



# ***BIODIVERSITY***

- **BIODIVERSITY IS DEFINED AS THE VARIETY AND VARIABILITY AMONG THE LIVING ORGANISMS AND THE HABITATE IN WHICH THEY LIVE**





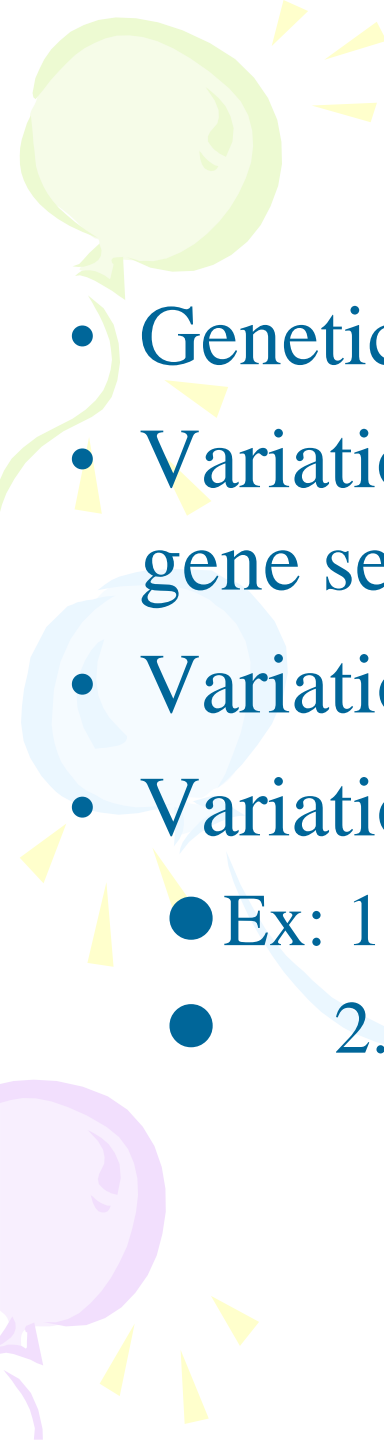
# LEVELS OF BIODIVERSITY

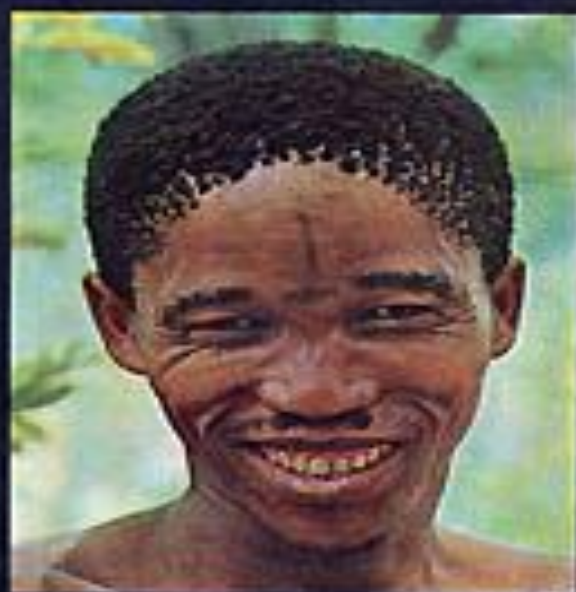
- GENETIC DIVERSITY
- SPECIES DIVERSITY
- ECOSYSTEM DIVERSITY

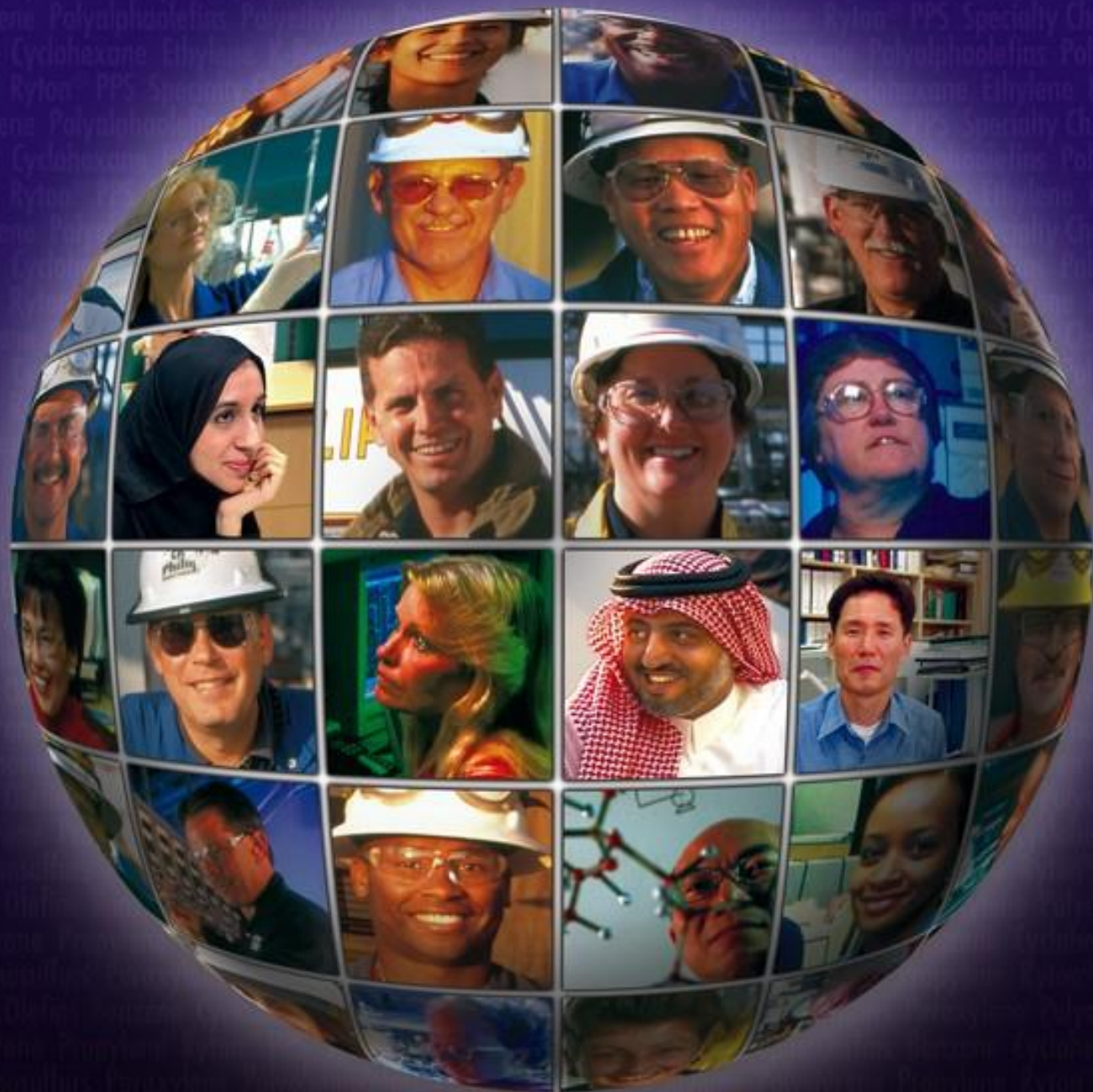
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# Genetic Diversity

- It is the basic source of biodiversity.
- The genes found in the organisms can form enormous number of combinations each of which gives rise to some variability.
- When the genes within the same species show different versions due to new combinations, it is called genetic variability.

