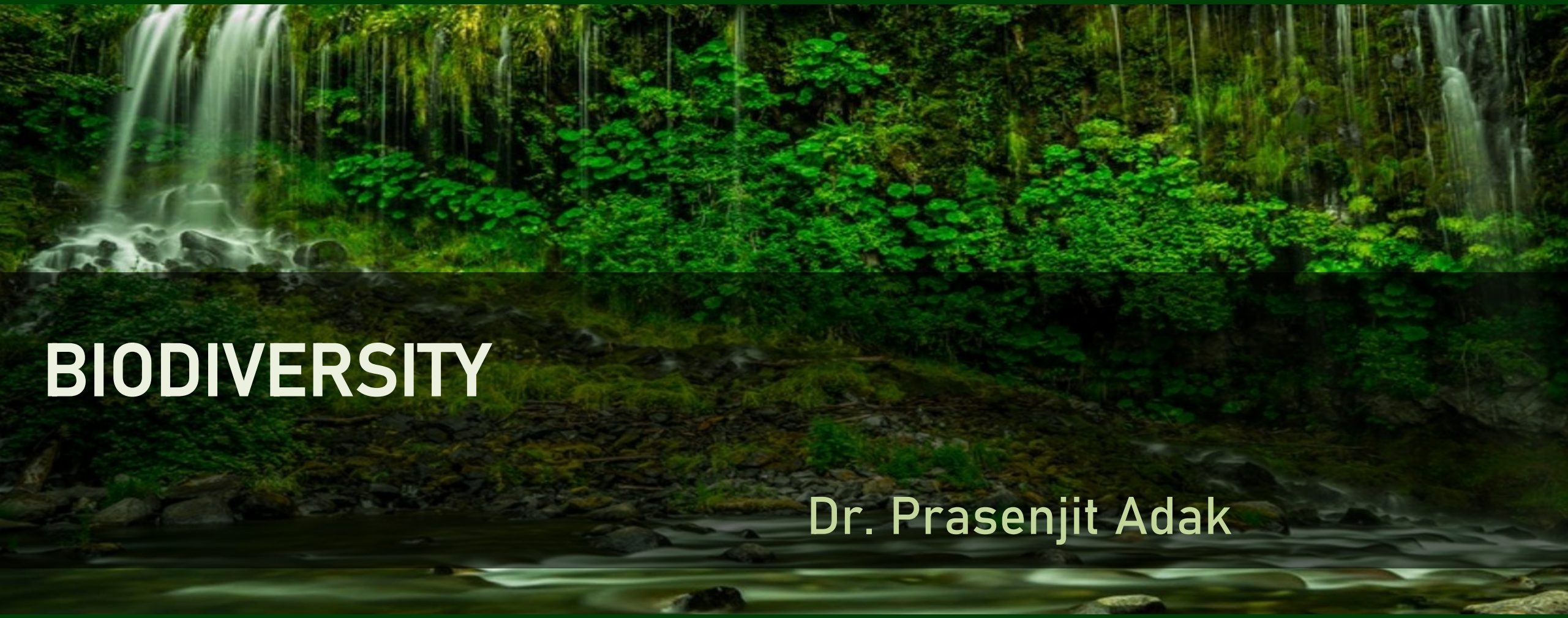


BIODIVERSITY

Dr. Prasenjit Adak

What is Biodiversity

- The term biodiversity is made up of two words – bio and diversity.
- Variability among living organisms from all sources (including terrestrial, marine and other ecosystems)
- Convention on Biological Diversity (1992) in Rio Earth Summit
- India ranks 10th among the plant rich countries of the world, 11th in terms of number of endemic species of higher vertebrates and 6th among the centers of diversity and origin of agricultural crops.

Levels of Biodiversity

- Genetic diversity
  - Variations among the genes of the same species are known as genetic diversity.
  - It is this type of diversity that gives rise to the different varieties of rice, mangoes, dogs etc.

GENETIC DIVERSITY

- **Genetic diversity** is the amount of variation in genetic material (DNA) within a species or within a population. The magnitude of variation in genes of a species increases with increase in size and environmental parameters of the habitat.
- **Genetic diversity has the following importance:**
- (i) It helps in speciation or evolution of new species;
- (ii) It is useful in adaptation to changes in environmental conditions;
- (iii) It is important for agricultural productivity and development

Levels of Biodiversity

- Species Diversity
  - Diversity which arises due to variations among species present in specific areas is called as ‘species diversity’.
  - Horses and donkeys are distinct species, as are lions and tigers.

SPECIES DIVERSITY

- It describes the variety in the number and abundance of the species within a region
- To accurately determine species diversity, both the **species richness**, which is the number of different species, and the **relative abundance**, which is the number of individuals within each species, must be considered
- The species richness depends largely on climatic conditions.
- When a species is confined entirely to a particular area, it is termed as **endemic species**

Levels of Biodiversity

- Ecosystem Diversity
  - Ecosystem diversity is the diversity of habitats which include the different life forms within.
  - The term also refers to the variety of ecosystems found within a biogeographical political boundary.

ECOSYSTEM DIVERSITY

- It describes the assemblage and Interaction of spices living together and the physical environment of a given area
- It relates varieties of habitats, biotic communities ecological processes in biosphere. It also tells about the diversity within the ecosystem.
- For example, the landscapes like grass lands, deserts, mountains etc. show ecosystem diversity
- The ecosystem diversity is due to diversity of niches, trophic levels and ecological processes like nutrient cycling, food webs, energy flow, role of dominant species and various related biotic interactions.
- Such type of diversity can generate more **productive and stable ecosystems** or communities capable of tolerating various types of stresses e.g. drought, flood etc.

