

# **Biodiversity and its Conservation**

**Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem components in which they occur.**

- In the Convention of Biological Diversity (1992) held in Rio de Janeiro biodiversity has been defined as the variability among living organisms and their ecosystems, including inter alia, the terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part.

# SPECIES DIVERSITY

- This is the variability found within the population of a species or between species of a community.
- It represents broadly the species richness and their abundance in a community. The two popular indices of measuring species diversity known as **Shannon-Wiener index** and **Simpson index**

- The Shannon diversity index (a.k.a. the Shannon–Wiener diversity index) tells you how diverse the species in a given community are, based on the number of species and the evenness of abundance – Randomness Index
- Tells us about the Richness and Evenness of the community, e.g., rich of nightingales
- Simpson's Diversity Index is a measure of biodiversity which takes into account the number of species present, as well as the relative abundance of each species - Dominance index.

- The Shannon-Wiener Species Diversity calculated by taking the number of each species, calculating the proportion each species is of the total number of individuals, and sums the product of the proportion times the natural log of the proportion for each species.
- Simpson's Diversity Index is used to calculate a measure of diversity, taking into account both the number of something as well as its abundance.

# Faunal Analysis-Remains of Animal Bones- Food Access and Consumption

- The Shannon-Wiener Diversity Index is calculated using the following equation:  
 $H = -\sum_{i=1}^n P_i \ln P_i$  where  $P_i$  is the proportion of each species in the sample. Given a very small sample size, with more than 5 species, the S-W index values ( $H$ ) can range of 0 to 4 using the natural log ( $\ln$ ).

# Species Richness and Relative Abundance

- Example
- Problem Statement:
- The samples of 5 species are 60,10,25,1,4. Calculate Shannon diversity index and Evenness for these values.
- Sample Values (S) = 60,10,25,1,4 number of species
- First, let us calculate the sum of the given values
- Sum =  $(60+10+25+1+4) = 100$

# Example

- Species (i)
- |   | No. in sample | pi   | ln(pi)               | pi x ln (pi) |
|---|---------------|------|----------------------|--------------|
| • Big bluestem  | 60            | 0.60 | -0.51                | -0.31        |
| • Partridge pea   | 10            | 0.10 | -2.30                | -0.23        |
| • Sumac   | 25            | 0.25 | -1.39                | -0.35        |
| • Sedge   | 1             | 0.01 | -4.61                | -0.05        |
| • Lespedeza   | 4             | 0.04 | -3.22                | -0.13        |
| • $S = 5$ , $\text{Sum} = 100$                                  |               |      | $\text{Sum} = -1.07$ |              |
| • $H=1.07$ , $H \text{ max} = \ln(S) = \ln (5)=1.61$ ,          |               |      |                      |              |
| • $E= H/H\text{max} = 1.07/1.61=0.66$ i.e., Evenness (E) = 0.66 |               |      |                      |              |
| • $H=1.07$ i.e., Shannon diversity index (H) =1.07              |               |      |                      |              |
| • Good Shannon-Wiener index value is between 1.5 and 2.0        |               |      |                      |              |

# Calculation of Simpson's Index

- Simpson's Diversity Index Calculation
1. Add the **individual species populations** together.
  2. Determine  $N \times (N - 1)$ .
  3. Where  $n$  is the number of individuals in each species. Work out  $n \times (n - 1)$  for each species.
  4. Sum all the values in step 3.
  5. Divide the sum obtained in step 4 by the value obtained in step 2.

$$D = 1 - [ n(n-1)/N (N-1) ]$$

**Simpson's Diversity Index =  $1 - D$ .**

# **Simpson's diversity index- How to calculate it for different types.**

- Sum all the values in step 3.
- Divide the sum obtained in step 4 by the value obtained in step 2. As a result you get Simpson's index D.
- Evaluate Simpson's diversity index as 1-D.

