2.2 BIODIVERSITY

2.2.1 INTRODUCTION

- Biodiversity is the abbreviated word for —biological diversity (bio-life or living organisms, diversity-variety). Thus biodiversity is the total variety of life on our planet, the total number of races, varieties and species. The sum of total of various types of microbes, plants and animals (producers, consumers and decomposers) in a system.

- Biomes can be considered life zones, environment with similar climatic, topographic and soil conditions and roughly comparable biological communities (Eg. Grassland, forest). The biomes shelter an astounding variety of living organisms (from driest desert to dripping rain forest, from highest mountain to deepest ocean trenches, life occurs in a marvelous spectrum of size, shape, colour and inter relationship). The variety of living organisms, the biodiversity, makes the world beautiful.

- There are 1.4 million species known presently. But based on new discoveries, by research expeditions, mainly in tropics, taxonomists estimate there are between 3-50 million different species may be alive today. Insects make up more than one half of all known species and may comprise more than 90% of all species on earth.

2.2.2 LEVELS OF BIODIVERSITY

- The concept of biodiversity may be analyzed in 3 different levels. They are
  1. Ecosystem diversity
  2. Species diversity
  3. Genetic diversity

1. Community or Ecosystem diversity

- A set of biotic components (plants, animals and microorganisms) and abiotic components (soil, air, water, etc) interacting with each other is known as an ecosystem.

- Ecosystem or ecological diversity means the richness and complexity of a biological community, including tropic levels, ecological processes (which capture energy), food webs and material recycling.

- The diversity at an ecological level or habitat level is known as ecosystem diversity.

  Ex: River ecosystem- Rivers include fish, aquatic insects, mussels and a variety of plants that have adapted.

- Ecosystem diversity is the aggregate of different environmental types in a region.

- It explains the interaction between living organisms and physical environment in an ecosystem.

2. Species diversity –

- A discrete groups of organisms of the same kind is known as species.

- Species diversity is the diversity between different species.

- The sum of varieties of all living organisms at the species level is known as species diversity.

- Species diversity describes the number of kinds of organisms within individual communities or ecosystems.

- The biotic component is composed of a large number of species of plants, animals and microorganisms which interact with each other and with the abiotic component of the environment.

  Ex: The total number of species living on earth is approximately more than 2 million. However, only around 1.5 million are found and assigned scientific names.

  Plant species: Apple, Mango, Wheat, Grapes, Rice etc

  Animal species: Lion, Tiger, Elephant,Deer etc

3. Genetic diversity –

- A species with different genetic characteristics is known as a sub-species or "genera".

- Genetic diversity is a measure of the variety of versions of same gene within individual species.

- Within individual species, there are varieties, that are slightly different from one other. These differences are due to differences in the combination of genes.

- Genes are the basic units of hereditary information transmitted from one generation to the other.

  Ex: (i) Rice varieties - All rice varieties belong to the species "*oryzasativa*". However there are thousands of rice varieties that show variation at the genetic level in the form of different size, shape, colour and nutrient content.

  (ii) Teak wood varieties: The various teak wood varieties available are - Indian teak, Burma teak, Malaysian teak etc.

2.2.3 FUNCTIONS OF BIODIVERSITY: Two main functions of biodiversity are

1. It is the source on which the entire human species depends on for food, fibre, shelter, fuel and medicine.

2. It depends on biosphere which in turn leads to stability in climate, water, soil, air and overall health of biosphere.

2.2.4 VALUE OF BIODIVERSITY

Definition and estimation of the value of biodiversity is not easy. The value of biodiversity is classified into:

      1. Direct Value and

      2. Indirect Value

1. Direct value of biodiversity: It is of two types

      a. Consumptive use value and

      b. Productive use value

a. Consumptive use value:

- The consumptive use value is the value placed on nature's products that are consumed directly, without passing through a market. Some of them are firewood, food, and game meat.

