



# Biodiversity

## Biodiversity

- Definition : genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.



# Biodiversity

The term 'biological diversity' was introduced by Norse and Mecmenus in the year 1980. The word 'biodiversity' was used for the first time by G Rosen in 1985.

Biodiversity refers to the diversity and variability among all living organisms and in the ecosystems found in entire world.



# Biodiversity

‘Biodiversity’ refers to the wide variety of life on earth, i.e., all plant, animals and micro-organisms, and their various species and various ecosystems that they live in. In simple words biodiversity is the sum total of all species.



# Biodiversity

- International Union for Conservation of Nature and Natural Resources (IUCN) and United Nations Environmental Program (UNEP) 1992 defined biodiversity as ‘The totality of genes, species, and ecosystems in a given region in the world.’
- In the Convention of Biological Diversity(1992), Biodiversity has been defined as the **variability among living organism from all sources** including terrestrial, marine and other aquatic ecosystem and the ecological complexes of which they are a part.



# Biodiversity

The term biodiversity refers to the all types of species, populations, communities and ecosystems, present in any specific area or entire earth.

Biodiversity may also be defined as the diversity and variability among living organisms and the habitats in which they live.



# Biodiversity

The estimated number of plant, animal or microorganism species on earth is about 10 to 50 million. Out of this only 1.5 million have been identified to date.

Out of 1.5 million identified species about 7,50,000 are insect species, about 2,50,000 are plants, about 40,000 are vertebrates, approximately 1,00,000 are fungi and the others are invertebrates and microorganisms.



## Levels of Biodiversity

- Biodiversity a combination of genes, species and the ecosystems.
- Hence, biodiversity is typically considered at three different levels.
  - Genetic diversity
  - Species diversity
  - Ecosystem diversity



# Genetic Biodiversity

- Living organisms have genes in their cells.
- Genes contain the basic instructions for the development of organisms.
- Genes effect the physical characteristics which affects the manner in which organisms interact with their environment.
- Variations in such features within the same species give rise to genetic diversity. A significant level of variation must be present for a species to adapt to changing environmental conditions.



## Genetic Biodiversity

- It is diversity within the species due to difference in its genetic structure. The gene found in organism can form enormous number of combination each of which give rise to some variability.
- Variation in the genetic content alters the shape, size and appearance of different individuals. The species with higher genetic diversity are capable in adapting easily to the changes in the environmental conditions. Genetic diversity culminates in the evolution of new species.



# Genetic Biodiversity

- Variation in the genetic material is essential for evolution. Without genetic diversity, a population cannot evolve in response to changing environmental conditions and will face the risk of extinction.
- For example, if a population is exposed to a new disease, the survival will depend on the genes towards the resistance to the disease. If such genes are not present, the entire may be wiped out by the disease.
- Domesticated species often have low levels of genetic diversity because only few species are selected for this purpose. A new virus or bacteria can attack a population of nearly identical organisms very rapidly. Thus, the genetic diversity generally offers protection from disease, which is lost in preferential breeding of crops and animals.