# **ECOSYSTEM DIVERSITY**

- This is the diversity of ecological communities showing variations in ecological niches, trophic structure, food-webs, nutrients etc.
- The ecosystems also show variations with respect to physical parameters like temperature, altitude, precipitation etc.

# **Saving the Humanity from Environmental Disasters and Dangers**

- The diversity has developed over millions of years of evolution. If we destroy this diversity, it will disrupt the ecological balance and ultimately the balance of life on Earth. We do not wish to experience or problems such as,, dieases or other natural disasters and may finally result in the elimination of Life on this Terrestrial Ball like dinosaurs.
- These are mainly due to variations in the physical factors such as moisture, temperature, air pressure, precipitation etc.

# **CAUSES OF BIODIVERSITY**

- Climate change- Temperature, Storms, Earth Changes
- Pollution.
- Destruction of habitats.
- Invasive alien species.
- Overexploitation of the natural environment.
- Hunting
- Habitat Fragmentation
- Collection for Zoo and Research
- Control of Pests and Predators
- Genetic Mutations
- Co-extinction – When related or dependent species vanishes.

# **VALUE OF BIODIVERSITY**

- The value of biodiversity in terms of commercial utility, ecological services and aesthetic value is enormous.

## **1. Consumptive use value:**

- These are direct use values where the biodiversity product can be harvested and consumed directly e.g. fuel, food, etc.

# **Medicines derived from the natural products**

- **Drugs and medicines:** About 75% of world's population depends upon plant extracts for medicines.
- The wonder drug Penicillin used as antibiotics is derived from fungus called **Penicillium**. Likewise, we get Tetracycline from a bacterium. **Quinine**, the cure for malaria, is obtained from the bark of **Cinchona**.

- Digitalin is obtained from foxglove (plant) which is an effective cure for heart ailments. Recently vinblastin and vincristine, two anti-cancer drugs, have been obtained from Periwinkle (*Catharanthus*) plant. This plant possesses anti-cancer alkaloids. A large number of marine animals/algae etc. are supposed to possess anti-cancer properties which are yet to be explored systemically.

## **Fuel:**

**Our forests have been used since ages for fuel wood. The fossil fuels coal, petroleum and natural gas are also products of fossilized remains of ancient living organisms. These products have contributed greatly to the present day biodiversity.**

**Firewood collected by individuals are normally marketed, but are directly consumed by tribals and local villagers, hence having a higher consumptive value.**

## **2. Productive use values:**

- These are the commercially usable values where the product is marketed and may include lumber or wild gene resources that can be traded for use by scientists introducing desirable traits in the commercialized domesticated animals.

- These may include the animal products of elephants, musk from musk from silk-worm, wool from sheep, fat of many animals, lac from lac insects etc. which are traded in the market.
- Many industries are dependent upon productive use values of biodiversity. Paper and pulp industry, Plywood industry etc.

- Railway sleeper industry, Silk industry, industry, ivory-works, leather industry Industry etc.
- Despite international ban on trade in p from endangered species, smuggling o horns, tusks, live specimen etc. worth dollars are being sold every year.
- Developing countries in Asia, Africa an America are the richest biodiversity ce

**Wild life products are smuggled and moved in large quantities to some rich western countries and also to China and Hong Kong where export of cat skins and snake skins fetches a booming business.**

**Donkeys from Pakistan to China**

**3. Social Value:** These are the values associated with the social life, customs, religion and psycho-spiritual aspects of the people. Many of the plants are considered holy and sacred in our country like Tulsi (holy basil), Peepal (Ficus), Mango, Lotus, Bael Patthar (Star apple) etc. The leaves, fruits or flowers of these plants are used in worship or the plant itself is worshipped.