- When direct consumption requires recreation, as in sport fishing and game viewing, the consumptive value is the whole recreational experience. Consumptive value seldom appears in national income accounts, but could be easily included in measures such as GDP. It is valued from the cost if resource was sold at market value, rather than being consumed.

- High consumptive use values on resources may lead to the following problems:

- Over-exploitation of wildlife in developing countries
- Loss of traditional controls on hunting and
- Loss of wildlife populations at productive levels.
- Consumptive use value benefits the communities closest to the resource if harvested sustainably and managed efficiently.

b. Productive use value:

- Productive use value refers to products that are commercially harvested (sold in a market).
- Its value is estimated at the production end rather than retail end by adding an inflated cost to the finished product.
- Productive use value is often the only value of biological resource reflected in national income accounts and may have a major impact on the national economy.
- Timber, fish, honey, construction materials, mushrooms, fruits, medicinal plants and game meat sold in a market have productive use value.

2. Indirect value of biodiversity

- Indirect values provide economic benefits without being harvested and do not appear in GDP. However, they are crucial to other natural products which influence the GDP.
- These values involve functions performed by biodiversity which are not of any use. Ex: Ecological Processes etc.
- Direct values are often derived from indirect values because plants and animals are supported by the services provided by their environments.
- Many classes of plant and animal species are consumed by tribal and non-tribal communities.
  Ex:
  1. Ecological functions
  2. Flood and storm protection
  3. Waste assimilation
  4. Microclimatic functions
  5. Nutrient cycles

6. Photosynthesis

7. Carbon stores

8. Soil protection, etc.

Indirect value of biodiversity is of the following types:

1. Non-consumptive use value

2. Optional value

3. Existence or ethical value and

4. Information value

1. Non-consumptive use value:

- This indirect value deals with nature's functions and services.

- It includes photosynthesis of plants which provides support system for other species by maintaining water cycle, regulating climate, production and protection of the soil, absorption and breakdown of pollutants, recreational, aesthetic, socio-cultural, scientific, educational, spiritual and historic values of natural environments.

- Recreational value is important with regard to tourism and helps the national GDP.

2. Optional value:

- This refers to the potential of biodiversity that is currently known and needs to be explored.

- This refers to the idea that there may be several existing species that may prove to be important in future and their usefulness needs to be studied with reference to a specific problem currently plaguing the society.

  Ex:

  1. The growing biotechnology field is searching for a the cure for diseases like cancer and AIDS.

  2. Medicinal plants and herbs play a very important role in the economic growth of our country.

3. Existence value:

- This is the value gained from continuous knowledge of existence. Also, this is the value that people are willing to pay to keep a species /

community /ecosystem from going extinct. Examples of this are high amounts being spent for animals like pandas, whales, lions etc.

- Our rich heritage teaches us to worship plants, animals, rivers and mountains. Examples being the Ganga river, trees like Banyan and Peepal and plants like the Vambu, Tulsi and Vengai are worshipped.

4. Information value: This relates to the educational, scientific and aesthetic and tourism values of biodiversity in an ecosystem

5. Aesthetic Values: Beautiful plants and animals inspire us to protect biodiversity. The most important aesthetic value of biodiversity is eco-tourism.

Ex:

1. People from distant places spend time and money to visit areas where they can enjoy aesthetic value of biodiversity. This is called eco-tourism.

2. The pleasant music of wild birds, beautifully coloured butterflies, colour of peacocks and colour of flowers are very important for their aesthetic value.

2.2.5 THREATS TO BIODIVERSITY

- Any disturbance in a natural ecosystem tends to reduce its biodiversity.
- Waste generated due to increase in human population and industrialization spoils the environment and leads to decreased diversity in biological species.
- Any change in the system leads to a major imbalance and threatens the normal ecological cycle.
- Causes for loss of biodiversity are:
    1. Habitat loss
    2. Poaching of wildlife and
    3. Man-wildlife conflicts