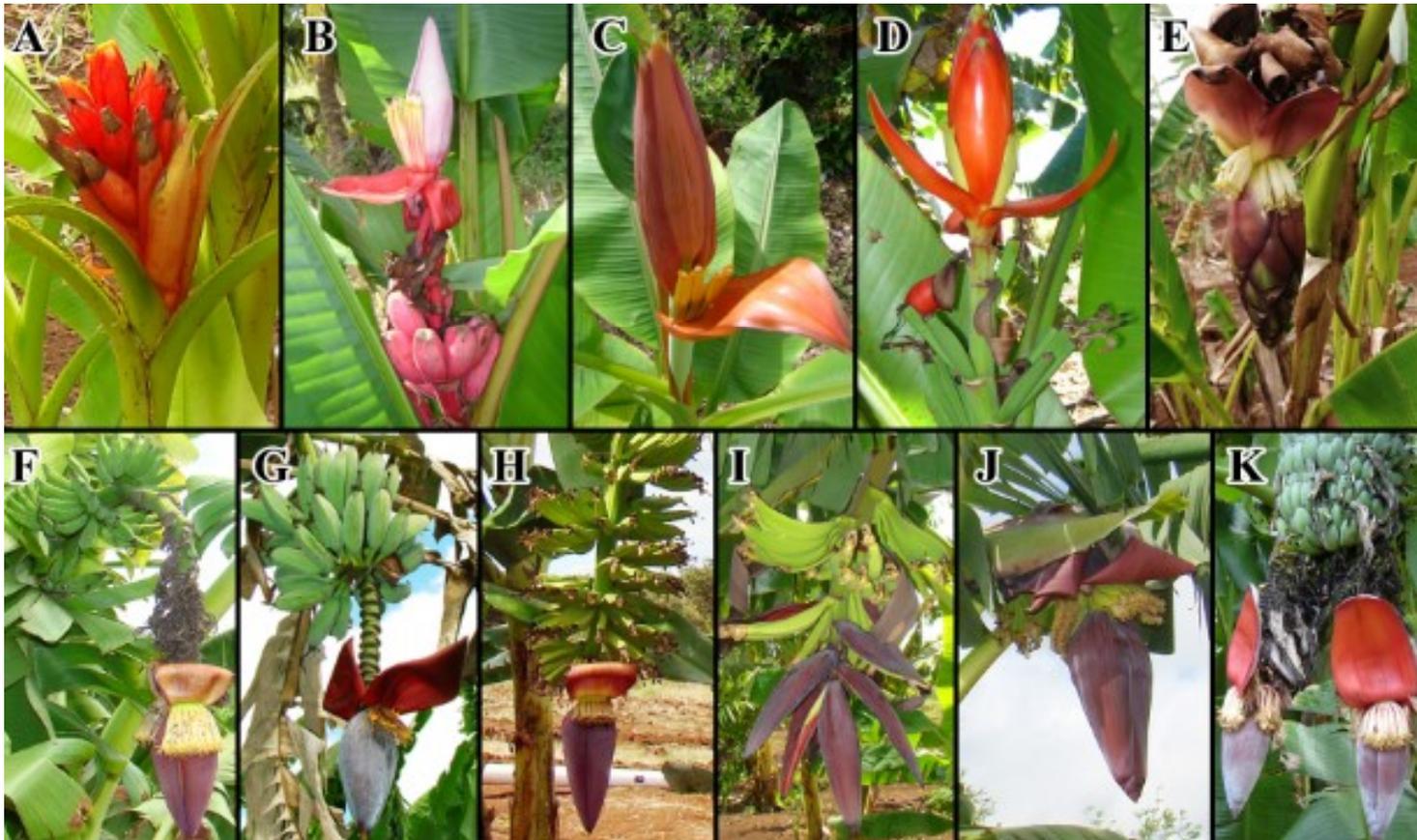


# Genetic Biodiversity in Banana





# Genetic Biodiversity in Banana





# Genetic Biodiversity in Beans





# Genetic Biodiversity in Beans





# Genetic Biodiversity in Rice





# Genetic Biodiversity in Rice





# Genetic Biodiversity in Wheat





# Genetic Biodiversity in Corn





# Genetic Biodiversity in Pitunia





# Genetic Biodiversity in Rose





# Genetic Biodiversity in Dogs





# Genetic Biodiversity in Dogs





## Species Biodiversity

The number of species of plants and animals that are present in a region constitutes its species diversity. It represents the species richness and their abundance in a community.

It includes all the species on this planet in the form of micro-organisms (viruses, bacteria, protists), plants and animals. Richer the species, greater will be the species diversity. For example, *Panthera leo persica* (lion), *Panthera uncia* (snow leopard) and *Panthera tigris* (tiger) belong to the same genera, but all are from different species. Plant and animal diversity in India is about 6.5 per cent of the world species.

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# Species Biodiversity

It is the diversity within an ecosystem that includes the number of species in a community and the relative abundance of species. Communities with more species are considered to be more diverse. Evenness measures the variation in the abundance of individuals per species within a community. Communities with greater evenness are considered to have greater species diversity.