- Their social life, songs, dances and customs are closely woven around the wildlife animals like Cow, Snake, Bull, Peacock etc. also have significant place in our psycho-spiritual arena and thus hold social importance. Thus biodiversity has distinct social value, attached with different societies.
- Snakes in Samastipur

# **Video on Nagpanchami festival**

## **Bihar**

- **Snakes are very dangerous and we should be careful of them. And we should not touch them.**
- <https://www.instagram.com/reel/DIWrN/>

**4. Ethical value:** It is also sometimes known as existence value. It involves ethical issues like all living beings must be preserved . It is based on the concept of Live and Let Live

If we want our human race to survive, then we must protect all biodiversity, because biodiversity is interdependent – Interdependence.

Role of each species on this earth to keep it in working condition by maintaining natural balance has evolved over the millions to billions of years.

- The ethical value means that we may only use a species, but knowing the very fact that the species exists in nature gives us pleasure. We feel sorry when we learn that passenger pigeon or dodo is no more on this earth.
- You may see the video of birds at Kruger National Park, South Africa.
- <https://www.youtube.com/watch?v=L1Oc>, accessed on August 23, 2023.

# **Songs of Birds**

- We are not deriving anything direct from Kangaroo, Zebra or Giraffe, but we all strongly believe that these species should exist in nature. This means, ethical value or existence value attached to each.
- Why the Horses and not Zebras were domesticated and not Zebras ?**
- Zebras are normally vulnerable to cardiac disorders. The risks of damage due to capture and handling are less suitable for domestication.

**Nightingale, Cuckoo and several colourful birds including parrots are found in zoos and gardens .**

**People from far and wide spend a lot of time and money to visit wilderness where they can enjoy the aesthetic value of biodiversity and this type of tourism is known as eco-tourism. The willingness to pay on such eco-tourism gives us even a monetary estimate for aesthetic value of biodiversity.**

**What are Safaris?**

# **Ecotourism Market**

- Ecotourism is estimated to generate Rs. 8.32 Crores in India in 2020-21 due to that roughly gives the aesthetic value of biodiversity.
- Ecotourism Market was valued at US\$ 100 Bn. in 2021 and is estimated to reach a value of US\$ 355.8 Bn. in 2027. ( Internet)

**5. Option values:** These values include potentials of biodiversity that are presently unknown and need to be explored. There is a possibility that we may have some potential cure for AIDS or cancer existing within the depths of a marine ecosystem or a tropical rainforest - Natural Products Bioinformatics, Computational Biology (Computer aided drug design) etc.

- The biodiversity is like precious gifts nature presented to us. We should not commit the folly of losing these gifts before unwrapping them.
- The option value also includes the value terms of the option to visit areas where a variety of flora and fauna, or specific species some endemic, rare or endangered exist.

## **Ecosystem service value**

**It refers to the services provided by ecosystems to humans like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of carbon, their role as carbon sinks, pollutant absorption and reduction of the threat of global warming etc.**

- **Different categories of biodiversity clearly indicate that ecosystem, species and genetic diversity all have enormous economic, ecological and socio-cultural losses.**

# **GLOBAL BIODIVERSITY**

- Following the 1992 The Earth Summit in Rio-de Janeiro, it became evident that there is a growing need to know and scientifically name, the huge number of species which are still unknown on this earth. Roughly one million species are known till date while perhaps 1% or may be just 2% of the total number.

**Tropical deforestation alone is reducing the biodiversity by half a percent every year.**  
**Mapping biodiversity has become important.**  
**Terrestrial Biodiversity.**

This is described as Biomes.

**Examples of Terrestrial Biodiversity** are temperate rainforests, tall grass prairies, savannas, tundra etc.

# Biome

This is known as a major life zone, is a region that includes communities of plants and animals that have a common adaptation to that particular environment.

This includes various communities which are named after the dominant features of the region – like grasslands, deserts or forests.

# Tropical Rainforests

- The tropical rainforests are inhabited by teeming millions of species of plants, amphibians ( frogs, toads etc. ), insects as well as mammals ( having mammals ). They are the Earth's largest storehouse of biodiversity.
- About 50 to 80% of global biodiversity is found in these rainforests.