1. Habitat loss: The loss of populations of interbreeding organisms is caused by habitat loss. Factors influencing habitat loss are:

a. **Deforestation:** Loss of habitat is mainly caused by deforestation activities. Forests and grasslands are cleared for conversion into agriculture lands or settlement areas or developmental projects. Forests and grasslands are natural home to thousands of species which disintegrate due to loss of their natural habitat.

b. **Destruction of wetlands:** Wetlands, estuaries and mangroves are destroyed due to farming, filling and pollution that cause loss of biodiversity

c. **Habitat fragmentation:** When the habitat is divided into small and scattered patches the phenomenon is called habitat fragmentation. This leads to the disappearance of most wildlife

d. **Raw material:** To produce hybrid seeds, wild plants are used as raw materials leading to extinction of many wild plant species.

e. **Production of drugs:** Pharmaceutical companies collect wild plants for the production of drugs leading to extinction of several medicinal plant species.

f. **Illegal trade:** Illegal trade of wildlife reduces biodiversity leading to habitat loss

g. **Developmental activities:** Construction of dams in forest areas coupled with the discharge of industrial effluents kills birds and other aquatic life.

2. Poaching of wildlife: Poaching refers to killing animals or commercial hunting. It contributes to loss of biodiversity. Poaching can be of two types listed below:

1. **Subsistence poaching:** This refers to killing animals for survival.

2. **Commercial poaching:** This refers to hunting animals in order to sell their products.

Factors influencing poaching:

1. **Human population**: Increased human population in India has led to pressure on forest resources, leading to degradation of wildlife habitats

2. **Commercial activities**: Although a ban has been imposed internationally on the trade of products of endangered species, there is a continued smuggling of wildlife products. Since trading of such products is highly profitable, poachers continue to hunt endangered animals and smuggle their fur, skin and tusks to other countries. Wildlife products include *furs, horns, tusks, live specimens and herbal products*. *Richest source* of biodiversity lies in developing nations in *Asia, Africa and Latin America*. *Advanced countries* like *Europe, North America, Japan, Taiwan, Hong Kong* are the *major importers* of wildlife products.

3. Man-Wildlife Conflicts: Man-wildlife conflicts arise, when wildlife starts causing immense damage and danger to man. Under such conditions it is very difficult for the

forest department officials to convince the affected villagers to gain the villagers support for wildlife conservation.

Ex:

1. In Sambalpur, Orissa, several people were killed by elephants. In retaliation, the villagers killed and injured several elephants.
2. In Mysore, elephants were killed by farmers in retaliation to the damage done by elephants to their cotton and sugarcane fields.
3. Villagers sometimes hide explosives in their fields to ward-off animals which explode when the elephants enter the fields
4. Several people were killed when leopards attacked them in Sanjay Gandhi National Park, Mumbai

Factors influencing man-animal conflicts

1. Shrinking forest cover compels wildlife to move outside the forest
2. Human encroachment into forest area induces a man-wildlife conflict
3. Injured animals have a tendency to attack man
4. Wild animals venture out of the forest area in search of food
5. Villagers set-up electric wiring around their fields. This injures animals (Elephants) who suffer pain and get violent.
6. Cash compensation paid by the government is not enough.
7. Garbage near human settlements or food crops attracts wild animals.

2.2.6 BIO-GEOGRAPHICAL CLASSIFICATION OF INDIA

- India has different climate and topography in different parts and hence is termed as a mega diversity country.
- India occupies *10th place among plant rich countries of the world.*
- It is essential to acquire knowledge about the distribution and environmental interaction of flora and fauna of India.
- Bio-geographers have classified India into ten bio-geographic zones with each zone having characteristic climate, soil and biodiversity.
- These zones are described below:
    1. **Trans-Himalayas:** The trans-himalayas is an extension to the Tibetean plateau. This region harbors the high-altitude cold desert in ladakh (Jammu

and Kashmir) and Lahaul Spiti (Himachal Pradesh). It accounts for 5.7% of the country's landmass.

