

# ENVIRONMENTAL ENGINEERING

## BIODIVERSITY AND ITS CONSERVATION



# **BIODIVERSITY:**

- **Introduction**
- **Levels of Biodiversity**
  - Genetic Diversity
  - Species Diversity
  - Ecosystem Diversity
- **Biogeographical Classification in India**
- **Value of Biodiversity**
  - Consumptive Use Value
  - Productive Use Value
  - Social Use Value
  - Ethical Use Value
  - Aesthetic Use Value
  - Option Value
- **Biodiversity at Global, National and Local Level**



Cont.....

- **India as a Mega – diversity Nation**
- **Hot Spots of Biodiversity**
- **Threats to Biodiversity**
- **Habitat Loss**
- **Poaching of Wildlife**
- **Man – Wildlife conflicts**
- **Endangered Species of India**
- **Endemic species of India**
  
- **CONSERVATION OF BIODIVERSITY**
  - **In – situ Conservation of Biodiversity**
  - **Ex – situ Conservation of Biodiversity**



# BIODIVERSITY - INTRODUCTION

Bio – **Life**



Diversity – **Variety**



Biodiversity is defined as, “the **variety and variability** among all groups of **living organisms** and the ecosystem in which they occur”.



## LEVELS OF BIODIVERSITY:

- **Genetic Diversity**
- **Species Diversity**
- **Community or Ecosystem Diversity**



# GENETIC DIVERSITY:

- Species of different **Genetic Characteristics**
- Diversity within species i.e. **Variations in genes** species.
- **Slight different** between species
- Difference due to **combination of genes**
- Basic units of **Hereditary transformed** from one **generation** to another.



Eg.: Rice varieties, teak wood varieties, etc.,





## ○ Species Diversity:

- **Discrete group** of organisms of the **same kind**
- Diversity between **species**
- **Sum of varieties of living organisms at species level**

Eg.:

- ✓ **Plant Species:** Apple, mango, grapes, rice, wheat, etc.
- ✓ **Animal Species:** Lion, tiger, deer, etc.