(a) Species Richness: Number of species per unit area

(b) Species Evenness: Evenness of individuals in a species



## Species Biodiversity

A great variety is found in microorganisms including algae, bacteria, fungi, protozoa and viruses, which are vital to life on Earth. At the ecosystem level, the greatest biomass in soil is microorganisms, especially fungi. These maintain soil structure and composition by degrading dead plant and animal remains.

Hence, the loss of microorganisms can lead to major changes in ecosystems.



# Ecosystem Biodiversity

Ecosystem diversity is the diversity of different ecosystems which includes biotic and abiotic components.

Ecosystems may be natural like ponds, grasslands, forests, deserts, oceans, etc., or artificial such as agricultural fields, artificial lakes or dams etc.

Every ecosystem has particular composition of species and ecological conditions.



# Ecosystem Biodiversity

- There are a large variety of different ecosystems on earth, which have their own complement of distinctive inter linked species based on the differences in the habitat. Ecosystem diversity can be described for a specific geographical region, or a country, a State or a district.
- Typical ecosystems include landscapes such as forests, grasslands, deserts, mountains, etc., as well as aquatic ecosystems such as rivers, lakes, and the sea. Each region also has man-modified areas such as farmland or grazing pastures.



# Ecosystem Biodiversity

There are a large factors which can affect the ecological diversity viz. variations in trophic structure, food-webs, nutrient cycling.

Physical parameters can also affect the ecological diversity like moisture, temperature, altitude, precipitation etc.

Hence, tremendous diversity exists within the ecosystems, because of a change in these factors.



## Ecosystem Biodiversity

For example a high degree of diversity is found in forest ecosystems, containing a dominance of trees.

Too many variations are observed between a tropical rainforest, a tropical deciduous forest, a temperate deciduous forest and a boreal forest.

The ecosystem diversity is of great value that must be kept intact. This diversity has developed over millions of years of evolution. If we destroy this diversity, it would disrupt the ecological balance.

Coniferous trees of boreal forests cannot take up the function of the trees of tropical deciduous forest lands and vice versa.



# Ecosystem Biodiversity

The enormous range of terrestrial and aquatic environments on earth has been classified into a number of ecosystems and the following are a few examples:

Tropical rainforests

Grasslands

Wetlands

Coral reefs and mangroves

Species contained within a given ecosystem also vary over time. Some of the world's richest habitats are tropical moist forests. Although they cover only 7 per cent of the world's surface, these areas contain at least 50 per cent of all plant and animal species.



## Biogeographical Classification of India

- India has different types of climate and topography in different parts of the country and these variations have induced enormous variability in flora and fauna.
- India has a rich heritage of biological diversity and occupies the tenth position among the plant rich nations of the world.



## Biogeographical Classification of India

India can be divided into ten major regions, based on the geography, climate and type of vegetation and the communities of mammals, birds, reptiles, amphibians, insects and other animals found.