2. **Himalayas:** The Himalayas are the northern boundaries of India. The entire mountain chain is running from Kashmir in the North-west to Assam in the north-east. The Himalayas comprise of a diverse range of biotic provinces and biomes. The himalayas cover 7.2% of the country's landmass

3. **Desert:** The extremely dry area west of the Aravalli hill range, is comprising both the salty desert of Gujarat and the sandy desert of Rajasthan. Deserts occupy around 6.9% of the country's land mass.
   The kinds of deserts found in India are:
      a. The desert of western Rajasthan
      b. The desert ofGujarat
      c. The high-altitude cold desert of Jammu & Kashmir and Himachal Pradesh. The Indian deserts have more diversified fauna.

4. **Semi-arid:** This zone lies between the desert and the Deccan plateau. It includes the Aravalli hill range. It overs approximately 15.6% of the country's landmass.

5. **Western Ghats:** The western ghats are a mountain range that runs along the western cost of India. They are a range extending north-south from southern tip of Gujarat in the north to Kanyakumari in the south.The mountains cover an area of about 160,000 sq. km. This ghat section covers an extremely diverse range of biotic provinces and biomes. It covers about 5.8% of the country's landmass.

6. **Deccan plateau:** It is a large triangular plateau south of the Narmada valley. Three sides of the plateau are covered by mountains slopes towards east. Satpura mountains cover the north while western ghats cover the west side and eastern ghats cover the eastern side of the plateau. It is the one of largest zones covering the southern and south-central plateau with mostly deciduous trees. It covers 4.3% of the country's land mass.

7. **Gangetic plain:** This plain covers the area between the south himalayas to the tropic of cancer. These plains were formed by the Ganges river system and are relatively homogeneous. This region experience 600 mm rainfall

annually. *Sunderbans* forests are located in this region and it covers 11% of the country's land mass.

8. **North-east India** These are pains and non-himalayan ranges of northeastern India and have a wide variety of vegetation. It covers around 5.2% of the country's land mass.

9. **Islands** The Andaman and Nicobar Islands in the Bay of Bengal has almost 300 big and small islands. Among these, only five islands are inhabited. Only tribes are found in the island of Nicobar. These islands have a highly diverse set of biomes and occupy 0.03% of the country's biomass.

10. **Coasts** India has a large coastline distributed both to the east and west with distinct differences between the two. The Lakshwadeep islands are included in this but the area of these islands is negligible.

2.2.7 INDIA AS MEGA-DIVERSITY NATION

• India's rich biological diversity - its immense range of ecosystems, species and genetic forms is by virtue of its tropical location, climate and physical features.

• India's biogeographical composition is unique as it combines living forms from three major biogeographical realms, namely - Eurasian, Agro-Tropical and Indo-Malayan.

• India's fabulous biodiversity is estimated to be over 45,000 plant species representing about seven percent of the world's flora; and its bewildering variety of animal life represents 6.5 per cent of world's fauna. 15,000 species of flowering plants, 53,430 species of insects; 5050 species of molluscs, 6,500 species of other invertebrates; 2,546 species of fishes; 1228 species of birds, 446 species of reptiles, 372 species of mammals and 204 species of amphibians have been identified.

• In India about 1, 15,000 species of plants and animals have been identified and described.

• India stands tenth in 25 most plant-rich countries of the world. Plant richness means greater uniqueness of species present.

• India has been described as one of 12 mega-diversity countries possessing a rich means of all living organisms when biodiversity is viewed as a whole. The greater the multidiversity of species, greater is the contribution to biodiversity. There are 25 clearly defined areas in the world called 'hot spots' which support about 50,000

endemic plant species, comprising 20 per cent of the world's total flora. India's defined location of 'hot spots' is the Western Ghats and the Northeastern regions.

- Forests, which embrace a sizeable portion of biodiversity, now comprise about 64 m. hectares or about 19 per cent of the land area of the country, according to satellite imaging. Roughly 33 cent of this forest cover represents primary forest. Indian flora comprises about 15,000 flowering plants and bulk of our rich flora is to be found in the Northeast, Western Ghats, the Northwest and Eastern Himalayas, and the Andaman and Nicobar Islands. Likewise, Assam and the Western Ghats are home to several species of mammal fauna, birds, and reptilian and amphibian fauna.