Photos from BakizAdhez 2004, and A.M. Okiyo, ERI

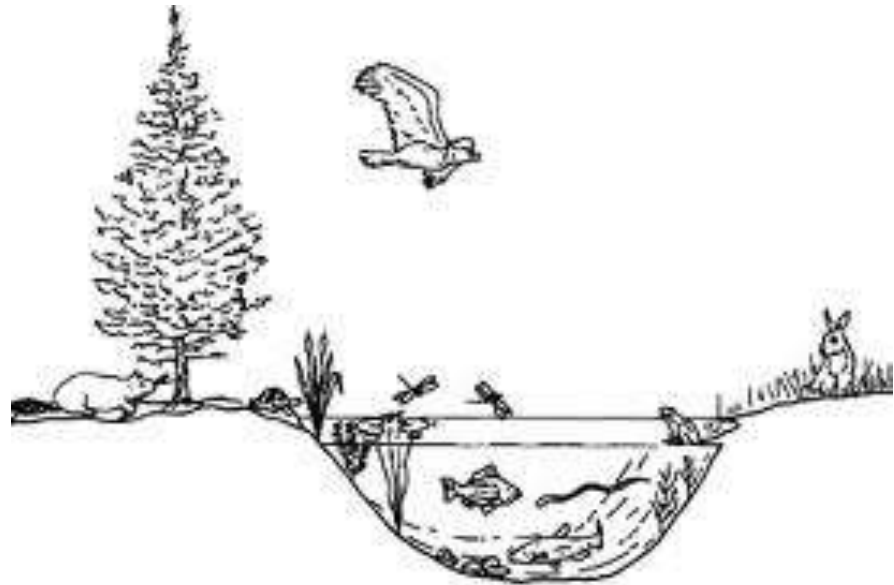




## ○ Community or Ecosystem Diversity:

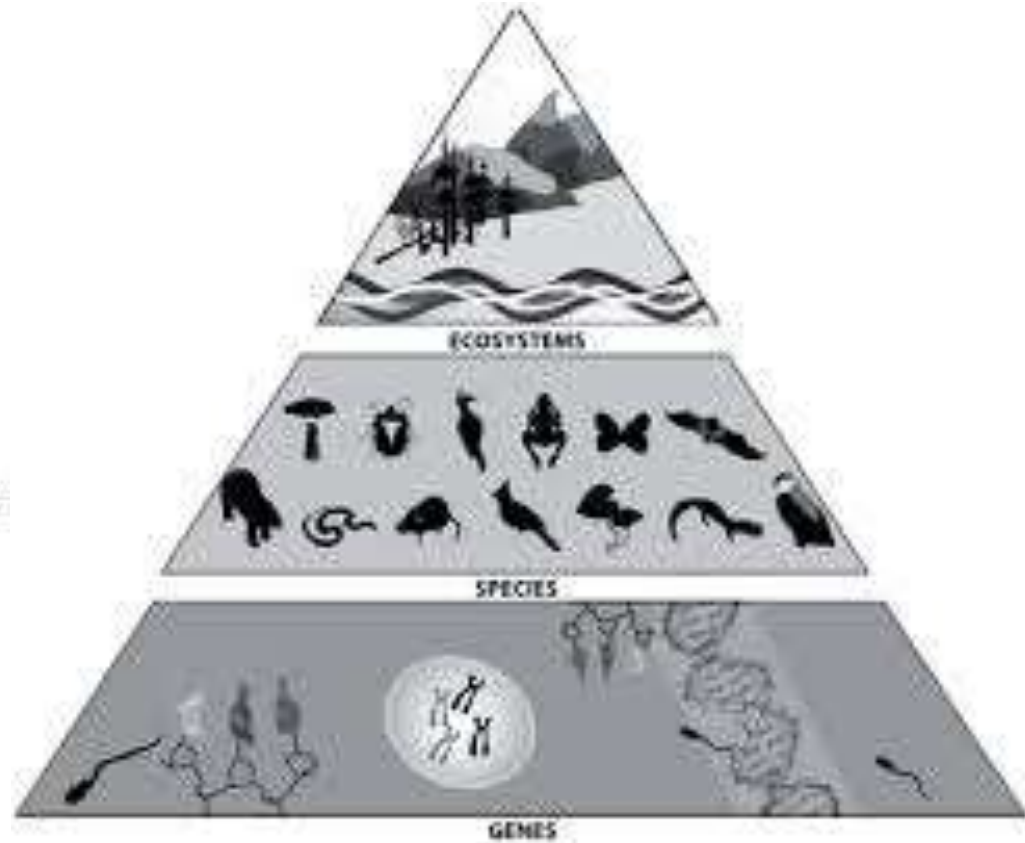
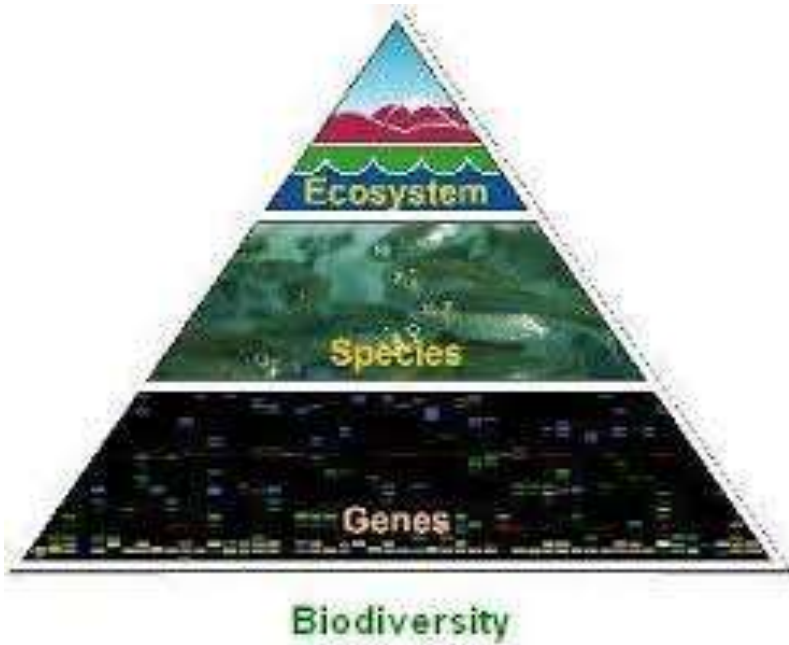
- Diversity at ecological or habitat level
- Biotic components i.e. plants, animals and micro organisms interact with Abiotic components i.e. environment – soil, air, water, etc.,
- Difference in environmental type.
- Interaction between living organisms and physical environment in an ecosystem.