Values of biodiversity

- Productive Value
  - Different products are obtained from different organisms, like silk from silk-worm, wool from sheep, fur of many animals,
  - lac from lac insects etc.
- Ecological Services
  - It refers to the services provided by ecosystems like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of water, their role as carbon sinks, pollutant absorption and reduction of the threat of global warming etc.
  - Biodiversity have enormous potential and a decline in biodiversity will lead to huge economic, ecological and socio-cultural losses.

Values of biodiversity

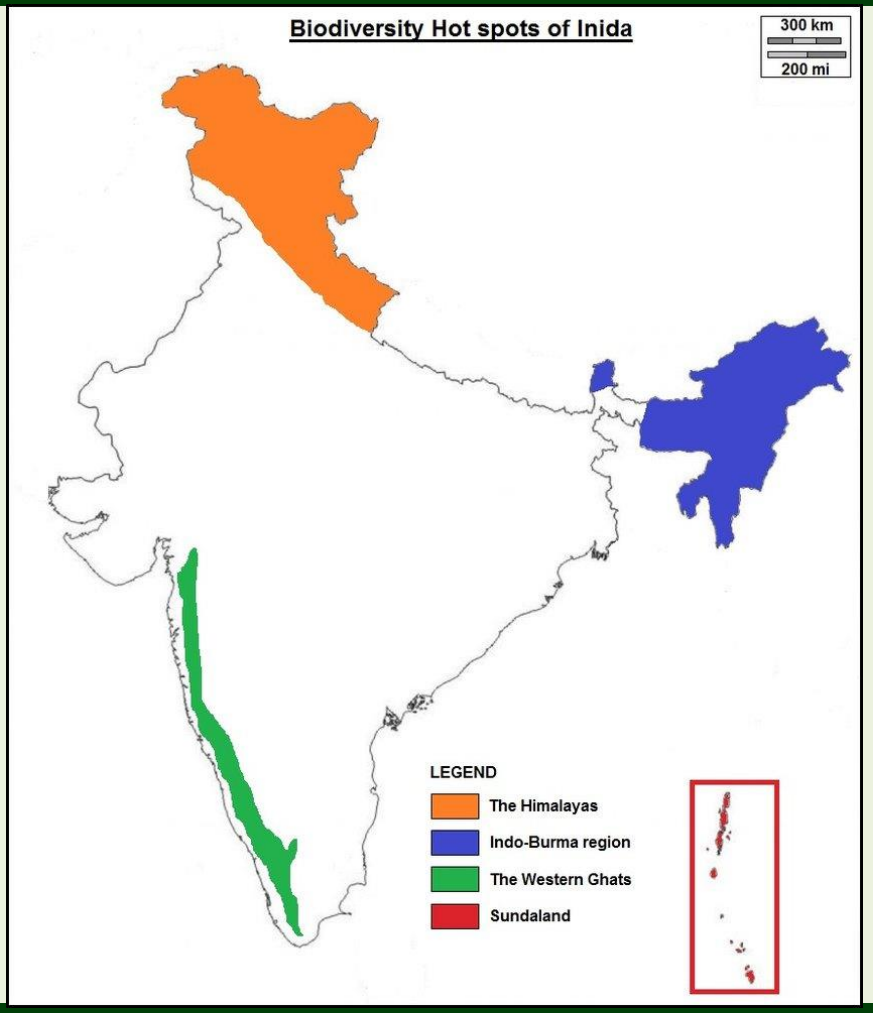
- Survival
  - Food: A large number of wild plants are consumed by human beings as food.
  - Fuel: The fossil fuels coal, petroleum and natural gas are also products of fossilized biodiversity.
- Health and Healing
  - About 75% of the world population depends upon different plants or plant extracts for medicines.
- Ethical and Aesthetic Value
  - Many of the plants are considered holy and sacred in our country like Tulsi, Peepal etc.
  - The ethical value means that we may or may not use a species but knowing the very fact that this species exists in nature gives us pleasure.
  - 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.

Hot spots of Biodiversity

- A biodiversity hotspot is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans
- These have been identified based on three criteria:
  - The number of species present.
  - Endemism (The number of those species found exclusively in an ecosystem e.g. Asiatic Lion in Gir Forest, Lion-tailed Macaque in Western Ghats of India).
  - The degree of threat they face.

Hot spots of Biodiversity

- Hot Spots of India
  - The Western Ghats
  - The Eastern Himalayas
  - Indo-Burma
  - Sundaland (Nicobar island)



Endangered species

- Plant or animal species which are at the verge of their extinction are called endangered species.
- Red panda, Gir lion, Gharial, Great Indian bustard etc. are some endangered animal species of India.

Vulnerable species

- A vulnerable species is one which has been categorized by the International Union for Conservation of Nature as likely to become endangered unless the circumstances that are threatening its survival and reproduction improve.
- vulnerable species in India: Sarus crane, Nilgiri Langur, Barasingha etc.

Rare species

- A rare species is a group of organisms that are very uncommon, scarce, or infrequently encountered.
- The International Union for Conservation of Nature uses the term "rare" as a designation for species found in isolated geographical locations. They are not endangered, but classified as "at risk".
- E.g. Gobi bear, Red wolf

- The endangered and vulnerable species include **Nilgiri Tahr**, **Lion-tailed Macaque**, **Parakeets**, **Laughing Thrush Birds** and more.

- **Himalayan Tigers**, **Snow leopard**, **Asiatic Elephant**, **One-horned Rhinoceros**, **Red Panda**, **Swamp deer**, **Water Buffalo**, **Indian Hornbill**, **Black-necked Crane**, etc are endemic but treated animals.