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- Genetic diversity occurs because:
  - Variation in the nucleotide sequence of particular gene segments.
  - Variation in chromosome number and structure.
  - Variation in linkage between genes and so on.
    - Ex: 1. Varieties of Rice in India.
    - 2. Varieties of Tiger and Butterflies.







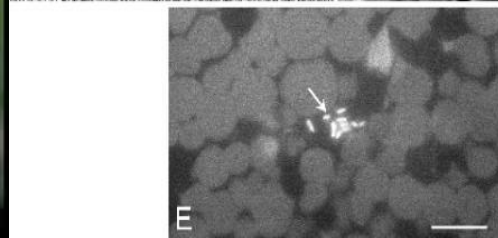
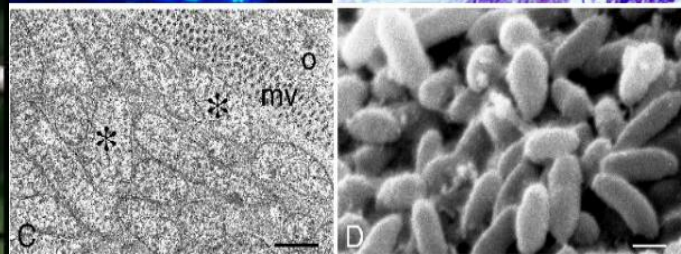
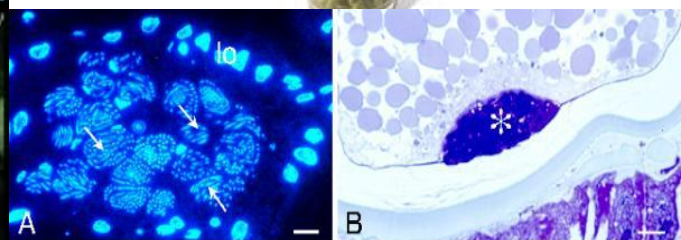
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# Species Diversity

- This is the variability found within the population of a species or between different species of a community.
- It represents broadly the species richness and their abundance in a community.





# Ecosystem diversity

- It is generally the diversity of ecological complexity showing variation in the ecological figures, trophical structures, food webs and nutrient cycles etc.
- The ecosystem also showing variations with respect to the physical parameters like moisture content, temperature, altitude, precipitation etc.



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# Measurement of Biodiversity

- Alpha Diversity
- Beta Diversity
- Gamma Diversity

## Alpha Diversity:

- It refers to the number of species in a single community and can be used to compare the number of species in different ecosystem.
- It refers to the species richness in an ecosystem.

# Beta Diversity

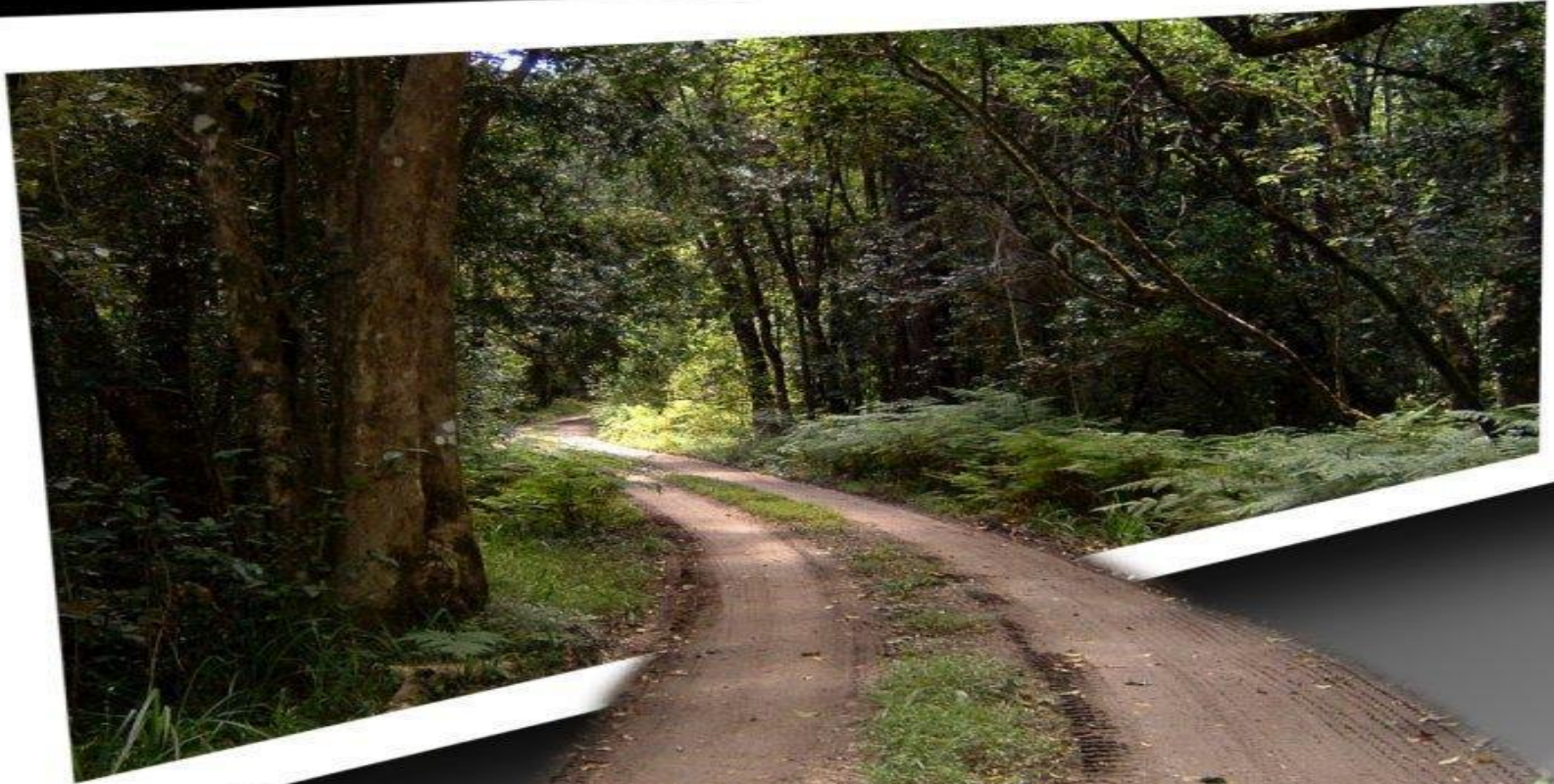
It refers to the degree to which species composition changes along an environmental gradient.