Eg. River Ecosystem





# LEVELS OF BIODIVERSITY



# BIOGEOGRAPHICAL CLASSIFICATION OF INDIA:

- India is **mega diversity** country with different types of **climate and topography** in different parts
- Variations due to the **variability in flora and fauna**
- It is important to study and know the **distribution, evolution and environmental relationship** of plants and animals.
- To know about the relationship of flora and fauna, biogeographers **classified India into ten biogeographic zones**
- Each zone has its own **climate, soil and biodiversity**.



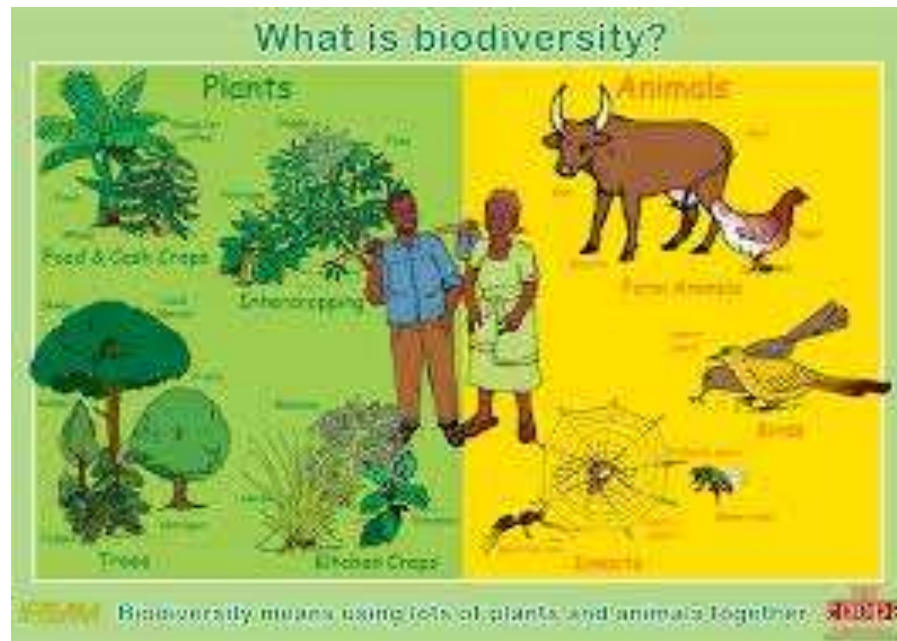
# INDIA'S MAJOR BIOGEOGRAPHICAL HABITATS:

- Trans – Himalayan region
- Himalayan mountain
- Desert
- Semi – Arid
- Western Ghats
- Deccan Peninsula
- Gangetic Plain
- North East
- Coasts
- Islands

