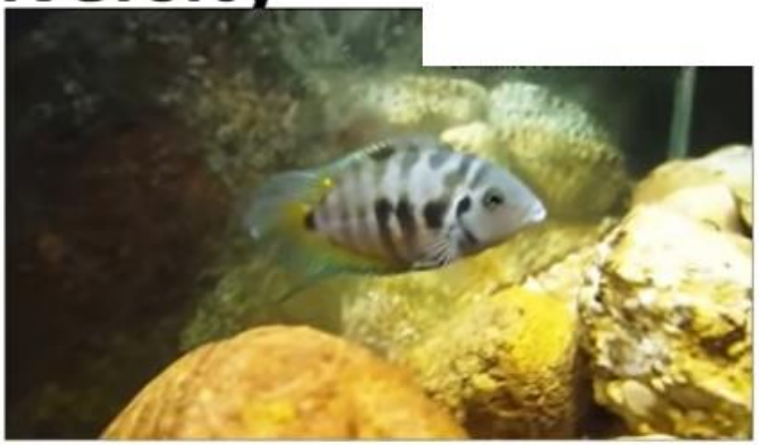
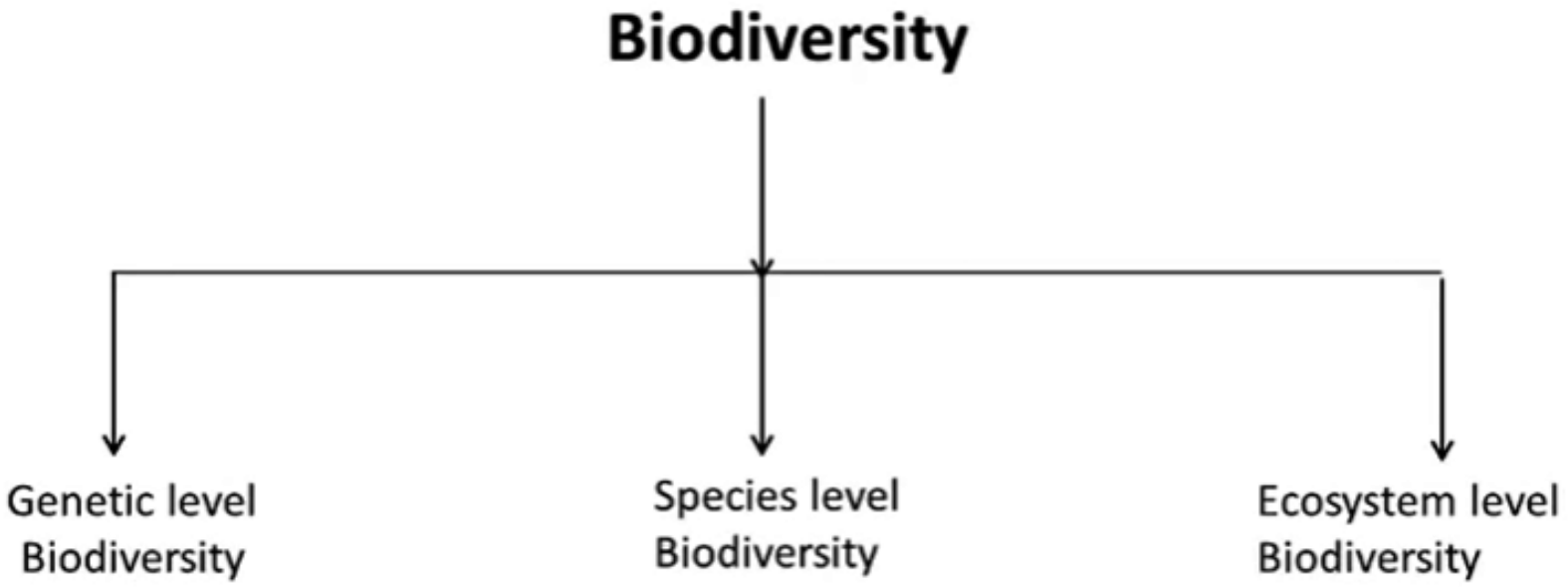
BIODIVERSITY AND CONSERVATION

Biodiversity



Biodiversity is variability of living organisms from all sources including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part.


Biodiversity
Genetic level Biodiversity
Species level Biodiversity
Ecosystem level Biodiversity

1- Genetic Level Biodiversity

The genes found in organisms can form enormous number of combinations each of which gives rise to some variability.

Genes are the basic units of hereditary information transmitted from one generation to other.

When the genes within the same species show different versions due to new combinations, it is called genetic variability.

2- Species Level Biodiversity

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.

There are two popular indices of measuring species diversity known as Shannon-Wiener index and Simpson index.