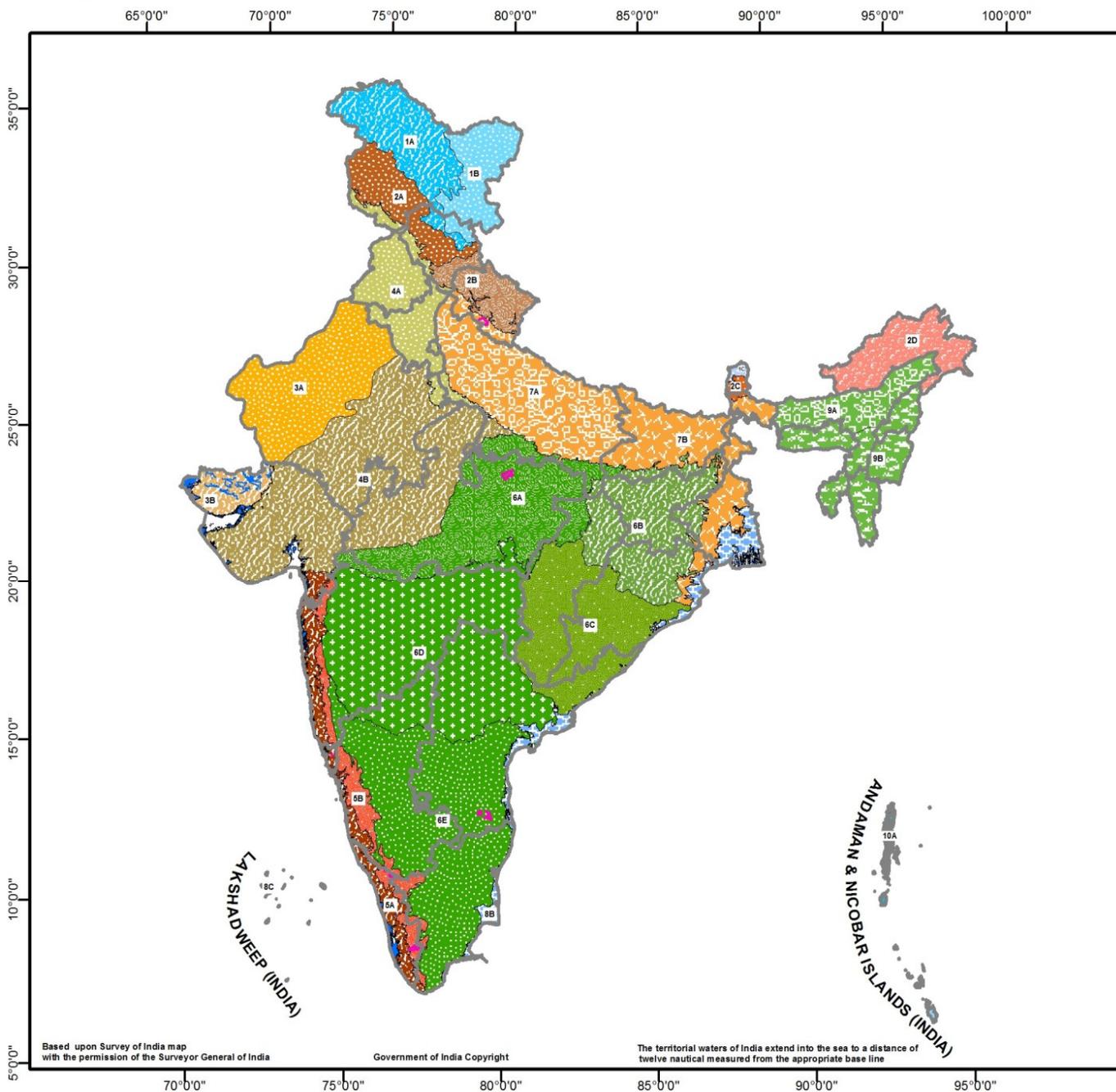
## Biogeographical Classification of India

1. Snow covered Trans Himalayan region of Ladakh.
2. Himalayan ranges and valleys of Kashmir, Himachal Pradesh, Uttarakhand, Assam and other North Eastern States.
3. Desert area of Kutch, Thar region.
4. Semi arid grassland region of the central India, Gujarat.
5. Western Ghats in Maharashtra, Karnataka and Kerala.
6. Deccan Peninsula consisting of Deccan Plateau south, Central, Eastern, Chhota Nagpur, Central Highlands.
7. Gangetic and Bhramaputra plains.
8. Western and eastern coastal belt with beaches, forests and mangroves.
9. Northeast States of India,
10. Andaman and Nicobar Islands.