# **Floral Analysis – Seeds and Pollen**

- There is an estimated 1,25,000 flowering plant species in tropical forests. However, now we know only 1-3% of these species.
- Several drugs are derived from plants found here.

## **Temperate Forests**

- Temperate forests have much less biodiversity, but there is much better documentation of the species.

# **Statistics May be deleted**

**Globally, we have roughly 1,70,000 flowering plants, 30,000 vertebrates and about 10,000 other groups of species that have been described.**

- It is interesting to know that marine biodiversity is even much higher than terrestrial biodiversity and ironically, they are known and described.
- Out of the 35 existing phyla ( categories of multicellular animals, 34 are marine. Of these 34, 32 of these are exclusively marine.

# **BIOLOGICAL DIVERSITY AT NATIONAL LEVEL**

**(Indian Biodiversity)**

**India ranks 10th among the plant rich countries of the world, 11<sup>th</sup> in terms of number of endemic species of higher vertebrates among the centers of diversity and over 50 agricultural crops**

**The total number of living species identified in our country is 1,50,000.**

# **REGIONAL OR LOCAL BIODIV**

- Biodiversity at regional level is better understood by categorizing species into three types, based upon their distribution :

**(i) Point ( $\alpha$ -) richness** refers to the number of species that can be found at a single point in a given space.

Diversity on a local scale, such as a particular field, or a patch of forest.

**(ii) Beta ( $\beta$ -) richness refers to the rate of species composition across different habitats.**

**It quantifies how species diversity changes from one habitat to another, providing insights into patterns of biodiversity i.e., between any two locations and their community.**

**(iii) Gamma ( $\gamma$ -) richness refers to the rate of species composition across large landscape gradients.**

**Gamma diversity is a measure of the overall species diversity for the different ecosystems within a region, such as along a mountain slope.**

**Originally, beta diversity was defined as:**  
 **$\beta$  diversity =  $\gamma/\alpha$  (sensu Whittaker, 1972).**

## **INDIA AS A MEGA-DIVERSITY COUNTRY**

- India is one of the 12 mega-diversity countries in the world.
- The Ministry of Environment and Forests, Ministry of Science and Technology and Environment, Climate Change, Govt. of India (2005) reported that India has about 47,000 species of plants and 81,000 species of animals which is about 7% and 6.5% respectively of global flora and fauna.

# **Endemism:**

- Species which are restricted only to particular area are known as endemic. India shows a good number of endemic species.
- About 62% of amphibians (frogs, toads, newts, salamanders etc.) and 50% of all mammals are endemic to India.
- Western ghats are the site of maximum endemism.

## **Center of origin - India**

**: A large number of species are known to have originated in India. Nearly 5000 flowering plants had their origin in India.**

**India has been the center of origin of species of crop plants and 320 species relatives of cultivated crops – lemon, eggplant (brinjal), Indian gooseberry (amla in Hindi), mango etc.**

- **Marine diversity:** Along 7500 km long coastline of our country in the mangroves, estuaries, coral reefs, backwaters etc., exists a rich biodiversity. More than 400 species of corals of the world are found.
- The marine diversity is rich in molluscs, crustaceans (crabs etc.).

# HOT SPOTS OF BIODIVERSITY

- Areas which exhibit high species richness as well as high species endemism are termed hotspots of biodiversity. The term was introduced by Myers (1988).
- There are 25 such hotspots of biodiversity at a global level out of which two are present in India, namely the Eastern Himalaya and Western Ghats.

- These hotspots covering less than 2% of world,s land area are found to have 50% of the terrestrial biodiversity.
- According to Myers et al. (2000) an area is designated as a hotspot when it contains at least 0.5% of the plant species as endemics.
- About 40% of terrestrial plants and vertebrate species are endemic and found in these hotspots.

