance (man-made or natural).

(iii) It must be resistant to invasion by alien species.

David Tilman through his long-term ecosystem experiments using outdoor plots provided some concrete evidences of link between species richness and stable community.

According to him, more species diverse communities show almost constant productivity in total biomass and also contribute to higher productivity. **Paul Ehrlich** gave rivet popper hypothesis to help understand the contribution of diversity for ecosystem balance. He compared each species with rivet in the body of an aeroplane (ecosystem). He explained that rivets (species), if removed from the aeroplane (ecosystem will seriously damage it.

6. Loss of Biodiversity

The International Union for Conservation of Nature (IUCN) was founded in 1948. Its headquarter is at Switzerland. It works in the field of nature conservation and sustainable use of natural resources.

IUCN Red List of threatened species is an inventory of global conservation status of biological species, which is compiled in Red Data Book. It was initiated in 1963.

IUCN Red List (2004) enlists the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years.

Some examples are Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Steller's sea cow (Russia) and three sub-species of tiger (Bali, Javan and Caspian).

A. Effects of Loss of Biodiversity Loss of biodiversity may lead to

(i) Decline in plant production.

(ii) Lower resistance and resilience to environment perturbations such as drought.

(iii) Increased variability in ecosystem processes such as plant productivity, water use, pest and disease cycles, etc.

B. **Causes of Loss of Biodiversity** Human activities have accelerated the rate of extinction of species from the Earth. The four major causes also called the **Evil Quartet** are responsible for the loss of biodiversity.

(i) Habitat Loss and Fragmentation

- (ii) Overexploitation
- (iii) Alien (exotic) Species Invasions
- (iv) Coextinctions

7. Reasons for Conserving Biodiversity

The reasons for conservation of biodiversity can be grouped into three categories

(i) **Narrowly Utilitarian** Humans derive countless direct economic benefits from nature therefore, it must be conserved.

(ii) **Broadly Utilitarian** Biodiversity plays a major role in ecosystem services. Thus, conservation is necessary.

(iii) **Ethical Argument** Every species has an intrinsic value even if it is not of any economic value to us. It is our duty to pass this biological legacy in good order to future generations.

8. Biodversity Conservation

It can be briefed into two plans- In situ conservation and Ex situ conservation.

A. **Ex situ conservation**In this type of conservation, the animals and plants are kept outside their natural home in a special care unit. Hence, it is known as ex situ conservation. Ex situ conservation includes offsite collections and gene banks. These are as follows

(i) **Gene Bank**The genes of the rare, endangered and desired quality of plants and animals are conserved at a safe place. This is known as gene bank.

(ii) **Cryopreservation** In this technique, the germplasm of threatened and endangered species is kept at very low temperature (-196°C) in liquid nitrogen. In this process, the biological activities, mitosis and the genetic changes stop. It is known as cryopreservation. Zoos, botanical gardens, wildlife safari park, etc., are other methods of ex situ conservation.

B. In situ Conservation In this process, the species are kept in their natural homes for conservation. It includes following procedures

(i) **National Parks**To provide safe homes for wildlife, central government has established National Parks. In these parks any type of human interference is prohibited. The property available in these parks cannot be used for commercial purpose. **First Indian National Park** is Jim Corbett National Park which is situated in Uttarakhand.

(ii) **Wildlife Sanctuaries**To provide safety to fauna wildlife, sanctuaries are setup. In these sanctuaries, residing communities are allowed for the limited cutting of trees, collection of forest products, etc.

(iii) Biodiversity Hotspots These are regions with very high levels of species richness and high degree of endemism and also regions of accelerated habitat loss. There are 34 international biodiversity hotspots in the world from which three are located in India.

(a) Eastern Himalayan Region This is situated in the Northern and Eastern parts. This includes Asom, Nepal, Sikkim and Bhutan. Temperate forests are found in it.

(b) Western Ghats This includes regions of Karnataka, Maharashtra, Kerala and Tamil Nadu. Evergreen forests are found near the sea coasts.

(c) Indo-Burma It extends from Bhutan to Myanmar covering most of the North-Eastern India.

(iv) **Biosphere Reserves**These are special category of protected areas of land and/or coastal environments, wherein people are an integral component of the system. They represent a specified area zonated for particular activity. These consist of core zone (no human activity), buffer zone (limited human activity), manipulation zone (several human activities are allowed).

(v) **Sacred Groves** These are small group of forests with special religious importance in a particular culture and are also of mythological importance, e.g. Aravalli Hills of Rajasthan, etc.

Note A Ramsar site is a wetland site designated as internationally important under the Ramsar convention (i.e. a convention on wetlands). It is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources established in 1971 in Iran. Currently, India has 26 Ramsar sites like Kolleru Lake (Andhra Pradesh), Deepor Beel (Asom), Pong Dam Lake (Himachal Pradesh), etc.

9. People Participation for Biodiversity Conservation

These activities are seen since past. These include various movements like Chipko Movement, Appiko Movement, etc.

Biodiversity rich countries expect to reap more benefits from the increasing resources have put into **bioprospecting**, i.e. exploration of molecular, genetic and species-level diversity for obtaining products of economic importance.