## Gamma Diversity

- It refers to the Species turnover rate with distance between sites of similar habitat or expanding geographical areas.
- It is applicable on larger geographical scales and is defined as the rate at which additional species are encountered as geographical replacements are made for a given habitat type in different localities.

# VALUE OF BIODIVERSITY

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## Classified as

- 1. Consumptive use value
- 2. Productive use value
- 3. Social Value
- 4. Ethical value
- 5. Aesthetic value
- 6. Optional values



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## **Consumptive use value**

These are the direct use values where the biodiversity product can be harvested and consumed directly.

Ex: fuel, food, drugs, fibre etc..

# CONSUMPTION

## ANIMALS





*FISH*



**PLANTS**

# PRODUCTION PURPOSE



FORET VINE



DAISY PLANT

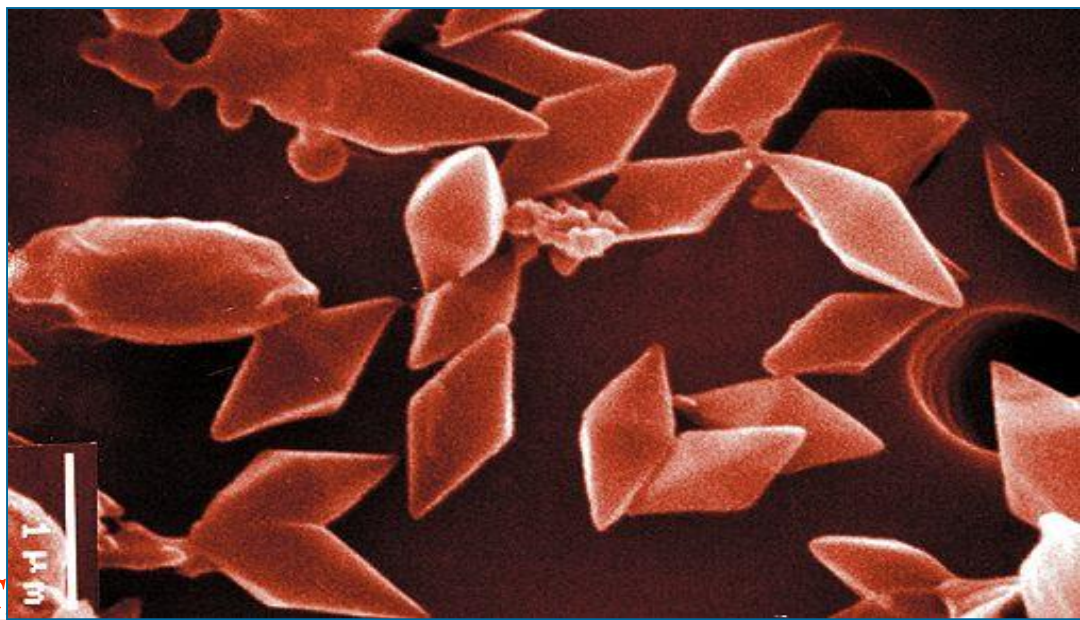


CALABER BEAN



# NEEM TREE

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# BACILLUS THURINGESIS



***MEDICINAL PLANTS***

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# Productive use value

- These are the commercially usable values where the product is marketed and sold.
- Ex: tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, fir of many animals, lac from lac insects etc..



# Tusks of elephants



# Musk from musk deer



# Silk from silk-worm



# Wool from sheep



# Fir of many animals




# Lac from lac insects





# Social Value

- These are the values associated with the social life, customs, religion, and physico - spiritual aspects of the people.
  - Many of the plants are considered holy and sacred in our country like tulsi, peepal, mango, lotus, bael etc.
  - Animals like cow, snake, bull, peacock, owl etc..
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# Tulsi