- As one of the oldest and largest agriculture societies, India has also a striking variety of at least 166 species of crop plants and 320 species of wild relatives of cultivated crops. There is a vital, but often-neglected factor when we focus on biodiversity. It may be a matter of she surprise for many to understand that the tribals who officially constitute 7.5 per cent of India's population have preserved 90 per cent of the country's biocultural diversity. To a large extent, the survival of our biodiversity depends on how best the tribals are looked after.

- To preserve our rich biodiversity, nine biosphere reserves are set up in specific biogeographic'' zones: the biggest one is in the Deccan Peninsula in the Nilgiris covering Tamil Nadu, Andhra Pradesh and Karnataka. Others are the Nanda Devi in Uttar khand in the Western Himalayas, the Nokrek in Meghalaya, Manas and Dibru Saikhowa in Assam, the Sunderban's in the Gangetic plain in West Bengal, Similar in Orissa, the Great Nicobar and the Gulf of Mannar in Tamil Nadu.

2.2.8 ENDANGERED AND ENDEMIC SPECIES OF INDIA

2.2.8.1 ENDANGERED SPECIES OF INDIA: A plant, animal or microorganism that is in immediate risk of biological extinction is called endangered species or threatened species. In India, 450 plant species have been identified as endangered species. 100 mammals and 150 birds are estimated to be endangered. India's biodiversity is threatened primarily due to:

1. Habitat destruction
2. Degradation and

3. Over exploitation of resources
- The RED-data book contains a list of endangered species of plants and animals. It contains a list of species of that are endangered but might become extinct in the near future if not protected.
- Some of the rarest animals found in India are:
  1. Asiatic cheetah
  2. Asiatic Lion
  3. Asiatic Wild Ass
  4. Bengal Fox
  5. Gaur
  6. Indian Elephant
  7. Indian Rhinocerous
  8. Marbled Cat
  9. Markhor

Extinct species is no longer found in the world.

Endangered or threatened species is one whose number has been reduced to a critical number. Unless it is protected and conserved, it is in immediate danger of extinction.

Vulnerable **species** is one whose population is facing continuous decline due to habitat destruction or over exploitation. However, it is still abundant.

Rare species is localized within a restricted area or is thinly scattered over an extensive area. Such species are not endangered or vulnerable. A few endangered pecies in the world are listed below:
  1. West Virginia Spring Salamander (U.S.A)
  2. Giant Panda (China)
  3. Golden Lion Tamarin (Brazil)
  4. Siberian Tiger (Siberia)
  5. Mountain Gorilla (Africa)
  6. Pine Barrens Tree Frog (Male)
  7. Arabian Oryx (Middle East)
  8. African Elephant (Africa)

Other important endangered species are:
  1. Tortoise, Green sea Turtle , Gharial, Python (Reptiles)

2. Peacock, Siberian White Crane, Pelican, Indian Bustard (Birds)

3. Hoolock gibbin, Lion-tailed Macaque, Capped mokey, Golden monkey (Primates)

4. Rauvol fia serpentina (medicinal plant), Sandal wood tree, etc

Factors affecting endangered species

1. Human beings dispose wastes indiscriminately in nature thereby polluting the air, land and water. These pollutants enter the food chain and accumulate in living creatures resulting in death.

2. Over-exploitation of natural resources and poaching of wild animals also leads to their extinction.

3. Climate change brought about by accumulation of green houses gases in the atmosphere. Climate change threatens organisms and ecosystems and they cannot adjust to the changing environmental conditions leading to their death and extinction.

- An international treaty to help protect endangered wildlife is, "Convention on International Trade in Endangered Species 1975" (CITES). This treaty is now signed by 160 countries.

1. CITES lists 900 species that cannot be commercially traded as live specimens or wildlife products as they are in danger of extinction.