- These hotspots lie in India extending to neighbouring countries namely, Indian region (covering Eastern Himalayas) and Western Ghats - Sri Lanka region.
- The Indian hotspots are not only rich in floral wealth and endemic species of plants but also reptiles, amphibians, swallowtail butterflies and some mammals.

# **May be deleted**

- **Eastern Himalayas:** There are numerous and semi-isolated valleys in Sikkim which are extremely rich in endemic plant species. Of 7298 Km<sup>2</sup> of Sikkim about 4250 plant species are found of which 60% are endemic.
- **Western Ghats:** It extends along a 17,000 km strip of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species. 62% amphibians and lizards are endemic to Western Ghats.

# **THREATS TO BIODIVERSITY**

- **Extinction or elimination of a species is not a process of evolution.**
- **In the geologic period the earth has experienced five major mass extinctions.**
- **However, the rate of loss of species in the past has been a slow process, keeping the vast span of time going back to 444 million years.**
- **ALARMING SITUATION : The process of extinction has become particularly fast in the recent years of human civilization.**

# **Extinction**

- One of the estimates by the noted ecologist, E.O. Wilson figure of extinction at 10,000 species per year or 27 times faster than normal.
- If the present trend continues we would lose 1/3<sup>rd</sup> of our current biodiversity by the middle of twenty first century.
- This would be very sad situation as this would disturb the balance of the nature and related natural phenomena keeping the mankind alive and ecosystems active and healthy.

## **SAVE PLANET – SAVE HUMANITY**

- We may face extinction like dinosaurs and the entire human race on this very earth. We may become a part of history.
- This is a Wake Up Call and that makes the study of environmental science at B.Tech level very urgent and important.

# **Video on Environmental Challenges on Earth**

- [https://www.google.com/search?q=video+on+environmental+challenges+that+can+be+alarming&sca\\_esv=8c966bae1d54a914&rlz=045IN1045&sxsrf=AE3TifPu1QO\\_5D6IZ\\_T0U5ouZWvjNLDMy221461&ei=vc23aPL3G6XgseMPkfCE0Ak&ved=0ahUKEwiyGwGHRE4AZoQ4dUDCBE&uact=5&oq=video+on+environmental+challenges+that+can+be+alarming&gs\\_lp=Egxnd3Mtd2l6LXNlcnAiI GVudmlyb25tZW50YWwgY2hhbGxlbmdlcyB0aGF0IGNhbibZzIFCECEYoAEyBRAhGKABSN3nAVAAWK\\_hAXABeACQAQCYBjAuNDkuM7gBA8gBAPgBAZgCNaAC8ESoAgrCAgcQIxgnGQYkQIYigXCAggQABiABBixA8ICCxAAGIAEGLEDGIMBwgIIECgQLhiABBjIBMICChAjGIAEGCcYigXCAgQQIxgnwglIREC4YgAYrwHCAgsQLhiABBiRAhiKBcICChAAGIAEGEMYigXCAhAQLhcBGloFwgINEAAAYgAQYQxjJAxIKBcICCxAAGIAEGJIDGloFwgIAcICBRAAGIAEwgIGEAAAYFhgewgIIIEAAAYgAQYogTCAgUQABGIYDGloFwgIEECEYFcICBRAhGJ8FmAMR8QWj-wUgDgMd5AH\\_8oCsgcGMC40OC40uAffRMIHCzAuMTYuMzQuMi4xyAwS-wiz-serp#fpstate=ive&vld=cid:324ca3c6,vid:nPCOIcWZ](https://www.google.com/search?q=video+on+environmental+challenges+that+can+be+alarming&sca_esv=8c966bae1d54a914&rlz=045IN1045&sxsrf=AE3TifPu1QO_5D6IZ_T0U5ouZWvjNLDMy221461&ei=vc23aPL3G6XgseMPkfCE0Ak&ved=0ahUKEwiyGwGHRE4AZoQ4dUDCBE&uact=5&oq=video+on+environmental+challenges+that+can+be+alarming&gs_lp=Egxnd3Mtd2l6LXNlcnAiI GVudmlyb25tZW50YWwgY2hhbGxlbmdlcyB0aGF0IGNhbibZzIFCECEYoAEyBRAhGKABSN3nAVAAWK_hAXABeACQAQCYBjAuNDkuM7gBA8gBAPgBAZgCNaAC8ESoAgrCAgcQIxgnGQYkQIYigXCAggQABiABBixA8ICCxAAGIAEGLEDGIMBwgIIECgQLhiABBjIBMICChAjGIAEGCcYigXCAgQQIxgnwglIREC4YgAYrwHCAgsQLhiABBiRAhiKBcICChAAGIAEGEMYigXCAhAQLhcBGloFwgINEAAAYgAQYQxjJAxIKBcICCxAAGIAEGJIDGloFwgIAcICBRAAGIAEwgIGEAAAYFhgewgIIIEAAAYgAQYogTCAgUQABGIYDGloFwgIEECEYFcICBRAhGJ8FmAMR8QWj-wUgDgMd5AH_8oCsgcGMC40OC40uAffRMIHCzAuMTYuMzQuMi4xyAwS-wiz-serp#fpstate=ive&vld=cid:324ca3c6,vid:nPCOIcWZ)