# Peepal tree



# Mango tree



# Lotus



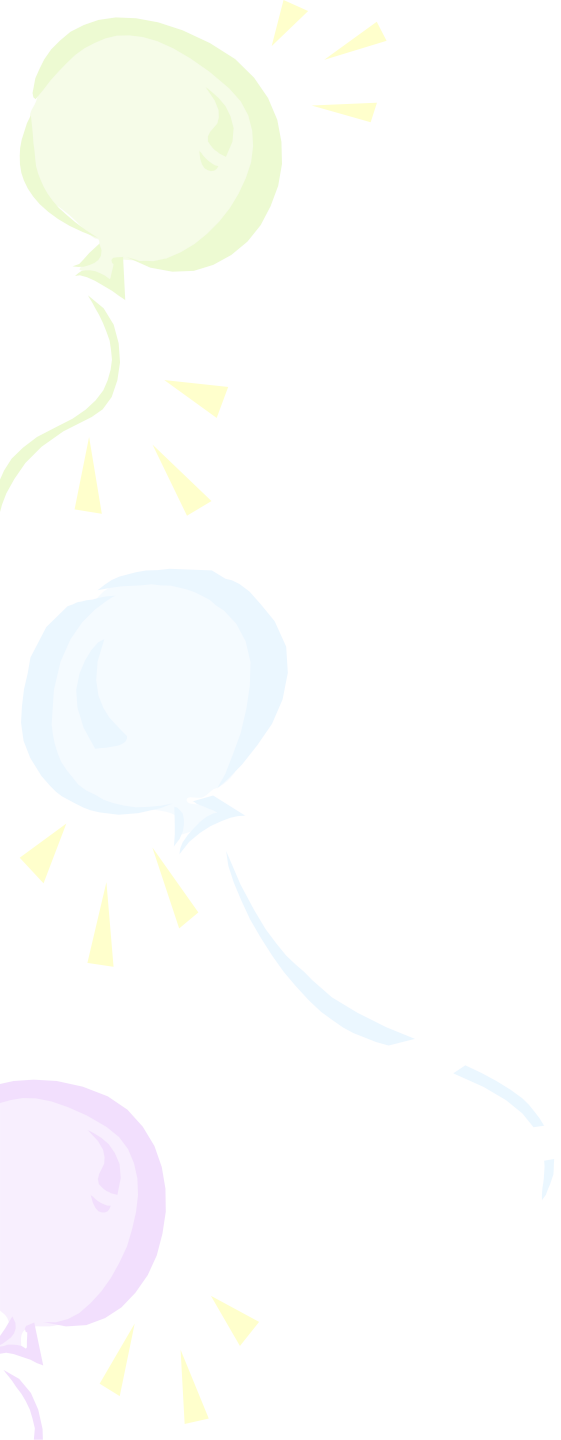
# Bael tree



# Cow



# Snake



# Bull



# Peacock





# Owl

(C) Pieter S. van der Meulen



A decorative graphic on the left side of the slide features a light green balloon at the top, a light blue balloon in the middle, and a light purple balloon at the bottom. Each balloon is connected to a thin, wavy streamer. Small yellow triangular shapes are scattered around the balloons, resembling confetti or streamer tassels.

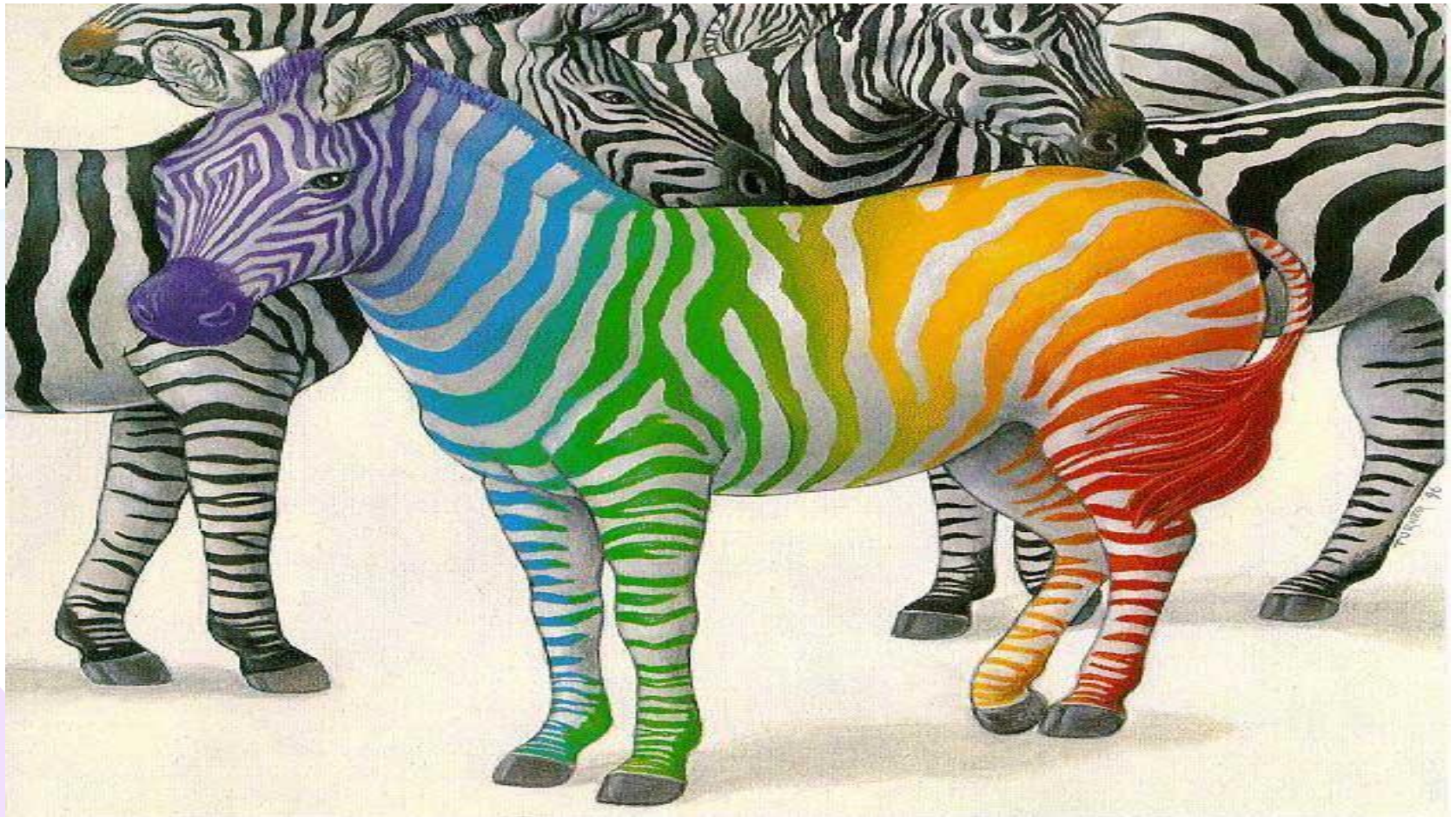
# Ethical value

- This means that we may or may not use a species, but knowing the very fact that this species exists in nature gives us pleasure.
- We are not deriving anything direct from kangaroo, zebra, or giraffe, but we all strongly feel that these species should exist in nature.

# Kangaroo

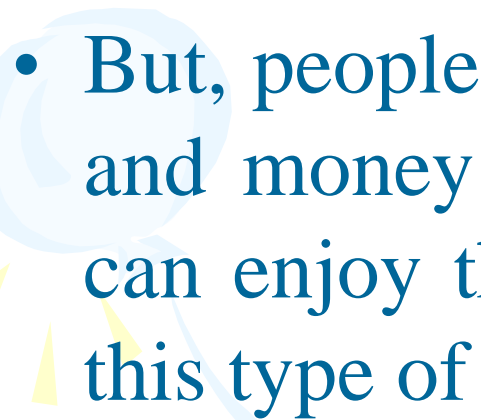



# Zebra/Giraffe





# Aesthetic value

- No one of us would like to visit vast stretches of barren lands with no signs of visible life.
  - But, people from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is now known as **eco-tourism**.
- 
- 

# Eco-tourism



# Eco-tourism



# Eco-tourism







# Optional values

- These are the potentials of the 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 ecosystems.