# 10 Biogeographic Zones of India



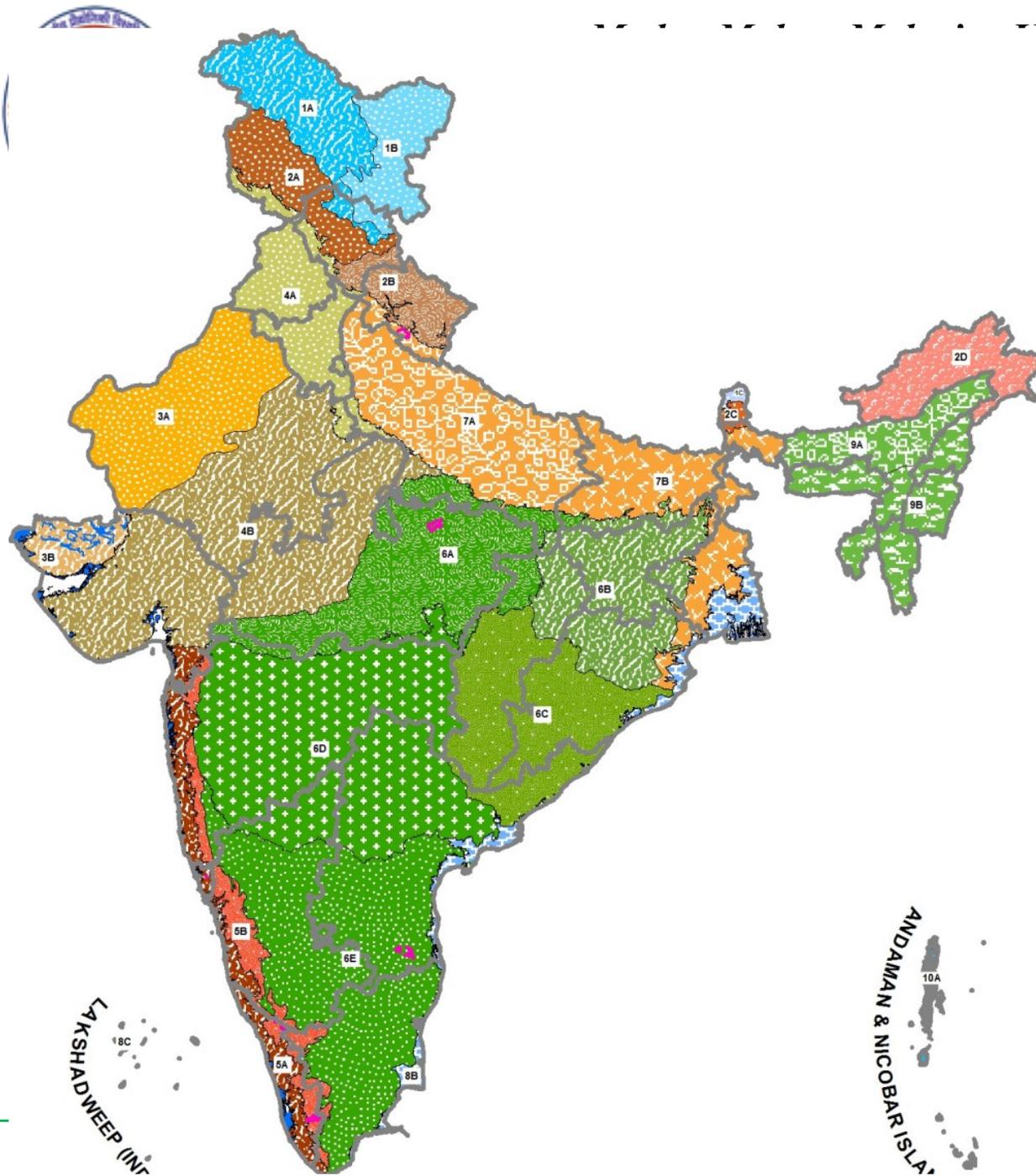


### Biogeographic Classification of India : Provinces

	% *
1A: Trans - Himalaya - Ladakh Mtns	3.3
1B: Trans - Himalaya - Tibetan Plateau	2.19
1C: Trans - Himalaya - Sikkim	0.10
2A: Himalaya - North - West Himalaya	2.1
2B: Himalaya - West Himalaya	1.6
2C: Himalaya - Central Himalaya	0.2
2D: Himalaya - East Himalaya	2.5
3A: Desert - Thar	5.4
3B: Desert - Katchchh	1.1
4A: Semi - Arid - Punjab Plains	3.7
4B: Semi - Arid - Gujrat Rajputana	12.9
5A: Western Ghats - Malabar Plains	2.0
5B: Western Ghats - Western Ghats Mtns.	2.0
6A: Deccan Peninsula - Central Highlands	7.3
6B: Deccan Peninsula - Chotta - Nagpur	5.4
6C: Deccan Peninsula - Eastern Highlands	6.3
6D: Deccan Peninsula - Central Plateau	12.5
6E: Deccan Peninsula - Deccan South	10.4
7A: Gangetic Plain - Upper Gangetic Plain	6.3
7B: Gangetic Plain - Lower Gangetic Plain	4.5
8A: Coasts - West Coast	0.6
8B: Coasts - East Coast	1.9
8C: Coasts - Lakshadweep	0.1
9A: North - East - Brahmaputra Valley	2.0
9B: North - East - North - East Hills	3.2
10A: Islands - Andamans	0.2
10B: Islands - Nicobars	0.1
Marine Influenced Area : 10440 sq.km	