Shannon-Wiener diversity function

$$H' = -\sum_{\infty}^{s} (p_i)\,[\ln(p_i)]$$

H' = Shannon-Wiener index of species diversity

s = number of species in community

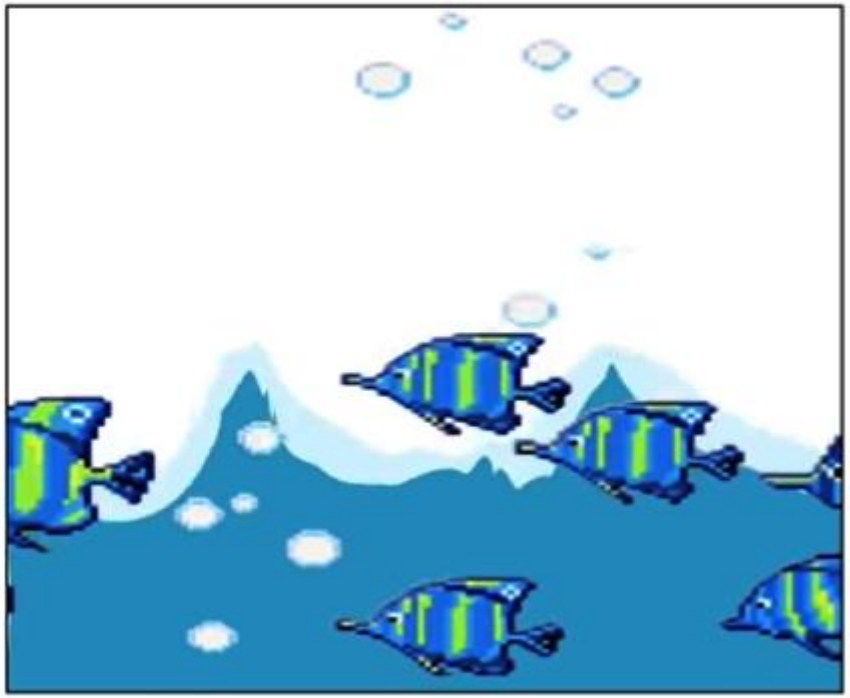
p_i = proportion of total abundance represented by i^{th} species

The current estimates given by Wilson in 1992 put the total number of living species in a range of 10 million to 50 million.

Till now only about 1.5 million living and 300,000 fossil species have been actually described and given scientific names.

It is quite likely that a large fraction of these species may become extinct even before they are discovered and enlisted.

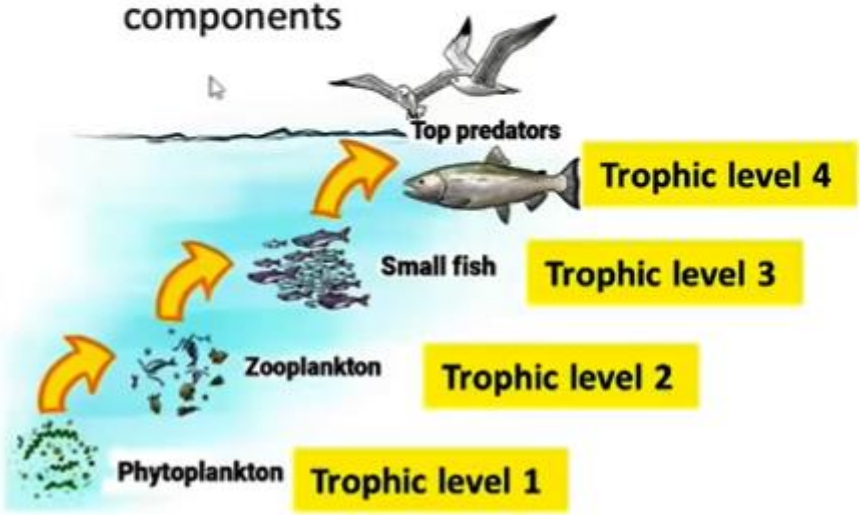
3- Ecosystem level Biodiversity



Aquatic Ecosystem

Ecosystem includes complexity in:

- Ecological niche
- Food chain
- Trophic structure
- Abiotic components and biotic components