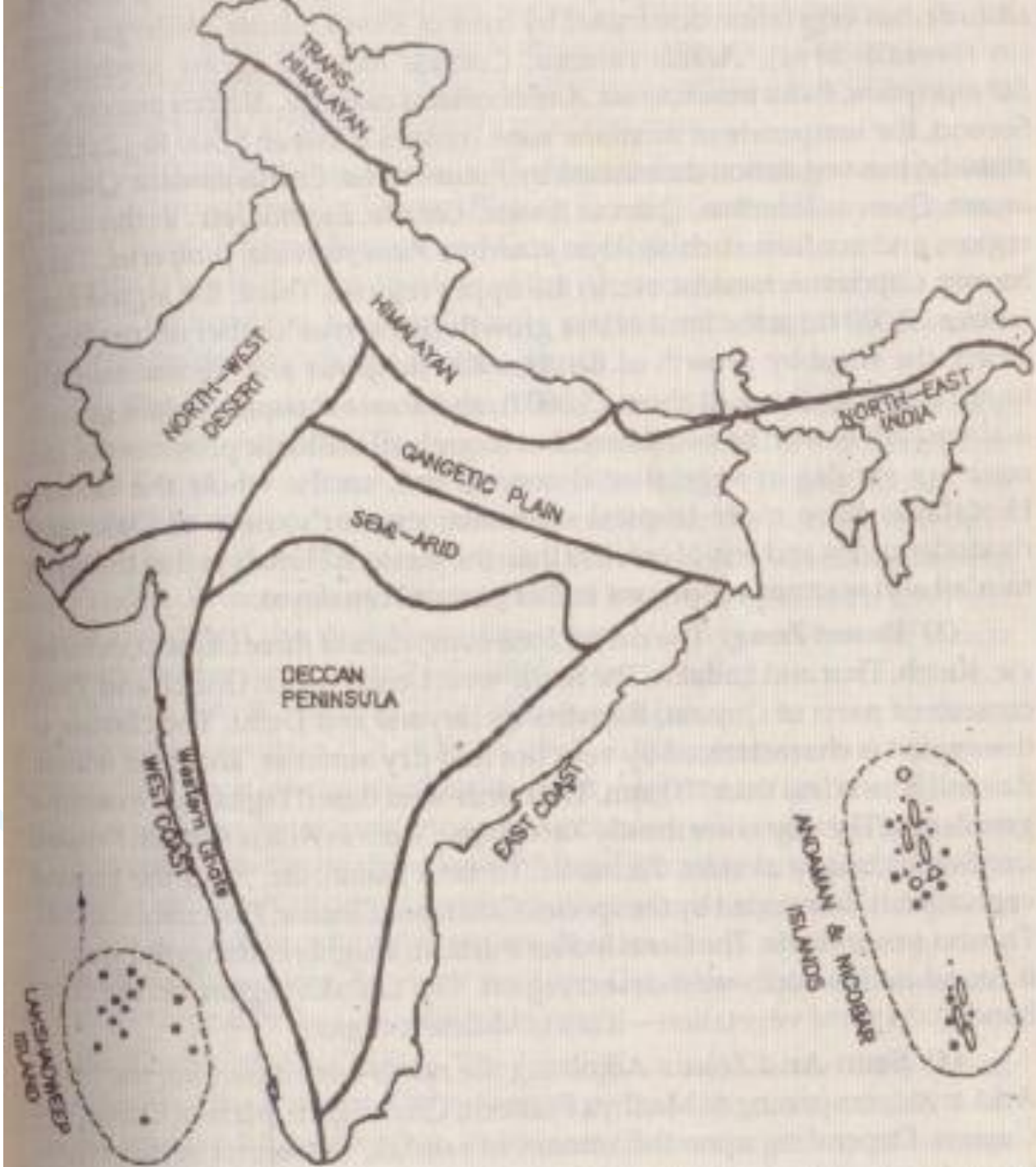
# *Biogeographical classification of India*

It deals with the plants and animals present in India.

In order to gain insight about the distribution and environmental interactions of flora and fauna of our country.

It has been classified into ten biogeographic zones.

Each of these zones has its own characteristics climate, soil, topography and biodiversity.





# *BIOGEOGRAPHICAL CLASSIFICATION OF INDIA*

- 1. Trans-himalaya With 2 Provinces
- 2. The Himalaya With 2 Provinces
- 3. The Indian Desert With 2 Provinces
- 4. The Semi Arid Zone With 2 Provinces
- 5. The Westren Ghats With 2 Provinces
- 6. The Deccan Peninsula With 5 Provinces
- 7. The Gangetic Plain With 2 Provinces
- 8. The Coasts With With 3 Provinces
- 9. North East India With 2 Provinces
- 10. The Islands With 2 Provinces

# BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

Wikimapia - Let's describe the whole world! - Microsoft Internet Explorer

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Showing 100 biggest cities, zoom in to see more

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# Biodiversity at Global, National and Local Levels

| <b>Group</b>     | <b>No. of species in INDIA (SI)</b> | <b>No. of species in WORLD (SW)</b> | <b>SI/SW (%)</b> |
|------------------|-------------------------------------|-------------------------------------|------------------|
| Mammals          | 350                                 | 4,629                               | 7.6              |
| Birds            | 1,224                               | 9,702                               | 12.6             |
| Reptiles         | 408                                 | 6,550                               | 6.2              |
| Amphibians       | 197                                 | 4,552                               | 4.4              |
| Fishes           | 2,546                               | 21,730                              | 11.7             |
| Flowering Plants | 15,000                              | 2,50,500                            | 6.0              |

# Patterns of Biodiversity

- Warmer areas hold more species than colder areas.
- Wetter areas hold more species than drier areas.
- Larger areas hold more species than smaller areas.
- Areas with varied climate and topography hold more species than the areas of uniform climate and topography.
- Areas of lower altitude hold more species than higher altitude areas.
- Less seasonal areas hold more species than higher seasonal areas.
- INDIA ranks 10<sup>th</sup> among the Plant richness countries.
- INDIA ranks 11<sup>th</sup> in terms of Endemic species of high vertebrates.
- INDIA ranks 6<sup>th</sup> among the Centre of Biodiversity and origin of agricultural crops.



# Species Richness

- Point Richness: The no. of species that can be found in a single point in a given area.
- Alpha-richness: The no. of species that found in a small homogeneous area.
- Beta-richness: The rate of change of species composition acquires in different habitats.
- Gamma-richness: the rate of change of species composition across landscape gradients.






# A Mega Diversity Nation

- India is one of the mega-diversity nations out of 12 in worldwide.
- Distribution of species into some major groups are:
  1. Endemism
  2. Centre of Origin
  3. Marine Diversity



# Endemism

- Species which are restricted only to a particular area are known as Endemic species.
  - Endemic animals and birds are species that are found only locally and are found nowhere else in the world.
  - About 62 % of Amphibians and 50 % of Lizards are endemic in India.
  - Western Ghats and Eastern Himalayan areas where the major species are endemism.
  - There are 42 species of Endemic birds in India out of which 35 are found in Western Ghats.
- 



# Centre of Origin

- A large number of species which are originated in India are called as Center of Origin.
- Nearly 5000 species of flowering plants, 160 species of crops and 320 species of wild relatives of cultivative crops having the Centre of Origin in India.