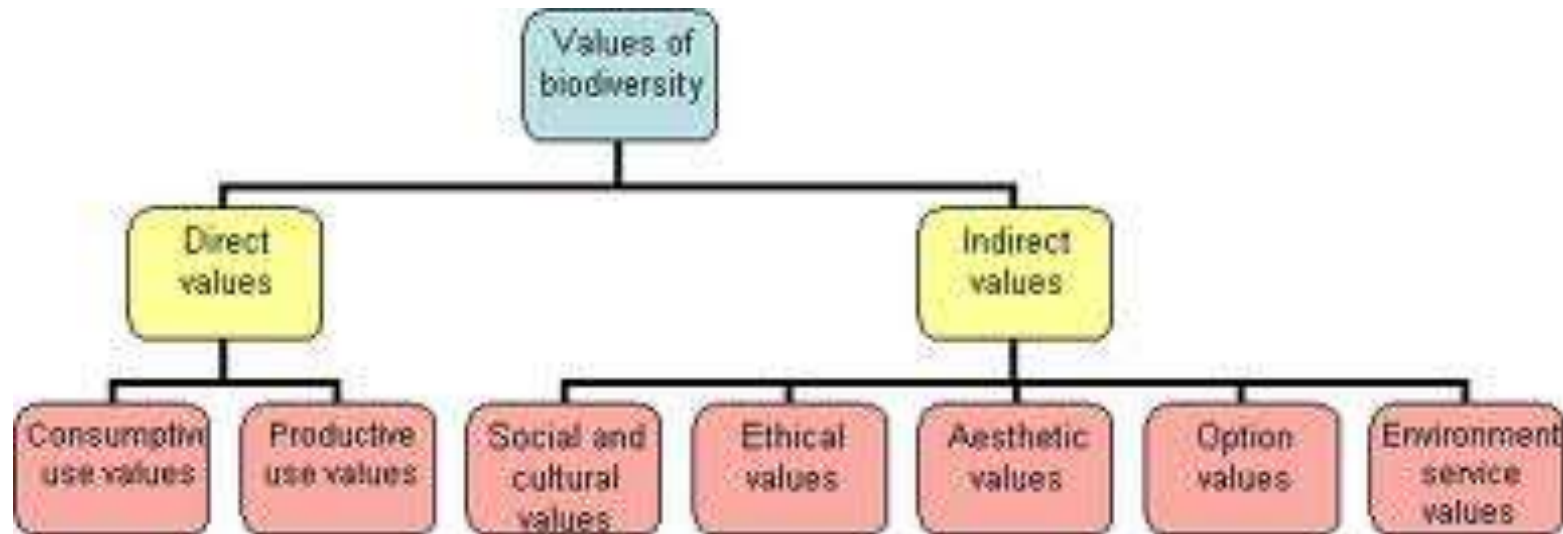


# VALUE OF BIODIVERSITY:

- **Biosphere** is supporting **combination** of different **organisms** with its own **significance**.
- **Biodiversity** is **stability** and proper **functioning** of the **Biosphere**.
- We get **benefit** from each organisms in biosphere.



# CLASSIFICATION AND IMPORTANCE OF VALUE OF BIODIVERSITY:



- ❑ Consumptive Use Value
- ❑ Productive Use Value
- ❑ Social Use Value
- ❑ Ethical Values
- ❑ Aesthetic Values
- ❑ Option Values





# □ CONSUMPTIVE USE VALUE:

- Direct use values
- Harvested and consumed directly
  - **Food** – 80 – 90% tropical wild plants
    - Cerropegia bulbosa
    - Codonopsis
    - Cicer microphyllum
  - **Drugs** – 70% of modern medicines from plants
    - Traditional systems – Ayurvedha and Sidha.
  - **Fuel** – firewoods – fossil fuels like coal, petroleum and natural gases



# □ PRODUCTIVE USE VALUE:

- Obtain commercial value
- Products are marketed and sold
- Derived from animal and plants

| Animal          | Animal Products |
|-----------------|-----------------|
| Silk - worm     | Silk            |
| Sheep           | Wool            |
| Elephants       | Tusk            |
| Fish and animal | Food            |



| <b>Plant &amp; Animal Product</b> | <b>Industry</b>                |
|-----------------------------------|--------------------------------|
| <b>Wood</b>                       | <b>Paper and pulp industry</b> |
| <b>Cotton</b>                     | <b>Textile industry</b>        |
| <b>Fruits, vegetables</b>         | <b>Food industry</b>           |
| <b>Leather</b>                    | <b>Leather industry</b>        |



## □ SOCIAL USE VALUE:

- Bio – resources are **used to society**
- Value associated with **social life, religion and spiritual aspects.**
  - **Holy Plants:** Tulsi, lotus, etc.
  - **Holy animals:** Cow, snake, bull, peacock, rat, etc.,.