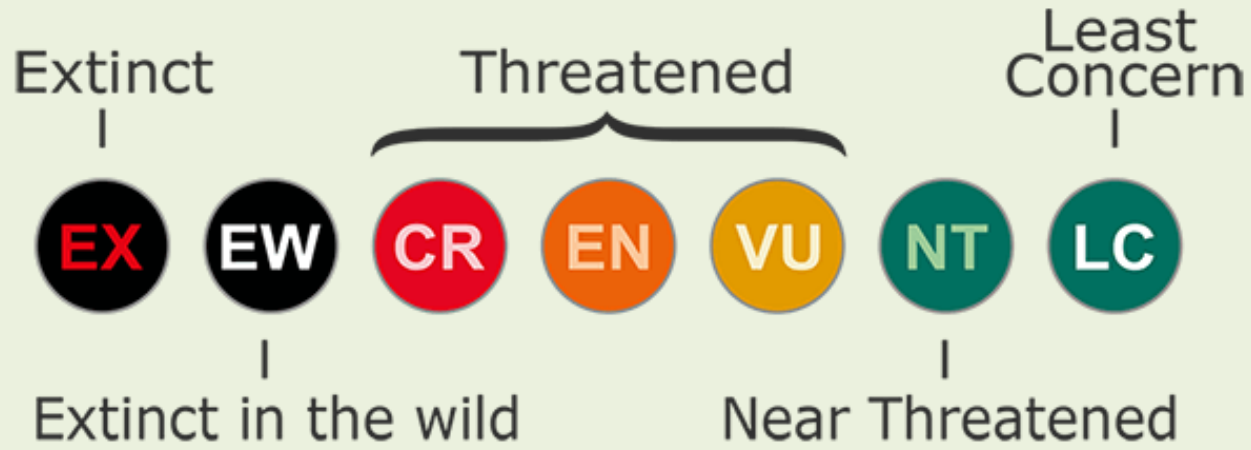
- Species such as **Pygmy Loris**, **Delacour's leaf monkey**, **Saola**, **the White-eyed River Martin**, **Giant Ibis**, **Vietnamese Gecko**, etc lies in category of critically endangered species.

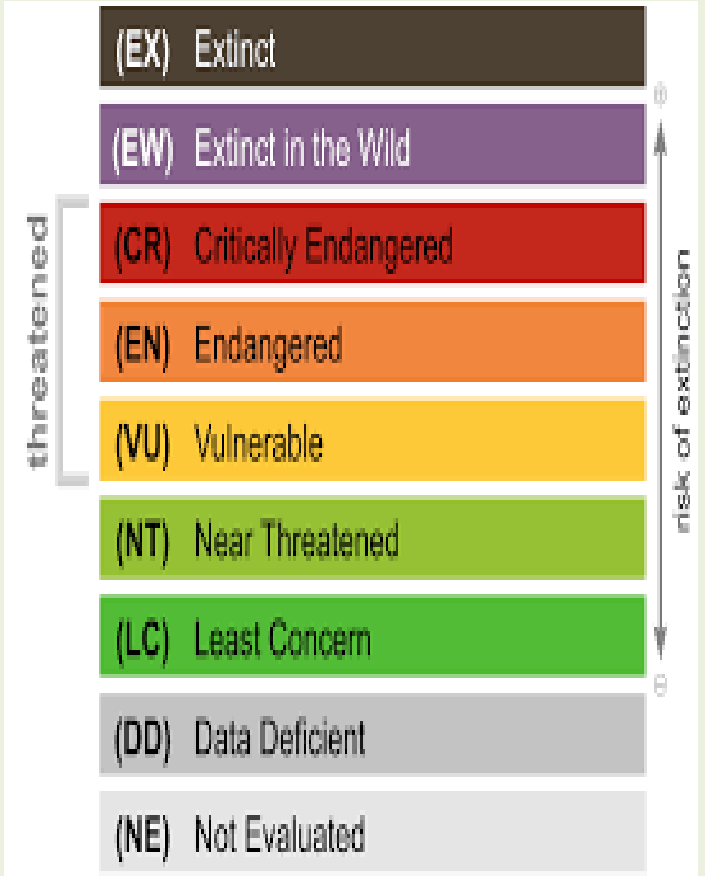
- **Turtles**, **Pangolins**, **Orangutans**, **Tigers**, **Rhinoceros**, **The Bali Starling**, **Straw Headed Bulbul** and many more are the **endangered species** here.

- The Western Ghats
- The Eastern Himalayas
- Indo-Burma
- Sundaland

Red Data Book

- Red data book is the document established by International Union for Conservation of Nature (IUCN) for documenting the rare and endangered species of plants, animals, fungi and also a few local species that exist within a state or country.





Endangered black buck

- The black buck is also known as kala hiran in India.
- Earlier, it was found all over India except in the north-eastern regions of the country.
- Due to large scale-poaching and destruction of habitat, its existence now restricted in some parts of Rajasthan, Punjab, Gujarat, Uttaranchal and Haryana.
- The black buck does not require dense forests, even it is usually found in open plains in herds. So, open plains need to be conserved in order to enable the black buck to move freely.
- Recently, the film actor Salman khan was sentenced to 5 yrs imprisonment for shooting black bucks.

Endemic Species

- The plant or animal species confined to a particular region and having originated there or a species which occur continuously in that area are known as endemic species. Restriction of species or taxa in small region is known as endemism.
- True Cardamoum (*Eletaria repens*), Peepal (*Ficus religiosa*), Palash tree (*Butea monosperma*), Bargat (*Ficus bengalensis*), etc. are some of the endemic plants of India.
- One-horned rhino (*Rhinoceros unicornis*), Tahr (*Nilgiritragus hylocrius*), Snow leopard (*Panthera uncia*), Royal Bengal tiger (*Panthera tigris tigris*), Gir lion (*Panthera leo persica*) etc. are some of the endemic animals of India.