## **LOSS OF HABITAT AND C**

- Billions of hectares of forests and grasslands have been cleared over the past 10,000 years, for conversion into agriculture lands, pastures, settlement areas or developmental projects.
- The wetlands are destroyed due to filling and pollution thereby causing biodiversity loss.

- Sometimes the loss of habitat is in installments so that the habitat is divided into small and scattered patches, a phenomenon known as habitat fragmentation.
- **POACHING**  
Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife.

- Despite international ban on trade in products from endangered species, smuggling of items like furs, hides, horns, tusks, live specimens and herbal products. worth billions of dollars per year continues.
- The developing nations in Asia, Latin America and Africa are the richest source of biodiversity and have enormous wealth of wildlife.

## **May be deleted**

**The cost of elephant tusks can go up to \$10,000 per kg; the leopard fur coat is sold at \$10,000 in Japan.**

**While bird catchers can fetch upto \$ 10,000 for a rare hyacinth macaw, a beautiful colorful bird, from Brazil.**

# **MAN-WILDLIFE CONFLICT**

- Sometimes we come across conflicts between man and wildlife when wildlife starts causing immense damage to crops and danger to man and under such conditions it becomes very difficult for the forest department to pacify the affected villagers and gain their support for wild-life. Human killing by leopards/tigers killing human in Sitapuri recently (2025).
- Menace of street dogs?

# **ENDANGERED SPECIES OF**

- The International Union for Conservation of Nature (IUCN) publishes the Red Data List which includes the list of endangered species of plants and animals.

**In India, nearly 450 plant species have been identified in the categories of endangered, threatened or rare. Existence of about 100 mammals and 150 species of birds is estimated to be threatened while an unknown number of species of insects are endangered.**

# ENDEMIC SPECIES OF INDIAN PLANTS

Out of about 47,000 species of plants in the country 7000 are endemic. Thus, Indian subcontinent has about 62% endemic species restricted mainly to Himalayas, Khasi and Western Ghats.

- Some of the important endemic floral species include orchids and species like *Sapria himalayana*, *Uvaria lurida*, *Nepenthes khasiana*, *Pedicularis perrotieri* etc.

- A large number out of a total of 81,000 animals in our country is endemic. The ghats are particularly rich in amphibians (frogs, toads etc.) and reptiles (lizards, crocodiles). About 62 amphibians and 50% lizards are endemic to Western Ghats.