## □ ETHICAL VALUES:

- Ethical issues must be preserved
- India has great cultural and religious basis
- May or may not be used but gives pleasure
  - River Ganga
  - Vembu, tulsi, etc,
  - Kangaroo, zebra, giraffe, etc.,.



## □ AESTHETIC VALUES:

- Beautiful nature of plants and animals is the most important value of biodiversity is eco – tourism.

## □ OPTION VALUES:

- Biodiversity that are unknown and need to be known
- Suggested that any species maybe proved valuable



# GLOBAL BIODIVERSITY:

- Total number of **living species** in the world are about **20 million** but only **1.5 million species** are found and given names.
- **Tropical deforestation** alone is **reducing** the biodiversity by **0.5% every year**.
- Terrestrial biodiversity or Biomass
  - Tropical rainforests
  - Temperate forests
- Marine diversity



# □ TERRESTRIAL BIODIVERSITY OR BIOMASS:

- Largest ecological units present in different geographic areas.

## 1. Tropical rain forests:

- Earth's largest storehouse of biodiversity
- Inhabited of millions of plants, insects, birds, and mammals.
- About 50 – 70% of global diversity
  - Medicinal plants: 25% of world drug is extracted here
  - Flowering plants: nearly 1,30,000 flowering plants are found and 1 – 3% is known.



## 2. Temperate Forest:

- Much less biodiversity
  - 1,70,000 flowering plants
  - 30,000 vertebrates
  - 2,50,000 other group of species

### Tropical Rainforest



### Temperate Forest





## □ MARINE DIVERSITY:

- It is much **higher than terrestrial biodiversity** but it is **less** known and **described**.
- **Estuaries, coastal waters and oceans** are biologically diverse.
- Sea is a cradle of every known animal **phylum**
- **35 existing phylum** of multicellular animals
- **34 marine**
- **16 exclusively marine**



# BIODIVERSITY AT NATIONAL LEVEL – INDIA:

- India is **second largest** nation containing 5% of world's biodiversity and 2% of the earth surface.
- **Rank of India in biodiversity:**
  - **10<sup>th</sup> rank** among the **plant rich**
  - **11<sup>th</sup> rank** among the **endemic species of higher vertebrates**
  - **6<sup>th</sup> rank** among **the centers of diversity** and origin of **agricultural crops**.
- India's is an **agricultural country** and **economic depends** on the **production of crops**
- India is considered as **mega – diversity** nation because of **rich in flora and fauna**
- **High demand** in **abroad** for Indian species



## ○ **Medicinal Value:**

- More than 2000 medicinal plants – cure many diseases
- Eg. Tulsi, neem, turmeric, etc.

## ○ **Commercial Value:**

- Indian sandal wood
- Tobacco – nicotine
- Wild edible mushroom – exported
- Demand for ornamental plants, flowers and fruits
- More than 100 species developed and formulated in abroad.



# BIODIVERSITY AT LOCAL LEVEL:

- Based on the spatial distribution the biodiversity at local level is classified as follows,

## 1. Point richness

- Species found in single point in a given place

## 2. Alpha richness or Alpha diversity

- Number of species found in small homogeneous area

## 3. Beta richness or Beta diversity

- Rate of change of species increase as more heterogeneous habitats

## 4. Gamma richness or Gamma diversity

- Changes across large landscape



# BIODIVERSITY IN TAMILNADU:

- Distribution of plants and animals among different districts in Tamil Nadu is uneven
  - Dense forest in Salem
  - Western Ghats has 1500 species of plants, 50 species of mammals and 90 reptiles.
  - Birds of several species in **Vedanthangal**
  - Elephant sanctuaries at **Anaimalai**
  - Tiger sanctuary at **Mundanthurai**