# Marine Diversity

- India having around 7500 KM long coastline.
- It majorly contains Mangroves, Estuaries and Back waters where more than 340 species of corals of the world are found.
- The marine diversity is rich in crabs, corals, Mangroves, sea grasses etc.
- A large portion of the Indian Biodiversity is still unexplored.
- Due to very diverse climatic conditions there is a major diversity of species exists in our country.

# Hot Spots of Biodiversity

- This term is introduced by Myers in 1988.
- The areas which exhibit high species richness as well as high species endemism are termed as Hot Spots of Biodiversity.
- Out of 25 hot spots in world wide 2 are present in India:
  1. Eastern Himalayan Areas
  2. Western Ghats
- The hot spots covering less than 2 % of World's land area which contains above 50 % of terrestrial biodiversity.
- An area is designated as hot spot when it contains atleast 0.5 % of plant species are Endemic.



# Endangered Species of India

- The International Union for Conservation of Nature and Natural Resources (IUCN) publishes the RED DATA BOOK which includes the list of endangered species of plants and animals.
- The RED DATA BOOK symbolized the warning signal for those species which are endangered and if not protected are likely to become extinct in near future.
- In INDIA nearly 450 plant species and 150 mammals and 150 species of birds are endangered.
- Reptiles: Gharials, Green sea Tortoise, Pythons etc.
- Birds: Peacock, Pelican, Siberian white crane etc.
- Mammals: Wolf, Red Pandas, Tigers, Leopards etc.
- Primates: Nilgiri Langur, Crapped Monkey, Bolded monkey
- Plants: Sandal Wood

# Types of Species

- **Endangered Species:** A species is said to be endangered when its no. has been reduced to a critical level or whose habitats have been drastically reduced.
- **Vulnerable Species:** Those species whose population is facing continuous decline due to over exploitation or habitat destruction.
- **Extinct Species:** A species is said to be extinct when it is not seen in wilds for 50 years at a stretch.
- **Rare Species:** The species which are not endangered or vulnerable at present but had a risk of endangered is called rare species.



# Characteristics of Endangered Species

- Small Range
- Large Territory or home range size
- Living on Islands
- Low product rates
- Narrow Habitat Requirements



# *INDIA AS A MEGA DIVERSE NATION*

- India contains about 8% of world biodiversity
- One of the 12 mega diversity countries
- Home to 33% life forms of the world
- 10 biogeographical zones 26 biotic provinces
- 33 botanical gardens, 89 national parks, 275 zoos, 504 sanctuaries and 12 biosphere reserves
- 47,000 species of plants and 81,000 species of animals



# India As a Mega Diverse nation

- 60% wealth can found in western ghats
- 372 mammals, 1228 birds, 428 reptiles, 204 amphibians, 2546 fishes, 57,245 insects, 5,042 molluscs others invertebrates
- India is home to 5 world heritage sites



# Endemic Species Of India

- Endemic species is a species native and confined to a certain region, it has comparatively restricted distribution.

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# Endemic Species in INDIA

- Out of 47,000 species of plants in India, about 7,000 are endemic.
- Ex: Orchids, Sapria Himalayana, Khasiana
- Around 81,000 species of animals are endemic.
- Ex: Lizards, Pythons, Indian Salamandar etc.



# *Locations*

- *Agastamalai Hills-----western Ghats*
- *Silent Valley ----Western Ghats*
- *New Amarambalam Reserve ----Western Ghats*
- *Periyar National Park----western Ghats*
- *Eastern And Western Himalaya*



# Eastern Himalayas

- Area comprises Nepal, Bhutan, northern India
- In Sikkim in an area 7298 km<sup>2</sup> out of 4250 plants 2550 are endemic
- In nepal 500 endemic species
- Butan 750 endemic species

The slide features a decorative background on the left side with a light green balloon at the top, a light blue balloon in the middle, and a light purple balloon at the bottom. Yellow streamers and triangular shapes are scattered around the balloons. The title 'Western Ghat' is centered at the top in a green, italicized font with a dark green underline.

## Western Ghat

- The area is one of the world's eight "Hottest biodiversity hotspots" and has over 5000 species of flowering plants, 139 mammal species, 508 bird species and 179 amphibian species. At least 325 globally threatened species occur in the Western Ghats. [\[3\]](#)



## *Western Ghat*

- Total area 17,000 km<sup>2</sup>
- Out of india's 49219 plant species, 1600 found western ghats
- Loss of biodiversity 2.4% per year.





***LION TAILED MACQUE***

A Nilgiri leaf monkey is sitting on a patch of green grass with scattered brown leaves. The monkey has a black face and head, with brown fur on its back and a lighter, tan-colored belly. It is looking towards the camera with its mouth slightly open. A blue, 3D-style text overlay is positioned across the middle of the image, reading "NILGIRI LEAF MONKEY".

***NILGIRI LEAF MONKEY***



**BROWN PALM CIVET**

*NILGIRI TAHR*  
**NILGIRI TAHR**






# Threats to Biodiversity

- The elimination of a species in nature is called as Extinction.
- As one species die out are replaced by other species.



## Causes of Extinction:

- Population Risk
  - Environmental Risk
  - Natural Calamities
  - Genetic Risk
  - Human action
- 

# Population Risk

- Random Variation in population rates (Birth & Death Rate).
- It is a risk especially to the species that consists of only a single population in one habitat.

# Environmental Risk

- It means variation in the physical or biological environment including variations in the predators, prey, Symbiotic or competitor species.
- In case of species that are sufficiently rare and isolated, such normal environmental variations can lead to their extinction.




# Natural Calamities

- It means sudden change in the environmental aspects.
- It includes fire, storms, floods, earthquake, volcanic eruption, change in the oceanic current and upwelling.



## Genetic Risk

- Change in the genetic characteristics in a small population of species is due to :
    1. Reduced genetic variation
    2. Genetic Drift or mutation
- 

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# Human action

- Habitat loss & Degradation
- Habitat Fragmentation
- Diseases
- Genetic assimilation
- Pollution
- Poaching





# Habitat loss & Degradation

- Agricultural activities
- Harvesting
- Extraction (mining, fishing, water logging)
- Development of human settlements and associated infrastructure.

## Habitat Fragmentation

- Development of roads, towers, canals, fields, industries etc.




# Diseases

- Pathogens or disease organisms may be considered as predators.
- The incidence of diseases in wild species may increase due to human activities.