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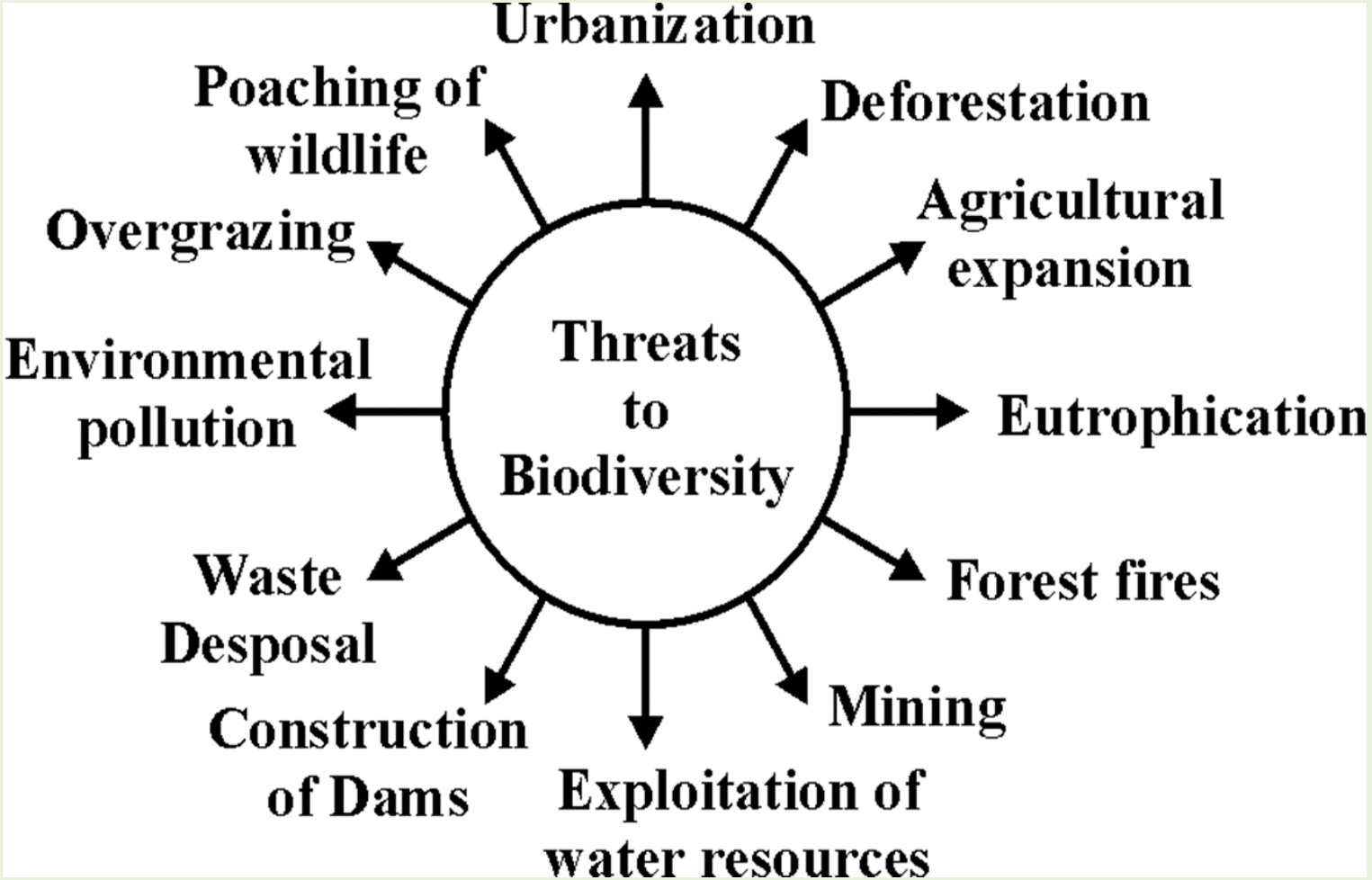
EDGE species

- Evolutionarily Distinct and Globally Endangered (EDGE) species represent a disproportionate amount of unique evolutionary history. They have few close relatives, are often the only surviving member of their genus, and sometimes the last surviving genus of their evolutionary family.
- Some EDGE species, such as Asian elephants, Chinese Pangolin, Malayan Tapir and red pandas, are well known.


Malayan Tapir

Chinese Pangolin

Threats to biodiversity



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Conservation of Biodiversity