# INDIA AS A MEGA – DIVERSITY NATION:

- Nearly 170 countries in this world and 12 of them contain 70% of the earth's biodiversity
- India is one among the 12 mega biodiversity countries
- The Ministry of Environment and Forests, Government of India records
  - 47,000 species of plants
  - 81,000 species of animals
  - Which is about the 7% and 6.5% of global flora and fauna respectively



# ENDEMISM OR ENDEMIC SPECIES:

- Species which are confined to a **particular area** are called as Endemic Species.
- India is **rich in endemic flora and fauna**
  - **33% of flowering plants**
  - **53% of fresh water fishes**
  - **60% of amphibians**
  - **36% of reptiles**
  - **10% mammalians**



- **Plant Diversity:** Nearly 5000 flowering plants and 166 crop plant species.
- **Marine Diversity:** More than 340 coral species, several species of mangrove plants and sea grasses are found.
- **Agro – Biodiversity:** 167 crop species and India is considered to the centre of origin of 30,000 to 50,000 varieties of rice, mango, turmeric, ginger, sugarcane, etc,.
- **Animal Biodiversity:** 75,000 animal species including 5,000 insects. India is a home of nearly 2,00,000 living organisms.





# HOT SPOTS OF BIODIVERSITY:

- Areas which exhibit **high species richness** as well as high species endemism are termed as **Hot spots of Biodiversity**.
- There are **25 hot spots of biodiversity** on a global level and two are present **in India i.e. Eastern Himalayas and Western Ghats**.
- At global level, these are the areas of **high conservation** priority, if these species lost, they can never be **replaced or regenerated**.
- Hotspot covering less than 2% of world's land are found to have 50% of terrestrial biodiversity.
- About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in hotspot.



# GLOBAL HOTSPOTS OF BIODIVERSITY:

1. Tropical Andes
2. Mesoamerican Forest
3. Caribbean
4. brazil's Atlantic Forest
5. Darien Panama Western Ecuador
6. Brazil's Cerrado
7. Central Chile
8. California Floristic Province
9. Madagascar
10. Eastern Arc and Coastal Forest of Kenya
11. Western African Forest
12. Cape Floristic Province
13. Succulent Karoo
14. Mediterranean Basin
15. Caucasus
16. Sundaland
17. Wallacea
18. Phillipines
19. Indo – Burma Eastern Himalayas
20. South – Central China
21. Western Ghats Sri Lanka
22. South – Western Australia
23. New Caledonia
24. New Zealand
25. Polynesia



# GLOBAL HOTSPOTS OF BIODIVERSITY:



# HOT SPOTS OF BIODIVERSITY IN INDIA:

## ○ Eastern Himalayas – Indo Burma region

- Geographically comprises of **Nepal, Bhutan and neighboring state of Northern India**
- 35,000 plant species of which 30% are endemic
- 63% mammals
- 60% of the Indian Birds

## ○ Western Ghats – Sri Lanka

- Geographically comprises of **Maharashtra, Karnataka, TamilNadu and Kerala**
- 1500 endemic, dicotyledonous plant species
- 62% amphibians and 50% lizards

- It is reported that only **6.8%** of the **original forest** are existing today and the rest has been **deforested of degraded**.



# HOT SPOTS OF BIODIVERSITY IN INDIA:



# THREATS TO BIODIVERSITY:

- **Extinction or elimination** of the species is a natural process of evolution
- During evolution, species have **died** and been **replaced** by others
- The process of extinction has become particularly **fast** in the recent years of **human civilization**
- Extinction of **10,000 species per year or 27 per day**
- The waste generated due to the **increase in human population and industrialization, spoils the environment and lead to more diversity** in biological species
- Any change in the system leads to a **major imbalance** and **threatens** the normal ecological cycle.