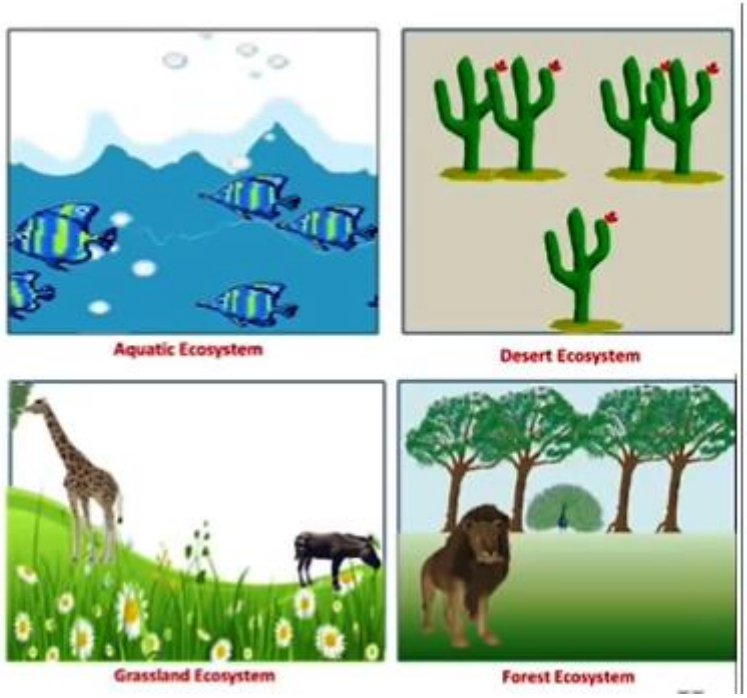


3- Ecosystem level Biodiversity

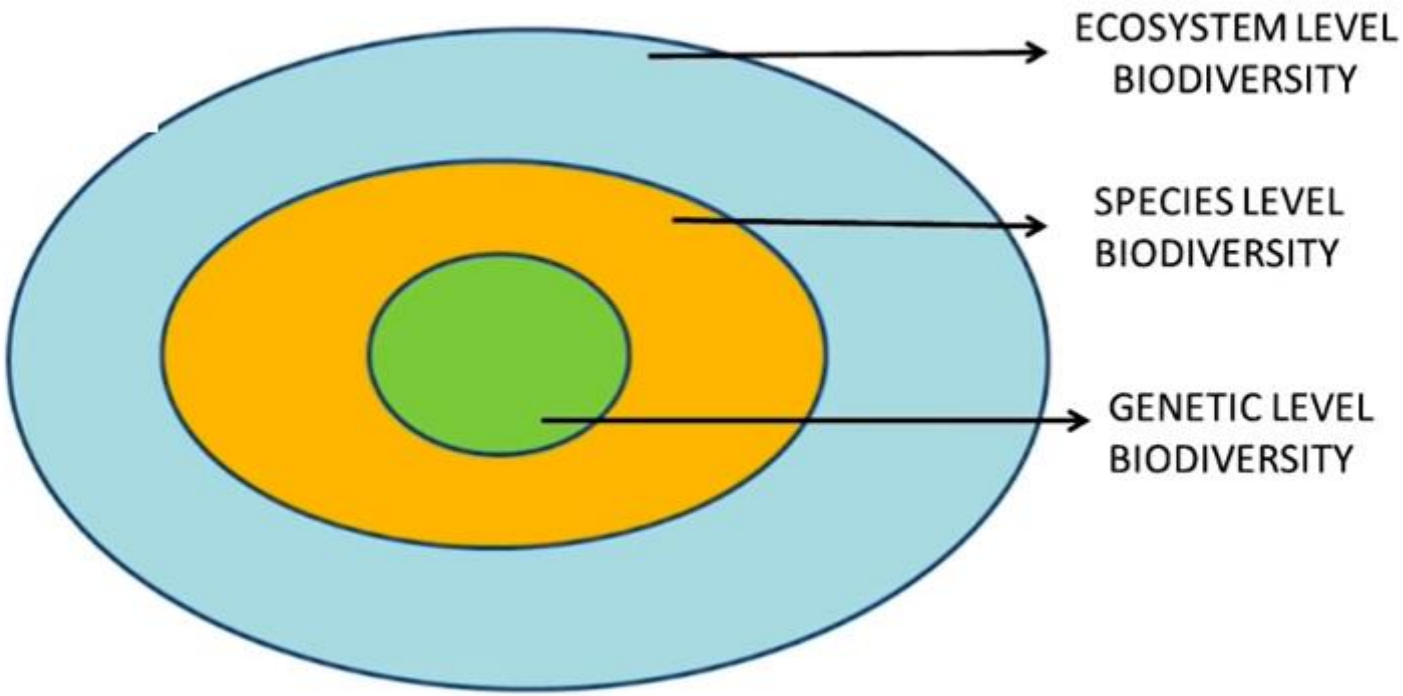
This is the diversity of ecological complexity showing variations in ecological niches, trophic structure, food-webs, nutrient cycling etc.

The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

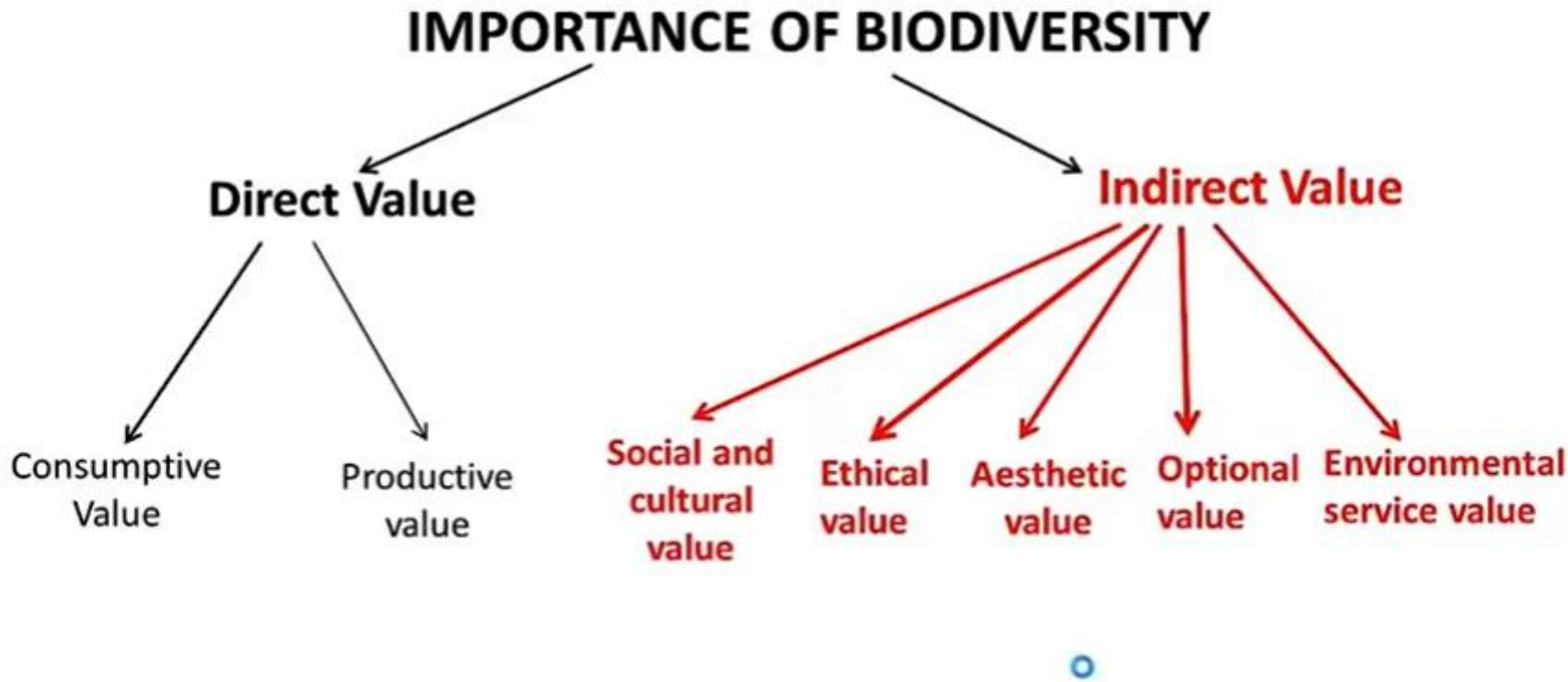
Thus, there occurs tremendous diversity within the ecosystems, along these gradients.