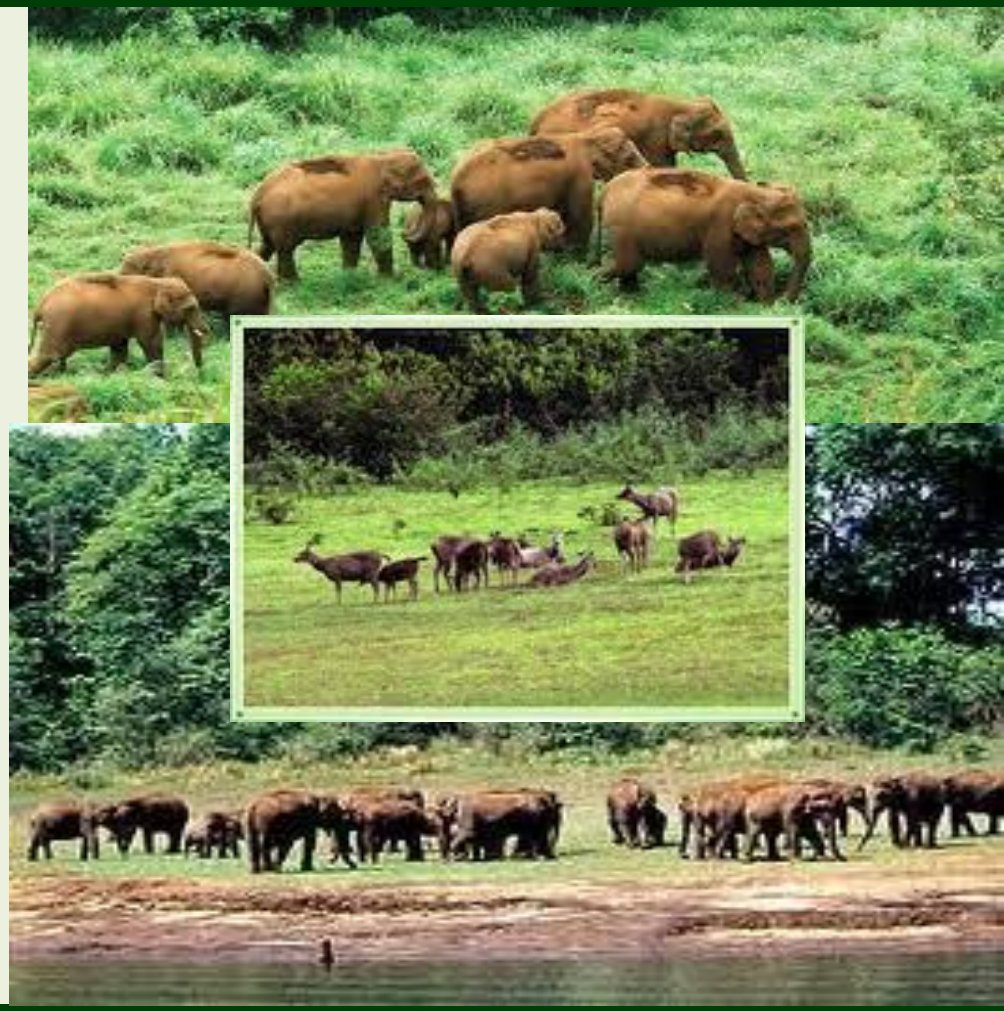
- Wildlife conservation is the practice of protecting animal species and their habitats.
- There are two approaches of biodiversity conservation:
  - In situ Conservation: Protection of species in their natural habitat.
  - Ex situ Conservation: Protection in a place away from their natural habitat.

In-situ Conservation

- National Parks (106 in India)
  - A national park conserves the environment and natural objects and wildlife therein. National parks are areas dedicated to conserve wild animals and natural scenery of the environment. All private rights are non existent and all forestry operations and other activities such as grazing of domestic animals is prohibited. No human inhabitation is allowed in the park apart from on duty public servants and people allowed by chief wildlife warden. It comprises the core zone.

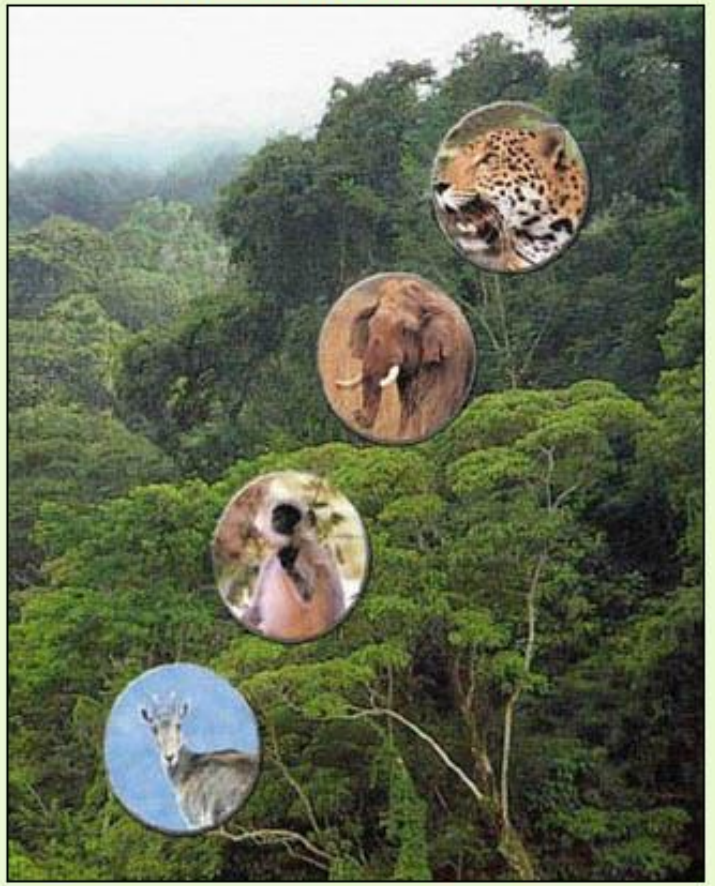
In-situ Conservation

- Wildlife sanctuaries (573 in India)
  - A wildlife sanctuary is an area specially designated where it is illegal to interfere in anyway with the natural life there. Hunting, shooting and fishing would be prohibited.
  - Wildlife sanctuary is a place where killing or capturing of any animal is prohibited except under orders of the authorities concerned. they provide protection and optimum living conditions to wild animals.
  - A wildlife sanctuary is dedicated the wildlife but it considers the conservation of species only in addition , its boundary is not limited by state legislation.
  - Bharatpur Bird Sanctuary, Chilika Lake Bird Sanctuary