# CAUSES AND ISSUES RELATED TO THREATS TO BIODIVERSITY:

## ○ Loss of Habitat:

- **Destruction and loss of natural habitat** is the single largest cause of biodiversity loss

## ○ Poaching (over harvesting):

- **Illegal trading** of wildlife products by **killing** prohibited endangered species

## ○ Man – Wildlife Conflicts:

- It arises when **wildlife starts causing immense damage and danger** to man.



# HABITAT LOSS:

## FACTORS INFLUENCING HABITAT LOSS:

- Deforestation
  - Destruction of wetlands
  - Habitat fragmentation
  - Raw materials
  - Production of drugs
  - Illegal trade
  - Developmental activities
- With the current rate of loss of forest habitat, it is estimated that 20 – 25% of the global flora and fauna would be lost within few years.






# POACHING:

1. **Subsistence poaching** – killing animal to provide enough **food for survival**
2. **Commercial poaching** – hunting and killing animals to **sell their products**

## Factors influencing Poaching:

- Human population
- Commercial activities

## Remedial Measures:

- Illegal hunting and trading should be stopped
  - Not purchase fur coat, purse or bag made of crocodile or python skin
  - Bio – diversity laws should be strengthened
- 

# MAN – WILDLIFE CONFLICTS:

## FACTORS INFLUENCING MAN – WILDLIFE CONFLICTS:

- Shrinking of forest cover
- Human encroachment
- Injured animals
- Cultivations of food and elephants search for food
- Electric wiring injure elephant and start violence
- Compensation is not enough and farmers kill wild animals
- Garbage near human settlement or food crops near forest area attracts wild animals



# REMEDIAL MEASURES FOR MAN – WILDLIFE CONFLICTS:

- Crop and cattle compensation scheme must be started
- Solar powered fencing with electric current proof trenches must be provided to prevent animals
- Crop patterns must be changed
- Adequate food and water should be available for wild animal in the forest
- Developmental and construction work around the forest must be stopped



# ENDANGERED AND ENDEMIC SPECIES OF INDIA:

- According to International Union Conservation of Nature and Natural Resources – IUCN the species are classified as follows,
  - **Extinct Species** – No longer found
  - **Endangered Species** – Number of species has been reduced to critical level
  - **Vulnerable Species** – Continuous decline due to habitat destruction
  - **Rare Species** – Species located within a restricted area or thinly scattered over a more extensive area.



# ENDANGERED SPECIES OF INDIA:

- When the **number of species** has been **reduced** to a critical level
- Unless it is **protected and conserved**, it is in immediate danger of extinction
- In India the following species are endangered
  - **450 plant species**
  - **100 mammals species**
  - **150 birds species**
- India's biodiversity **is threatened** due to habitat **destruction, degradation and over exploitation of resources.**



## **IMPORTANT ENDANGERED SPECIES:**

- **Reptiles** – tortoise, green sea turtle, python, etc.
- **Birds** – peacock, Siberian white crane, etc.
- **Mammals** – Indian wolf, tiger, Indian lion, etc.
- **Primates** – capped monkey, golden monkey, etc.
- **Plants** – medicinal plants, sandal wood tree, etc.

## **FACTORS AFFECTING ENDANGERED SPECIES:**

- Pollution
- Over – exploitation
- Climatic changes



# ENDEMIC SPECIES:

- Species found only in particular region
- In India 47,000 species and 7000 plants are endemic
- 62% of our endemic species are found in Himalayas and Western Ghats

## 1. **Fauna** – Animals present in a particular region

1. 81,000 species of animals
2. Western Ghats is rich in 62% amphibians and 50% reptiles

## 2. **Flora** – Plants present in a particular region

# FACTOR AFFECTING ENDEMIC SPECIES:

- Habitat loss and fragmentation
- Pollution



# CONSERVATION OF BIODIVERSITY:

- Biodiversity is important for **sustainable development**
- Value of biodiversity is due to the **commercial, medicinal, genetic, aesthetic and ecological importance**
- **The management of biosphere for greater sustainable benefits to the present and future generation**