2. CITES restricts trade of 2900 other species as they are endangered.

Drawbacks of cites

1. This treaty is limited as enforcement is difficult and convicted violators get away by paying only a small fine.

2. Member countries can exempt themselves from protecting any listed species.

2.2.8.2 ENDEMIC SPECIES OF INDIA

Species that are found only in a particular region are known as endemic species. Almost 60% the endemic species in India are found in Himalayas and the Western Ghats.

Endemic species are mainly concentrated in:

1. North-East India

2. North-West Himalayas

3. Western Ghats and

4. Andaman & Nicobar Islands.

Examples of endemic Flora species are

1. Sapria Himalayana
2. Ovaria Lurida
3. Nepenthis khasiana etc

Endemic fauna of significance in the western ghats are:

1. Lion tailed macaque
2. Nilgiri langur
3. Brown palm civet and
4. Nilgiri tahr

Factors affecting endemic species:

1. Habitat loss and fragmentation due to draining and filling of inland wetlands.
2. Pollution also plays an important role.

   Ex: Frog eggs, tadpoles and adults are extremely sensitive to pollutants especially pesticides.
3. Over-hunting and
4. Populations can be adversely affected by introduction of non active predators and competitors. Disease producing organisms also play an important adversary in reducing populations of endemic species.

2.2.9 THREATS TO BIODIVERSITY

Due to

1. **Habitat loss** Deforestation activities (cutting trees for timber, removal of medicinal plants)
2. Production of hybrid seeds requires wild plants as raw material, farmers prefer hybrid reeds, many plant species become extinct.
3. Increase in the production of pharmaceutical companies made several number of medicinal plants and species on the verge of extinction.
4. Removal of forest-cover for road laying and also due to soil erosion.
5. Illegal trade of wild life.
6. Population explosion, construction of dam, discharge of industrial effluents use of pesticides.

Poaching of wild life

- Due to poaching, illegal trade and smuggling activities most of our valuable fauna are under threat organised crime has moved into illegal wild life smuggling because of huge profit Eg. Tiger, Deer for hides, Rhinoceros – for horns, Elephant – for ivory tusk, Sea Horse, Star turtle – sold to foreign market.
- (Extinction, the elimination of species, is a normal process of the natural world. Species die put and are replaced by others as part of evolutionary change.
- Human caused reduction: The climate change caused by our release of green house gases in the atm. could have catastrophic effects. Human disturbance of natural habitat is the largest single cause pf loss of biological diversity. Woodlands and grasslands are converted now use about 10% of the world's land surface for crop production and about twice the amount for pasture and grasslands.)
- Hunting: Over harvesting is responsible for depletion or extinction of many species.
- Eg. The American passenger pigeon was the world's most abundant bird. In spite of this vast population, market hunting and habitat destruction caused the entire population to crash with in 20 years.

Fragmentation

Habitat fragmentation reduces the biodiversity because many animals like bears and large cats require large territories to subsist. Some forest birds reproduce only in deep forest or habitat far from human settlement. A large island for example, can support more individuals of given species and therefore less likely to suffer extinction due to genetic problems and natural catastrophes.

Commercial products:

Smuggling of fuels, hides, horns and folk medicines also affect the biodiversity in an abrupt manner.

2.2.10 CONSERVATION OF BIODIVERSITY

The following measures should be taken to conserve biodiversity

1. Illegal hunting and trade of animals and animal products should be stopped immediately
2. People-at-large should boycott purchasing coats, purse or bags made of animal skin
3. Bio-diversity laws should be strengthened.

4. Adequate crop and cattle compensation schemes must be started
5. Solar powered fencing must be provided with electric current proof trenches to prevent animals from entering fields.
6. Cropping pattern should be changed near the forest borders
7. Adequate food and water should be made available for wild animals within forest zones.
8. Development and construction work in and around forest region must be stopped.

- Biodiversity is one of the important tools for sustainable development. The commercial, medical, genetic, aesthetic, and ecological importance of biodiversity emphasizes the need for its conservation.