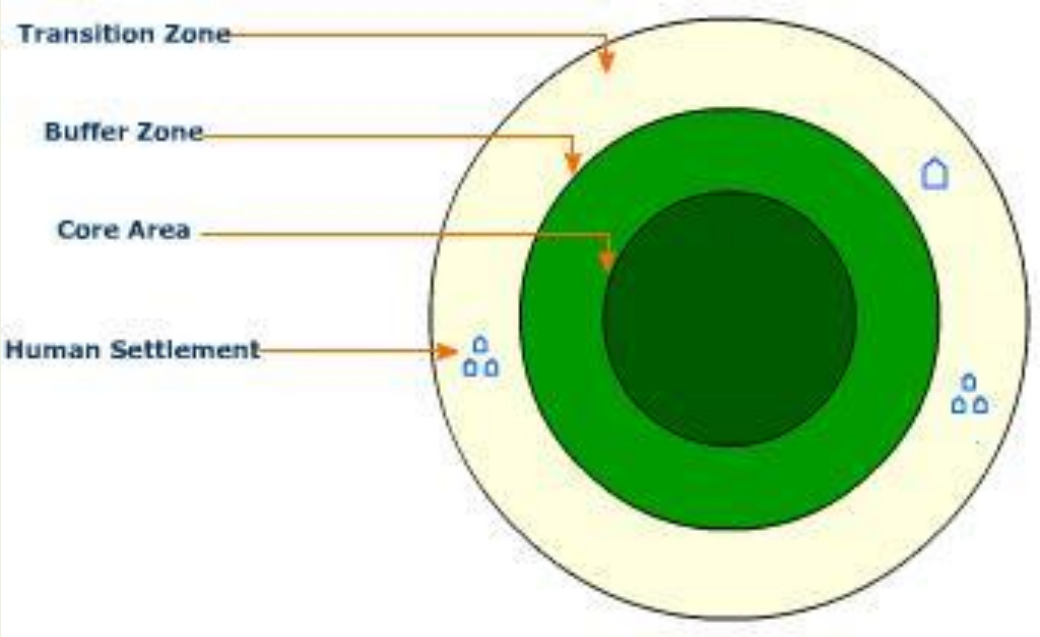
In-situ Conservation

- Biosphere reserves (18 in India)
  - Biosphere reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with its sustainable use. They are internationally recognized, nominated by national governments and remain under sovereign jurisdiction of the states where they are located.
  - Sunderbans, nilgiri, Kachchh



In-situ Conservation

- Zones of a in-situ conservation
  - Core zone
    - In core or natural zone human activity is not allowed. This area is legally protected and undisturbed ecosystem.
  - Buffer zone
    - The immediate surrounding area of core zone is buffer zone. Here limited human activities live like research, education and research strategy is permitted.
  - Transition zone
    - transition zone is the outermost or peripheral area of biosphere reserve. With the cooperation of reserve management and local people several human activities like settlements, cropping, recreation, and forestry are carried out without disturbing the environment.
  - Restoration zone
    - Through the restoration activities selected degraded area called restoration region is restored to natural form. This is a part of Buffer zone.



In-situ Conservation

	Objectives	Features	Zone
National Parks	Conservation of species of a habitat with minimal or very low intensity of human activities	No person resides in the park other than public servants on duty and persons permitted by the chief wildlife warden	Core
Wildlife Sanctuary	Conservation of species and habitats by manipulative management	No person resides in the park other than public servants on duty and persons permitted by the chief wildlife warden	Core, Buffer and Restoration
Biosphere Reserves	Conservation of natural resources and the improvement of the relationship between humans and the environment	Both natural and human-influenced ecosystems; substantial human settlement	Core, Buffer, Restoration and Transition

In-situ Conservation

- Advantages
  - Ecological integrity is maintained and managed
  - Better opportunity for conservation as well as evolution
  - Cheaper way of conservation.
- Disadvantages
  - Less protection against pollution
  - Poachers and Eco tourists may cause damage

Ex-situ Conservation

Aquaria:

- The aquaria are mainly used for the threatened and endangered fresh water species.

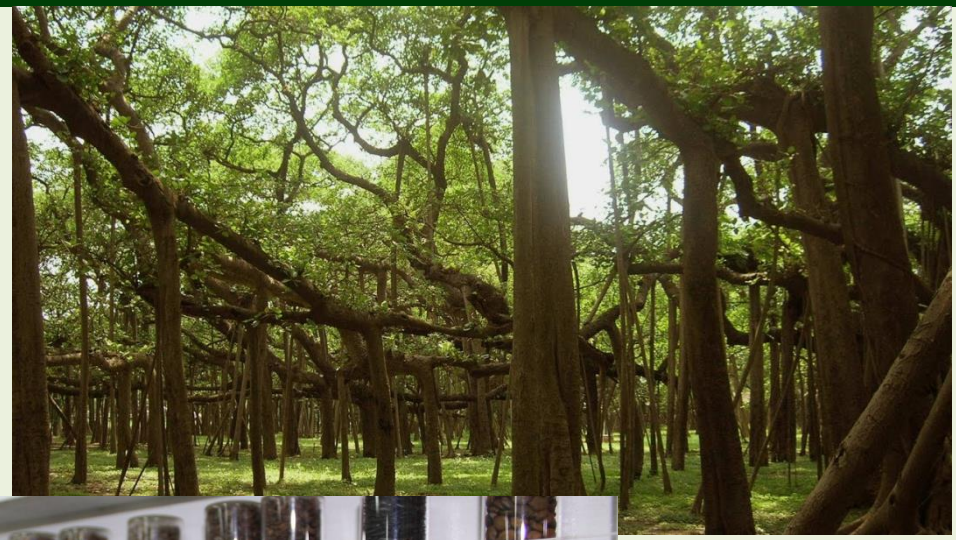
Zoo:

- In the past, zoos were mainly display facilities for the purpose of public enjoyment and education. As large numbers of the species traditionally on display have become rarer in the wild, many zoos have taken on the additional role of building up numbers through captive breeding programs.