Levels of Biodiversity



IMPORTANCE OF BIODIVERSITY


IMPORTANCE OF BIODIVERSITY
Direct Value
Indirect Value
Consumptive Value
Productive value
Social and cultural value
Ethical value
Aesthetic value
Optional value
Environmental service value

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

1) FOOD

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

2) Medicine

Penicillin

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

2) Medicine

Digitalis

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

2) Medicine

Catharanthus

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

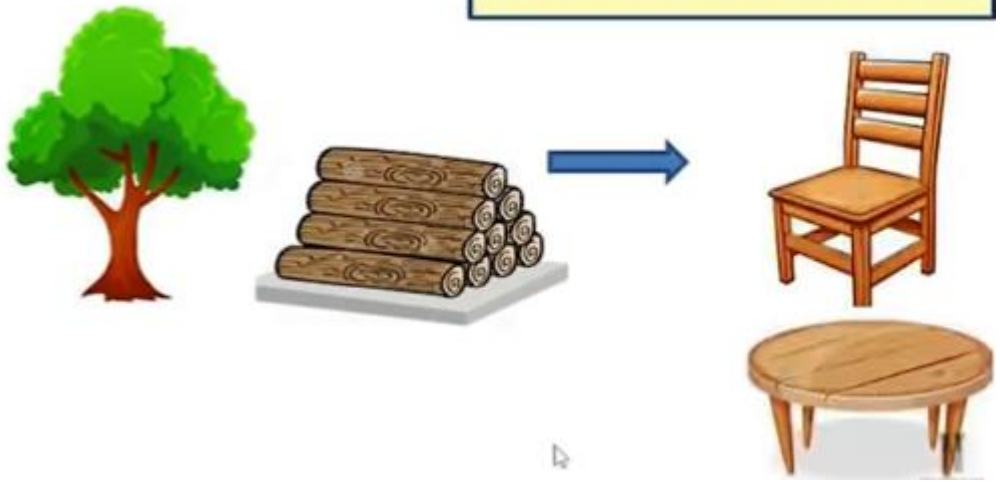
3) FUELWOOD

IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

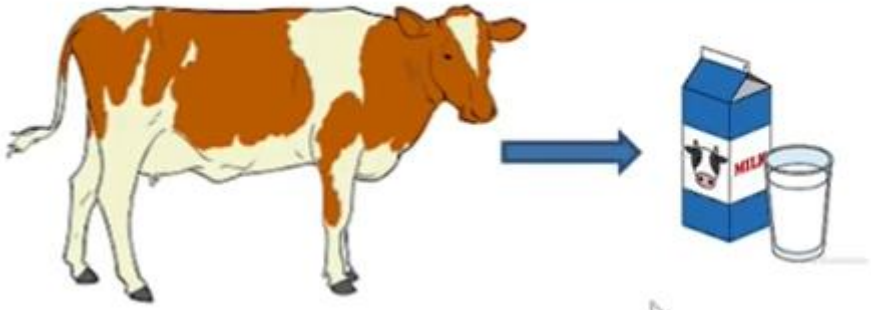


IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value

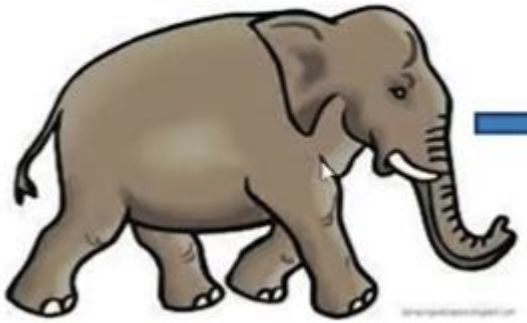


IMPORTANCE OF BIODIVERSITY

(i) Direct Value

Consumptive Value

Productive value



IMPORTANCE OF BIODIVERSITY

(ii) Indirect Value

1- Social and cultural value

IMPORTANCE OF BIODIVERSITY

(ii) Indirect Value

2- Ethical value

IMPORTANCE OF BIODIVERSITY

(ii) Indirect Value

3 - Aesthetic value

IMPORTANCE OF BIODIVERSITY

(ii) Indirect Value

4- Optional value

IMPORTANCE OF BIODIVERSITY

(ii) Indirect Value

5- Environmental service value

Provisioning services

Goods produced or provided by ecosystems

- Food
- Fuel wood
- Fiber
- Timber

Regulating services

Benefits from regulation of ecosystem processes

- Water partitioning
- Pest regulation
- Climate regulation
- Pollination

Cultural services

Nonmaterial benefits from ecosystems

- Spiritual
- Recreational
- Aesthetic
- Educational

Support services

Factors necessary for producing ecosystem services

- Hydrological cycle
- Soil formation
- Nutrient cycling
- Primary production

Source: Adapted from MEA 2003.