## Poaching of Wildlife


- Illegal killing of wild animals is called as Poaching of wild life.
  - Animals are killed for their meat, skins, internal organs, for sports equipments and accidental killing.
- 



# Man – Wildlife Conflicts

- When wildlife causing damage to humans beings.

## **Case Studies:**

- In Sambalpur, Orissa - 195 human beings are killed in last 5 years by elephants and in return the villagers killed 98 elephants and badly injured more than 30 elephants.
  - In 2008, in India 16 Tigers were killed.
  - In 2004, a man eating tiger was reported to kill 16 Nepalis and one 4 year child in Royal Chitwan National park.
- 

# Causes of Man – Wildlife Conflicts

- Dwindling habitats of Tigers, elephants, Rhinos and Bears due to shrinking of forest cover areas.
- Usually the ill, weak and injured animals have a tendency to attack human.
- Less available of paddy and sugarcane within the sanctuaries.
- Usually villagers put electric wiring around their crop fields and animals get injured.
- Decreases of wildlife corridors due to human settlements in the forest.
- The cash compensation paid by the Govt. is very less as damaged caused to the farmers crop.

# Habitat degradation and loss



# Invasion Of Non Native Species

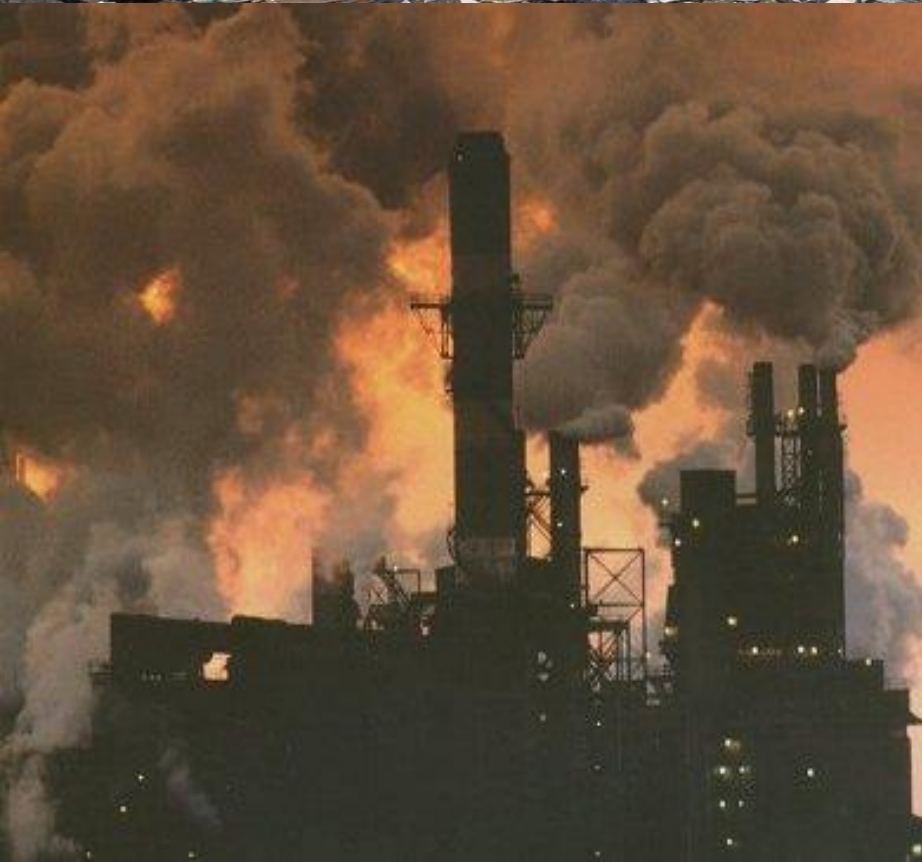


# Over exploitation of resources



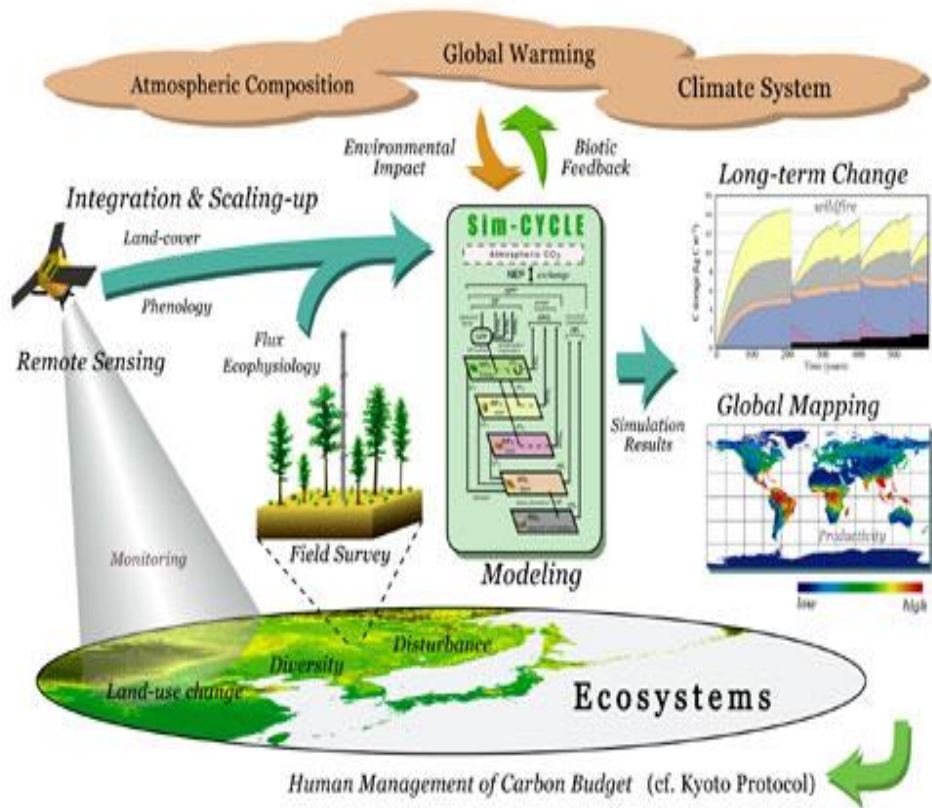


# POLLUTION





# Global Environmental Change



# Poaching



# HOT SPOTS OF BIODIVERSITY

- *Hot spots are regions that harbor a great diversity of endemic species and, at the same time , have been significantly impacted and altered by human activities*

# HOT SPOTS OF BIODIVERSITY

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## To qualify as a hot spot

Must support 1500 endemic plant species, 0.5% of the global total existing primary vegetation is the basis for assessing human impact in a region



## Biodiversity Hotspots

Earth's biologically richest places, with high numbers of species found nowhere else. Hotspots face extreme threats and have already lost at least 70 percent of their original vegetation.