Ex-situ Conservation

Botanical Gardens:

- Botanical gardens are used for the conservation of rare and endangered plant species for study and research of specific plant characters and for disseminating scientific information and experiences to promote sustainable development.



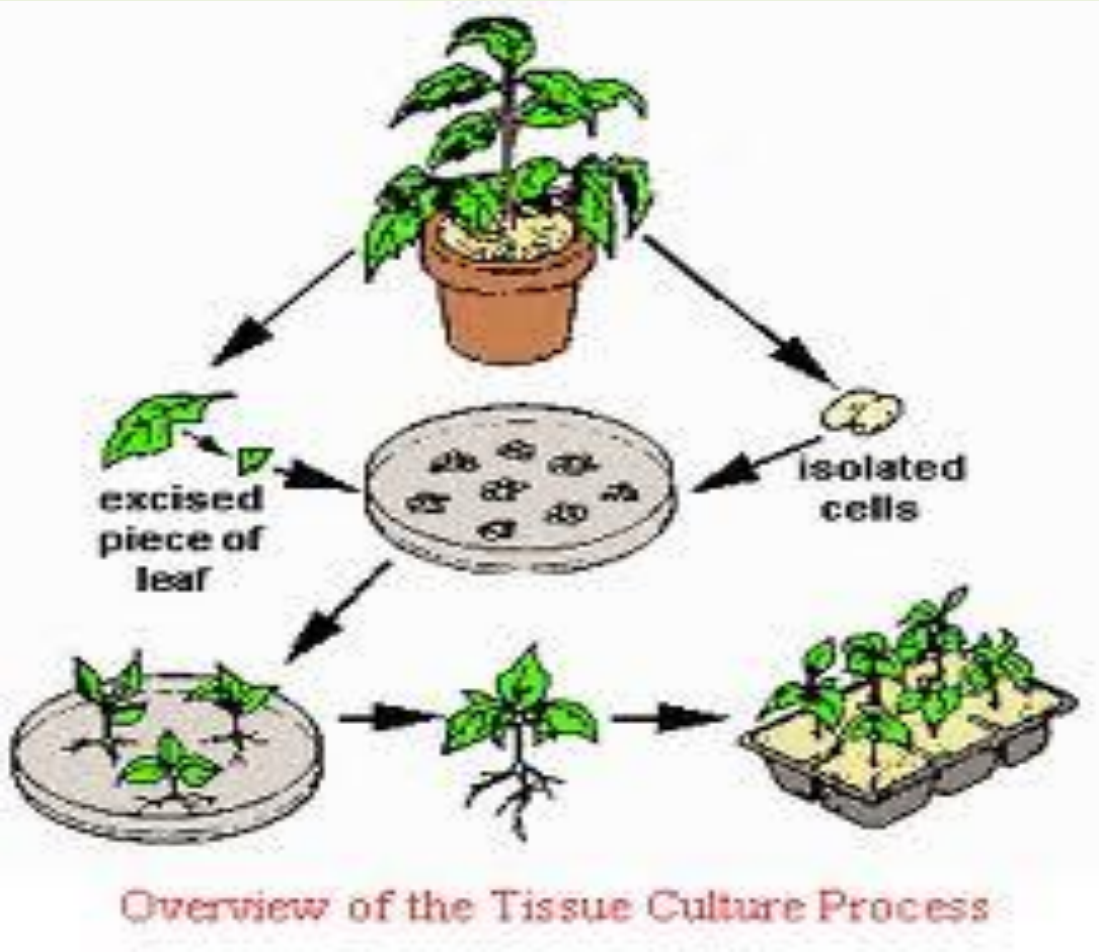
Gene Bank:

Seed Bank

- Pollen Bank
- Sperm Bank
- Ova Bank

Ex-situ Conservation

- Tissue Culture Technique:
  - Tissue culture refers to a special technique used for asexual propagation in plants a very small piece of shoot apex ,leaf section or even an individual cell is cut and placed in a sterile culture in a test tube, petri dish.
- DNA technology:
  - DNA of plant or animal cell or a part of it to be conserved. DNA technology can provide an innovative and effective approach for biodiversity conservation



Overview of the Tissue Culture Process

Ex-situ Conservation

- Advantages
  - Organisms are completely protected from predation and poaching
  - The species survive longer and may breed more offspring than usual
  - The quality of offspring may be improved by genetic techniques
  - Breeding of hybrid species is possible.
- Disadvantages
  - Animals may not behave as normal making reproduction difficult
  - Animals may not survive reintroduction into the wild
  - Overprotection may result in loss of natural occurrence.

Man-wildlife conflict

- Sometimes we come across conflicting situations when wildlife starts causing immense damage and danger to man and under such conditions it becomes very difficult for the forest department to pacify the affected villagers and gain local support for wild-life conservation.
  - Elephant is one of the holy animal in India, especially in Kerala but due to elephant attack some 500 people are killed by each year.
  - The Corbett National Park of Uttarakhand is famous for notable man-eaters leopard, responsible for at least 400 attacks on humans.
  - The largest Swamp and mangroves forest of India is also home to over 500 Bengal tigers, who killed from 50-250 people per year in India and Bangladesh.