SACRED GROVES IN INDIA

SACRED GROVES

Sacred groves comprise of **patches of forests or natural vegetation** that are usually dedicated to **local folk deities or tree spirits** (Vanadevatais).

These spaces are protected by local communities because of their religious beliefs and traditional rituals that run through several generations.

SACRED GROVES


Distribution of Sacred Groves in India
JAMMU & KASHMIR
5000
HIMACHALA PRADESH
PUNJAB
UTTRANCHAL
18
HARYANA
DELHI
248
RAJASTHAN
255
UTTAR PRADESH
21
BIHAR
SIKKIM
50
ARUNACHAL PRADESH
101
40
ASSAM
NAGALAND
MEGHALAYA
100
MANIPUR
TRIPURA
MIZORAM
JHARKHAND
GUJARAT
29
MADHYA PRADESH
600
WEST BENGAL
CHATTISHGARH
ORISSA
322
MAHARASHTRA
2837
ANDHRA PRADESH
55
GOA
1531
750
KARNATAKA
100
PONDICHERRY
2000
TAMIL NADU
KERALA
528
ANDAMAN & NICOBAR ISLANDS

ECOLOGICAL SIGNIFICANCE OF SACRED GROVES

- **Conservation of Biodiversity** – The sacred groves are important repositories of floral and faunal diversity that have been conserved by local communities in a sustainable manner.

- **Recharge of aquifers** – The groves are often associated with ponds, streams or springs, which help meet the water requirements of the local people. The vegetative cover also helps in the recharging the aquifers.

- **Soil conservation** - The vegetation cover of the sacred groves improves the soil stability of the area and also prevents soil erosion.

THREATS TO THE SACRED GROVES

- **Disappearance of the traditional belief systems,** which were fundamental to the concept of sacred groves. These systems and their rituals are now considered mere superstition.
- **Destruction due to rapid urbanization and developmental** interventions such as roads, railways tracks, dams including commercial forestry.
- Many groves are suffering due to the transformation of the primitive forms of nature worship into formal temple worship.
- Invasion by **exotic weeds** such as *Eupatorium odoratum, Lantana camara* and *Prosopis juliflora* is a serious threat to some groves.
- Pressures due to **increasing livestock** and fuelwood collection.

GLOBAL BIODIVERSITY

NATIONAL BIODIVERSITY

REGIONAL BIODIVERSITY

GLOBAL BIODIVERSITY

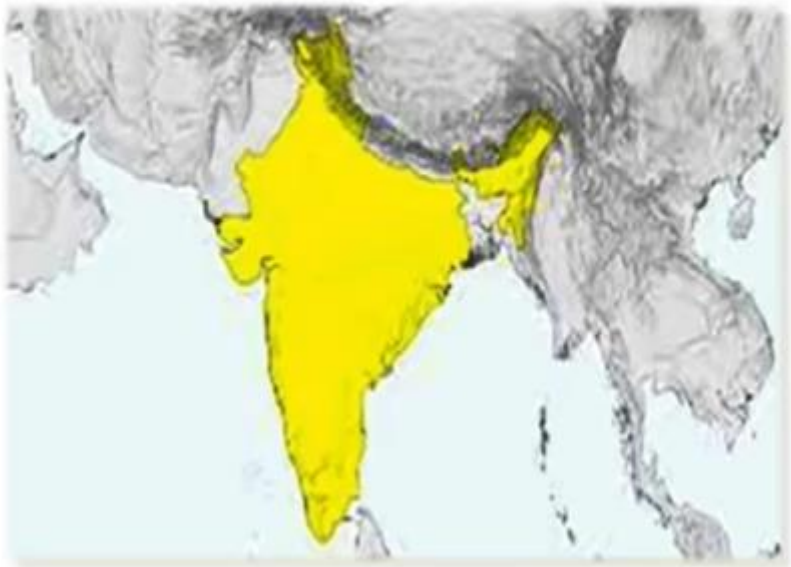
(World Resource Institute, 1999)

Taxonomic group	Number
Bacteria & Cyanobacteria	5,000
Protozoans (Single called animals)	31,000
Algae	27,000
Fungi (Molds, Mushrooms)	45,000
Higher Plants	2,50,000
Sponges	5,000
Jelly fish, Corals etc.	10,000
Flatworms, roundworms, earthworms	36,000
Snails, Clams, Slugs etc	70,000
Insects	7,50,000
Mites, Ticks, Croaks, shrimps	1,20,000
Fish and Sharks	22,000
Amphibians	4,000
Reptiles	5,000
Birds	9,000
Mammals	4,000
Total	1,400,000

BIODIVERSITY IN INDIA

INDIA- A MEGABIODIVERSE COUNTRY

- India **ranks 10th** among plant rich countries of the world
- India **ranks 11th** in terms of endemic species of higher vertebrates
- India **rank 6th** among the centres of diversity and origin of agricultural crops