# FACTORS AFFECTING BIODIVERSITY:

- **Disturbed by human activities** such as construction of dams in forest, release industrial waste, using pesticides and insecticides in crop fields, urbanization, etc.
- **Poaching, over – exploitation and degradation**
- Marine ecosystem is disturbed by **oils spills and effluents**
- **Global warming, ozone layer depletion and acid rain**



# ADVANTAGES OR NEED OF BIODIVERSITY CONSERVATION:

- Immediate benefits to society such as recreation and tourism
- Availability of raw materials
- Preserves genetic diversity
- Ensures sustainable utilization
- Conservation of ecological diversity
- Biodiversity loss result in ecological and environmental deterioration, so it is essential to conserve biodiversity.



# TYPES OF BIODIVERSITY CONSERVATION:

- **In – situ Conservation** : Involves protection of fauna and flora within its natural habitat.

| In – situ Conservation Methods | Numbers available |
|--------------------------------|-------------------|
| Biosphere Reserves             | 7                 |
| National Parks                 | 80                |
| Wild – life Sanctuaries        | 420               |
| Botanical Gardens              | 120               |



## ○ **Biosphere Reserves:**

- Gulf of Mannar
- Nilgiri
- Nanda Devi

## ○ **National Park:**

- Kaziranga – Assam
- Gir National Park – Gujarat
- Periyar – Kerala
- Bandipur - Karnataka

## ○ **Wildlife Sanctuaries:**

- Mudumalai Wildlife Sanctuary – Tamil Nadu
- Vedanthangal Bird Sanctuary – Tamil Nadu

## ○ **Gene Sanctuaries or Botanical Gardens:**

- Gene sanctuary for citrus
- Gene sanctuary for pitcher plant



## **MERITS OF IN – SITU CONSERVATION:**

- Very cheap and convenient method
- Adjusted to natural disasters like drought, floods, forest fires, etc.

## **LIMITATIONS OF IN – SITU CONSERVATION:**

- Large surface area is required for preservation
- Maintenance is not proper due to shortage of staff and pollution



# EX – SITU CONSERVATION:

- Protection of **flora and fauna outside the natural habitat**
- Involves in maintenance and breeding of species in controlled conditions
- Identify the species of risk and extinction
- Prefers the species which are more important to man future
  - **Botanical gardens**
  - **Seed banks**
  - **Microbial culture collections, tissue and cell cultures**
  - **Museums**
  - **Zoological gardens**



## **METHODS OF EX – SITU CONSERVATION:**

- **National Bureau of Plant Genetic Resources (NBPGR)** – preserves agricultural and horticultural crops
- **National Bureau of Animal Genetic Resources (NBAGR)** – preserves the semen of domesticated bovine animals
- **National Facility for Plant Tissue Culture Repository (NFPTCR)** – conservation of varieties of crop plants or tree by tissue culture



## **MERITS OF EX – SITU CONSERVATION:**

- Survival increase due to special care and attention
- Longer life span due to assured food, water, shelter and security
- It is carried in case of endangered species

## **LIMITATIONS OF EX – SITU CONSERVATION:**

- Expensive method
- Freedom of wildlife is lost
- Animal cannot survive in natural environment
- Adopted only for few selected species





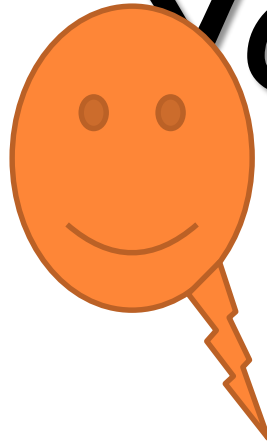
# CONSERVATION OF BIODIVERSITY LEADS TO.....





**BIODIVERSITY**  
IS LIFE • IS OUR LIFE

**THANK  
YOU!!!!**



**SAVE OUR EARTH FOR  
THE NEXT GENERATION  
TO KNOW ATLEAST OF  
WHAT IS THE PLEASURE  
OF NATURE!!!!!!**