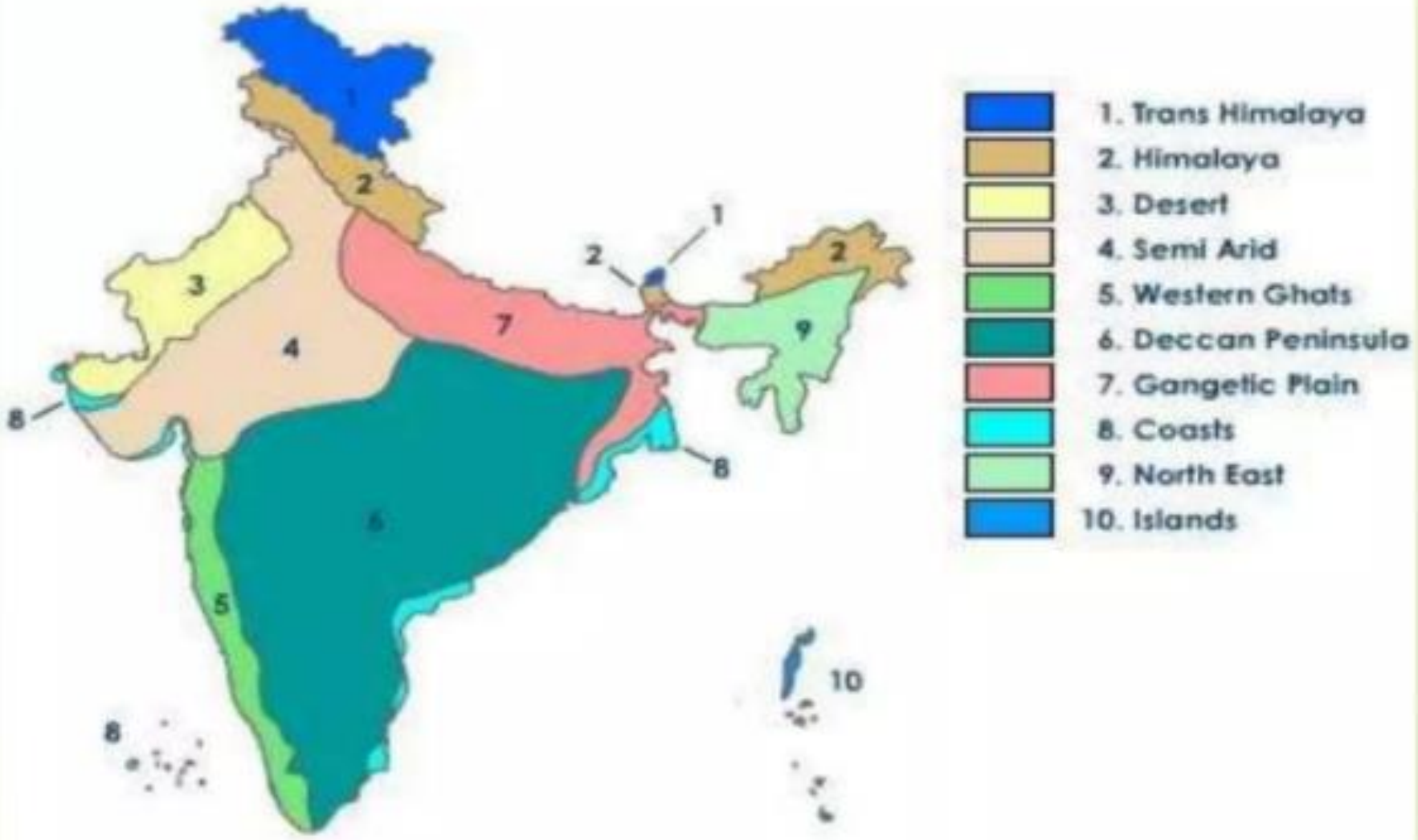
Causes of Man-animal conflicts

- shrinkage of habitat
- Man-eating tendency
- Food scarcity
- Electric wiring
- Lack of corridors
- Inadequate compensation to the farmers.

Major biogeographic habitats of India

	Biogeographic zone	Biotic province
1	Trans-Himalayan	Upper region
2	Himalayan	North-west Himalayas, West Himalayas, Central Himalayas, East Himalayas
3	Desert	Kutch, Thar, Ladakh
4	Semi-Arid	Central India, Gujrat-Rajwara
5	Western Ghats	Malabar coast, Western Ghat mountains
6	Deccan Peninsula	Deccan plateau, Chhota Nagpur, Central highlands
7	Gangetic plain	Upper Gangetic plain, Lower Gangetic plain
8	North-east India	Brahmaputra Valley, North-eastern hills
9	Islands	Andaman Islands, Nicobar Islands, Lakshadweep Islands
10	Coasts	West coasts, East coasts

10 Biogeographic Zones of India



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Phyto-geographical regions of India

- On the type of flora, India has been divided into following phytogeographical regions:
  - The Western Himalayas
  - The Eastern Himalayas
  - Western Deserts
  - Gangetic Plains
  - Central India
  - Western Coast
  - Deccan Plateau
  - North-East India
  - Andaman and Nicobar Islands

Zoo-geographical regions of India

- On the type of fauna, India has been divided into following zoogeographical regions:
  - Himalayan Region
  - Northern Plains
  - Desert Lands
  - Nilgiri Region
  - Malabar Region
  - Deccan Plateau Region

India: A Mega-diversity nation

- IUCN identified 17 mega-diverse countries in 1998. India is one of them.
- Few of the fields of diversity of India are:
  - Geographical diversity
  - Climatic diversity
  - Biodiversity
  - Habitat diversity
  - Cultural diversity

Thank You

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