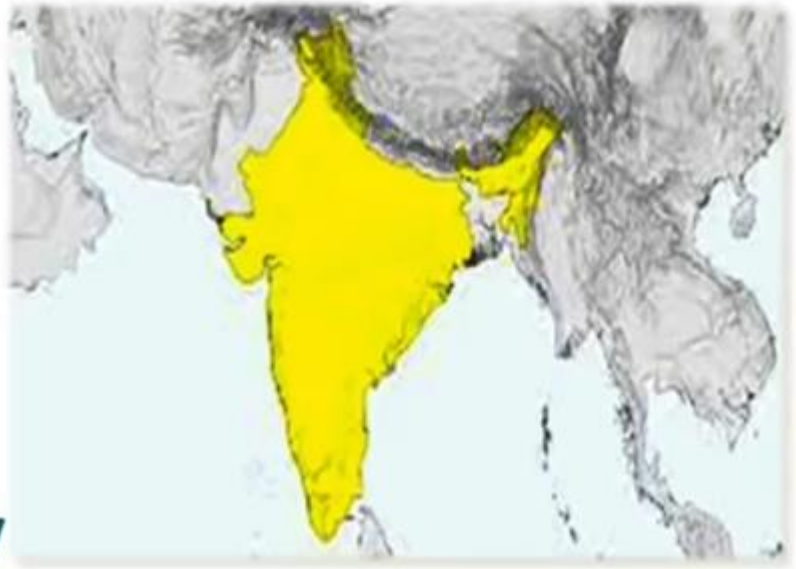
INDIA- A MEGABIODIVERSE COUNTRY

1. Ten Biogeographical zones

2. Centre of Origin

3. Endemism

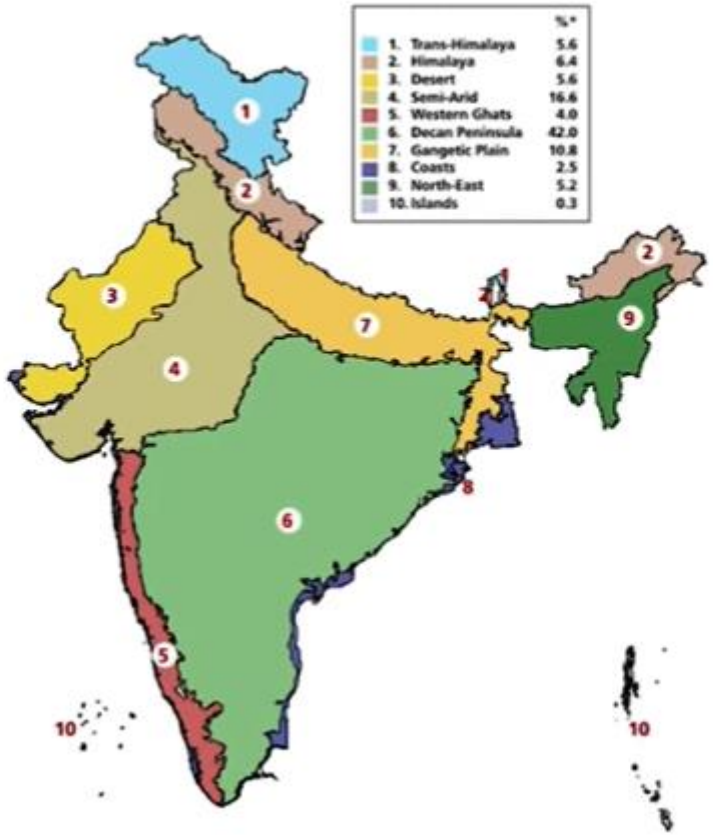
4. Four hotspots of biodiversity



INDIA- A MEGABIODIVERSE COUNTRY

1. Ten Biogeographical zones

Biogeographical zones in India