\* Represents percentage of the total geographical area of India : 3287263 sq.km





## Biogeographic Classification of India : Provinces

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## Value Of Biodiversity

### Consumptive use value

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

- Food: A large number of wild plants are eaten by human beings as food. About 80,000 edible plant species have been reported from wild. About 90% of present day food crops have been domesticated from wild tropical plants. A large number of wild animals are also used as food.



## Consumptive use value

### Drugs and medicines

- About three fourths of the world's population depends upon plants for medicines.
- Penicillin used as the first antibiotic, was derived from a fungus called Penicillium. Similarly, we get Tetracyclin from a bacterium. Quinine, the original drug used for malaria, is obtained from the bark of Cinchona tree.
- A variety of marine animals possess anti-cancer properties and may provide newer treatment for cancer.



## Value Of Biodiversity

### Consumptive use value

- Fuel: Forests have been used for fuel wood since time immemorial.
- Firewood collected by individuals is directly consumed by tribals and local villagers, hence falls under consumptive value.



## Value Of Biodiversity

### Productive use values

- Commercially usable values where the product is marketed and sold. It includes plant products like timber, bamboo, cane.
- These may include the animal products like tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, fur of many animals, lac from lac insects etc, all of which are traded in the market.



## Value Of Biodiversity

### Productive use values

- Wild gene resources that can be sold for use by scientists for introducing desirable traits in the crops and domesticated animals..
- Some of the industries are dependent on productive use value are: the pulp and paper industry, Plywood industry, Silk industry, textile industry, leather industry, pearl industry etc.



## Value Of Biodiversity

### Social Value

- These are the value associated with the social life, customs, religion and spiritual aspects of the people. Many plants are considered sacred in India such as Tulsi, Peepal, Mango, Lotus, Bael etc.
- The leaves, fruits or flowers of these plants are used in worship or the plant itself is worshipped. The tribal people are very closely linked with the wild life in the forests.
- Many animals like Cow, Snake, Bull, Peacock, Owl etc. hold special social importance. Thus biodiversity has distinct social value, attached with different societies.



## Value Of Biodiversity

### Ethical value

- It involves the ethical issues like “all life must be preserved”. It is based on the concept of “Live and Let Live”. For the survival of human being survive, protection of biodiversity becomes our duty.
- Due to human action already a large number of plant and animal species have become extinct, e.g. “passenger pigeon” or “dodo” is no more on this earth. We may not derive anything directly from many animals like Kangaroo, Zebra or Giraffe, but these species should exist in nature. There is an ethical value or existential value attached to each species.



## Value Of Biodiversity

### Aesthetic value

- Great aesthetic value is attached to biodiversity. No one of us would like to visit vast stretches of barren lands with no signs of visible life. 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.
- Ecotourism is estimated to generate about 12 billion dollars of revenue annually, that roughly gives the aesthetic value of biodiversity.



## Value Of Biodiversity

### Option values

- These values include the 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 which may be obtained from a marine animal, or a tropical rainforest.
- Thus option value is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an effective option for something important in the future.



## Value Of Biodiversity

### Ecosystem service value

- A non-consumptive use value related to various important ecosystem services has been recognized.
- 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.



## Value Of Biodiversity

- Different categories of biodiversity value clearly indicate that ecosystem, species and genetic diversity all have enormous potential and a decline in biodiversity will lead to huge economic, ecological and socio-cultural losses.