- |   |  |  |                                |
|---|--|--|--------------------------------|
| 1 Atlantic Forest                           | 13 East Indonesian Islands             | 23 Madagascan and Indian Ocean Islands | 31 Southwest Australia         |
| 2 California Floristic Province             | 14 Eastern Afrocarpus                  | 24 Madagascar Forests of West Africa   | 32 Succulent Karoo             |
| 3 Cape Floristic Region                     | 15 Himalaya                            | 25 Horn of Africa                      | 33 Sundaland                   |
| 4 Caribbean Islands                         | 16 Indo-Burma                          | 26 Indo-Australian                     | 34 Tropical Andes              |
| 5 Cerrado                                   | 17 Japan                               | 27 Macaronesian Basin                  | 35 Tumbes-Cochabamba           |
| 6 Congo                                     | 18 Madagascar and Indian Ocean Islands | 28 Mesoamerica                         | 36 Wallacea                    |
| 7 Chilean Winter Rainfall-Valdivian Forests |  | 29 Mountains of Central Asia           | 37 Vietnam China and Sri Lanka |
| 8 Coastal Forests of Eastern Africa         |  | 30 Mountains of Southwest China        |                                |
|   |  | 31 New Caledonia                       |                                |
|   |  | 32 New Zealand                         |                                |
|   |  | 33 Philippines                         |                                |
|   |  | 34 Polynesia-Micronesia                |                                |
- New hotspots



# Hot spots

➤ 32 hot spots in the world

➤ 3 in India

Eastern Himalayas

Western Ghats

Indo- Burma

# ENDANGERED SPECIES

?

## *Globally threaten animals*

India contains 86 mammals

70 birds

25 reptiles

3 amphibians

Ex: Bengal fox, Asiatic cheetah, Marbled Cat, Asiatic Lion, Indian Elephant, Asiatic wild Ass, Markhor, Indian Rhinoceros.....



*Asiatic cheetah*  
Asiatic cheetah



© Bruce Tanner

**MARBLED CAT**





**Indian Elephant**



**Asiatic Wild Ass**





***markhor***



***wild asiatic water buffalo***



***Indian Rhinoceros***



***gaur***



## ASIATIC LION

Prey on chital,sambar,nigai

Restricted to Gir National Park

Total population around 250

# RED PANDA

- A cat like animal with a handsome wooly coat, bright red in colour
- Weight 3-4 kg
- Tree climber
- Found in himalaya region, nepal sikkim, upper burma, southern china
- Habitate destruction and hunting





*RED PANDA*



# BLACK BUCK

- FASTEST ANIMAL IN THE WORLD
- RAJASTHAN, GUJARAT, MAHARASHTRA, KARNATAKA AND MADHYAPRADESH
- HUNTED FOR SPORT, FLESH AND SKIN AND RAPID HABITATE DESRTUCTION





# BLACK BUCK





*SLENDER LORIS*







# Conservation of Biodiversity

- It is defined as the management of human use of the Biosphere, so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of future generation.
- Objectives:
  1. To maintain essential ecological processes and life supporting systems.
  2. To preserve the diversity of species or the range of genetic material found in the organisms or plants.
  3. To ensure sustainable utilization of species and ecosystem which supports millions of rural communities as well as the major industries all over the world.

# CONSERVATION OF BIODIVERSITY

- ❑ *There are two approaches of biodiversity conservation*
- ❑ *In situ conservation: this is achieved by protection of wild flora and fauna in nature itself. Ex: Biosphere reserves, national parks, sanctuaries, reserve forests etc.*
- ❑ *Ex situ conservation: this is done by establishment of gene banks, seed banks, zoos, botanical gardens, cultur collections etc..*



# In situ conservation

- At present we have 7 major biosphere reserves
- 80 national parks
- 420 wild life sanctuaries
- 120 botanical gardens in our country.

# IN-SITU / ON-SITU Conservation

- It means conservation of species in their natural ecosystem or even in man made ecosystem.
- It includes a system of protected area.
- Ex: National Parks, Sanctuaries, Biosphere reserves etc.

## Advantages:

- Best strategy for long term protection of biodiversity.
- It is cheaper to protect species population in their natural habitat.

## Disadvantages:

- Many protected habitats are used for logging, tourism or other profitable activities, which diluting the objective of conservation of biodiversity.

# *Biosphere reserves*



**Srisaillam  
Tiger Reserve**



**Srisaillam  
Tiger Reserve**



**Srisaillam  
Tiger Reserve**



**Srisaillam  
Tiger Reserve**







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# Sanctuaries



# Reserve forests





# Ex situ conservation

- This is mainly for conservation of crop varieties, the wild relatives of crops and all the local varieties with the main objective of conserving the total genetic variability of the crop species for future crop improvement programmes.
- Three types of gene bank/seed banks.

# EX-SITU Conservation



- It means conservation of species sample of genetic diversity particularly of endangered species away from the natural habitat under human supervision.
- Ex: Zoo, Game Farms, Aquaria for animal and plant species are maintained in Botanical Gardens, Arboreta and seed banks.

## Advantages:

- The organisms are assured of food, shelter and security and hence can have longer life span and breeding activities.
- Under human care and secure condition the chances of survival increases.
- It also provides the possibility of using genetic techniques to improve the concerned species.



## Disadvantages:

- Limitation of space, finance and facilities for selected species.
  - The organisms were adapted to the ever changing natural environment and hence gene-pool gets stagnant.
- 
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## Differences between the In-situ Conservation & Ex-situ Conservation:

### In-situ Conservation

- On-site collection / conservation.
- Endangered species are protected in its habitat.
- The protection of ecosystems is through
  - National parks,
  - Biosphere reserves,
  - Sacred forests, and
  - Sacred lakes.

### Ex-situ Conservation

- Off-site collection / conservation.
- Conservation of genetic resources of species away from their habitat.
- The protection of ecosystems is through Off-site collection and gene banks. Such as
  - (i) Collection of organisms (wild, domestic)
  - (ii) Gene banks,
  - (iii) Seed banks,
  - (iv) Orthodox seed banks,
  - (v) Recalcitrant seed banks,
  - (vi) Invitro preservation
  - (vii) Cryo preservation.

# National bureau of plant genetic resources(NBPGR)



# National bureau of animal genetic resources (NBAGR)





# National facility for plant tissue culture repository (NFPTCR)



**THANK YOU**