1. Trans- Himalaya

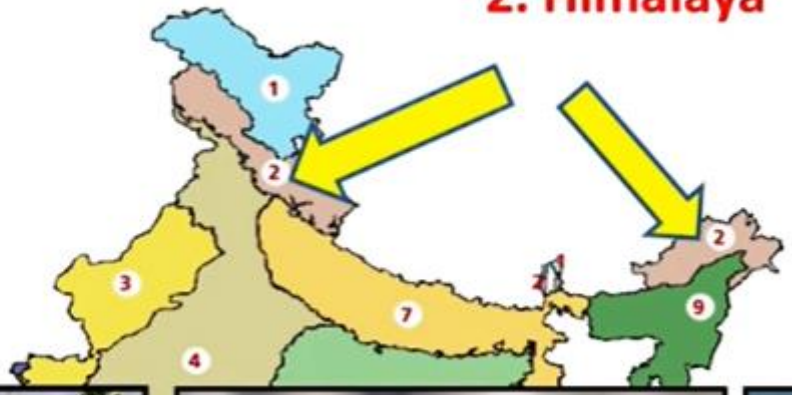
Snow leopard

Alpine plants

Himalayan Balsam

2. Himalaya

2. Himalaya

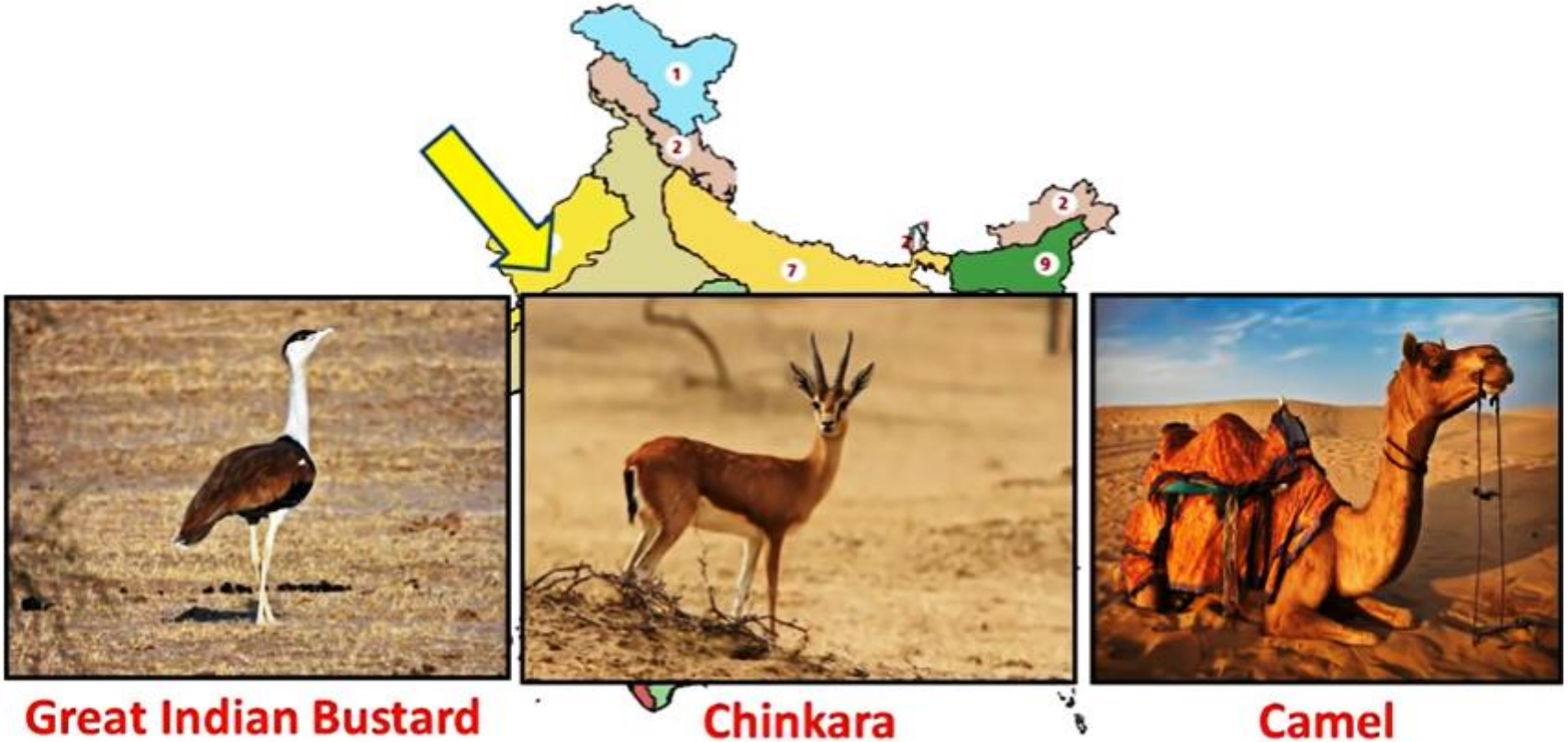


Pine Tree

Musk Deer

Rhododendron

3. Desert

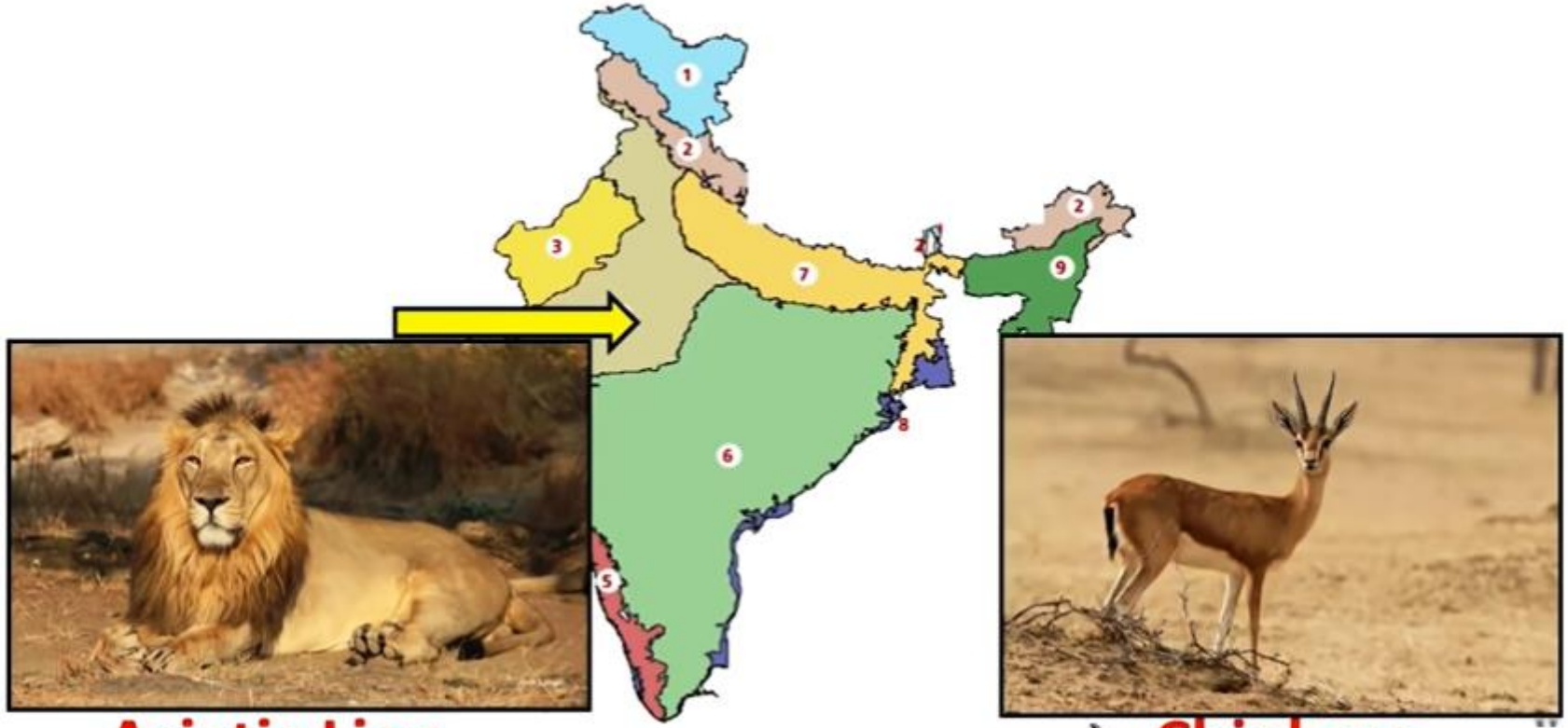


Great Indian Bustard