Factors affecting biodiversity:
1. Biodiversity is disturbed by human activity
2. Poaching of animals, over-exploitation of natural sources and degradation of habitats affect biodiversity.
3. Marine ecosystems are disturbed due to oil spills and discharge of effluents
4. Climatic factors like global warming, ozone depletion and acid rain also affect biodiversity

Need for biodiversity
1. It provides recreation and tourism
2. Drugs, herbs, food and other important raw materials are derived from plants and animals
3. It preserves the genetic diversity of plants and animals
4. It ensures sustainable utilization of life supporting systems on earth.
5. It needs to conservation of essential ecological diversity and life supporting systems
6. Loss of biodiversity leads to ecological and environmental deterioration

Types of conservation
There are two types of biodiversity conservation:
1. In-situ conservation and
2. Ex-situ conservation

1. IN-SITU CONSERVATION

In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".

      a. Biosphere reserves

      b. National parks

      c. Wildlife sanctuaries

      d. Gene sanctuaries

a. Biosphere reserves: They cover large areas (>5000 sq.km.) They are normally used to protect species for a long time. The roles of biosphere reserves are listed below:

    i.   Long-term survival of evolving ecosystem

    ii.   Protect endangered species

    iii.   Protect maximum number of species and communities

    iv.   Serve as site of recreation and tourism

    v.   May also be used for educational and research purposes

    vi.   Biosphere reserves function as an open system and changes in land use are not allowed. No tourism and explosive activities are allowed in biosphere reserves.

b. A national park: It is an area dedicated for the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve. A national park is used for enjoyment through tourism, without affecting the environment. It is used to protect, propagate and develop wildlife. Grazing domestic animals inside national parks is prohibited All private rights and forestry activities are prohibited inside a national park

c. Wildlife sanctuary is an area that is reserved for the conservation of animals only.

    i.   It protects animals only

    ii.   It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely

d. Gene sanctuary is an area where plants are conserved.

Other projects for the conservation of animals are *Project Tiger, Gir Lion Project, Crocodile breeding project, project elephant etc*

Advantages of in-situ conservation

     i.   It is cheap and convenient

    ii.   Species get adjusted to natural disasters like drought, floods, forest fires etc.

Disadvantages of in-situ conservation

     i.   A large surface area of earth is required to preserve biodiversity

    ii.   Maintenance is not proper due to shortage of staff and pollution

2. EX-SITU CONSERVATION

Ex-situ conservation involves protection of flora and fauna outside their natural habitats. This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.

1. Ex-situ conservation involves maintenance and breeding of endangered plant and animal species under controlled conditions
2. It identifies those species that are at a high risk of extinction
3. It prefers species that are important for man in the near future among the endangered species.

Important centers of ex-situ conservation:

1. Botanical gardens
2. Seed banks
3. Microbial culture collections
4. Tissue and cell cultures
5. Museums and
6. Zoological gardens

Methods of ex-situ conservation

National Bureau of Plant Genetic Resources (NPBGR) It is located in New Delhi and uses the Cryopreservation Technique to preserve agricultural and horticultural crops. Cryopreservation technique involves using liquid nitrogen at -196 C. Varieties of rice, turnip, radish, tomato, onion, carrot, chilli, tobacco have been successfully preserved for years using this technique.

National Bureau of Animal Genetic Resources (NPAGR) It is located in Karnal, Haryana and preserves the semen of domesticated bovine animals.

National Facility for Plant Tissue Culture Repository (NFPTCR) In this facility, conservation of varieties of crop plants or trees is done using tissue culture. This facility has been created within the NPBGR.

Advantages of Ex-situ conservation

1. Survival of endangered species is increasing due to special care and attention
2. In captive breeding the animals are assured of food, water, shelter and security thereby have a longer life span
3. It is carried-out in cases of endangered species that do not have any chance of survival in the wild

Disadvantages of Ex-situ conservation

1. It is an expensive method
2. Freedom of wildlife is lost
3. Animals cannot survive in the natural environment