Different species of monitor lizards (Varanus), reticulated python and Indian Salamander. Viviparous toad Nectophryne are some important endemic species of our country

# **CONSERVATION OF BIODIVERSITY**

- The enormous value of biodiversity due to its genetic, commercial, medical, aesthetic, ecological and optional importance emphasizes the need to conserve biodiversity.
- There are two approaches of biodiversity conservation:
- (a) **In situ conservation (within habitat)** achieved by protection of wild flora and fauna in nature itself. e.g. Biosphere Reserves,

# Biodiversity Conservation

- National Parks, Sanctuaries, Reserves etc.

(b) **Ex situ conservation (outside habitat)** is done by establishment of gene banks, zoos, botanical gardens, cultural collections etc.

- At present we have 7 major Biosphere Reserves, 80 National Parks, 420 wildlife sanctuaries and 120 Botanical gardens country covering 4% of the geographical area.
- The Biosphere Reserves conserve some representative ecosystems as a whole for long-term in situ conservation.

# **Biosphere Reserves**

- In India we have Nanda Devi (U.P.), (Meghalaya), Manas (Assam), Sunder (West Bengal), Gulf of Mannar (Tamil Nilgiri (Karnataka, Kerala, Tamil Nadu), Nicobars and Simlipal (Orissa/Odisha) Biosphere Reserves.
- Different Zones : Core - Buffer –Transition Area- Human Settlement-Research Station-Monitoring- Education Training Tourism
- Image in the Next Slide

The three zones that characterise a Biosphere Reserve are



- Within the Biosphere reserves we may have one or more National Parks.

For example, Nilgiri Biosphere Reserve has two National Parks viz. Bandipur and Nagarhole National Park

- A National Park is an area dedicated to the conservation of wildlife along with its environment.

- It is also meant for enjoyment thro tourism but without impairing the environment.
- Grazing of domestic animals, all pri rights and forestry activities are pro within a National Park.
- There are Monitoring stations, Rese Training , Human settlement etc. as

# **Tree transplantation – Cur deforestation**

- For plants, there is one gene sanctuary (Lemon family) and one for pitcher plant (insect eating plant) in Northeast India.
- For the protection and conservation of animals, there have been specific projects in the country e.g. Project Tiger, Gir Lion Project, Crocodile Breeding Project, Project Elephant, Leopard Project.

## **Ex - situ Conservation**

- This type of conservation is mainly done for conservation of crop varieties, the wild species of crops and all the local varieties with the objective of conserving the total genetic diversity of the crop species for future crop Improvement. It is also used in afforestation programmes, e.g., even Bonsai trees can be used to conserve genes. Bonsai are not genetically modified. Any tree can be made bonsai.

**Gene bank/seed bank facilities:**

- (i) National Bureau of Plant Genetic Resources (NBPGR) is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryo-preservation of seeds, pollen etc. using liquid nitrogen at a temperature as low as - 196°C.

- **Varieties of rice, pearl millet, Brassi radish, tomato, onion, carrot, chilli, poppy etc. have been preserved successfully in liquid nitrogen for several years without losing seed viability**

- (ii) **National Bureau of Animal Genetic Resources (NBAGR) located at Karnal, Haryana.**
- **It preserves the semen of domesticated bovine animals.**

- (iii) National Facility for Plant Tissue Repository (NFPTCR) for the development of a facility of conservation of varieties of plants/trees by tissue culture. This facility has been created within the NBPGR, Delhi.

# **G 15 Countries**

- The G-15 countries have also resolved to set up a network of gene banks to facilitate the conservation of various varieties of aromatic and medicinal plants for which India is the networking co-ordinating country.
- The founder-members were Argentina, Chile, Brazil, Mexico, Jamaica and Venezuela from the Americas; Egypt, Algeria, Senegal, Nigeria and Zimbabwe from Africa; and India, Malaysia and Indonesia from Asia.
- The first G-15 summit was held in Malaysia in 1996.

# Related Material

- Life of earth = 4.6 million years.
- Total number of species on the earth million or 8.7 million ?
- Total number of animals = 1.6 million
- In the world, some 900 thousand different kinds of living insects are known. Their representation approximates 80 percent of the world's species.