Chinkara

Camel

4. Semi-arid region



Asiatic Lion

Chinkara

5. Western Ghat

Evergreen forest

Lion-tailed macaque

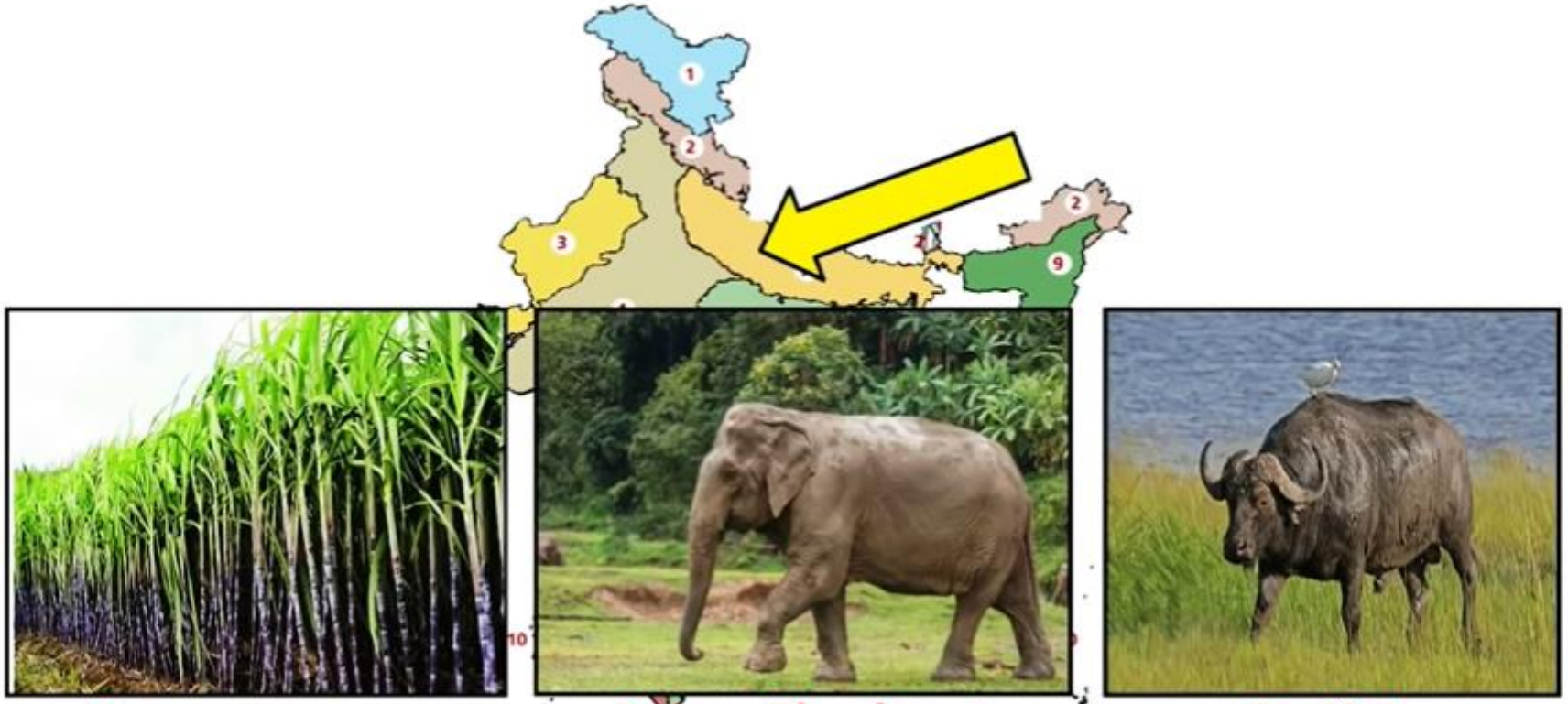
Asian Elephant

6. Deccan peninsula

Deciduous forest

Deer

7. Gangetic plains



Sugarcane

Asian Elephant

Buffalo

8. Coasts

Mangrove tree

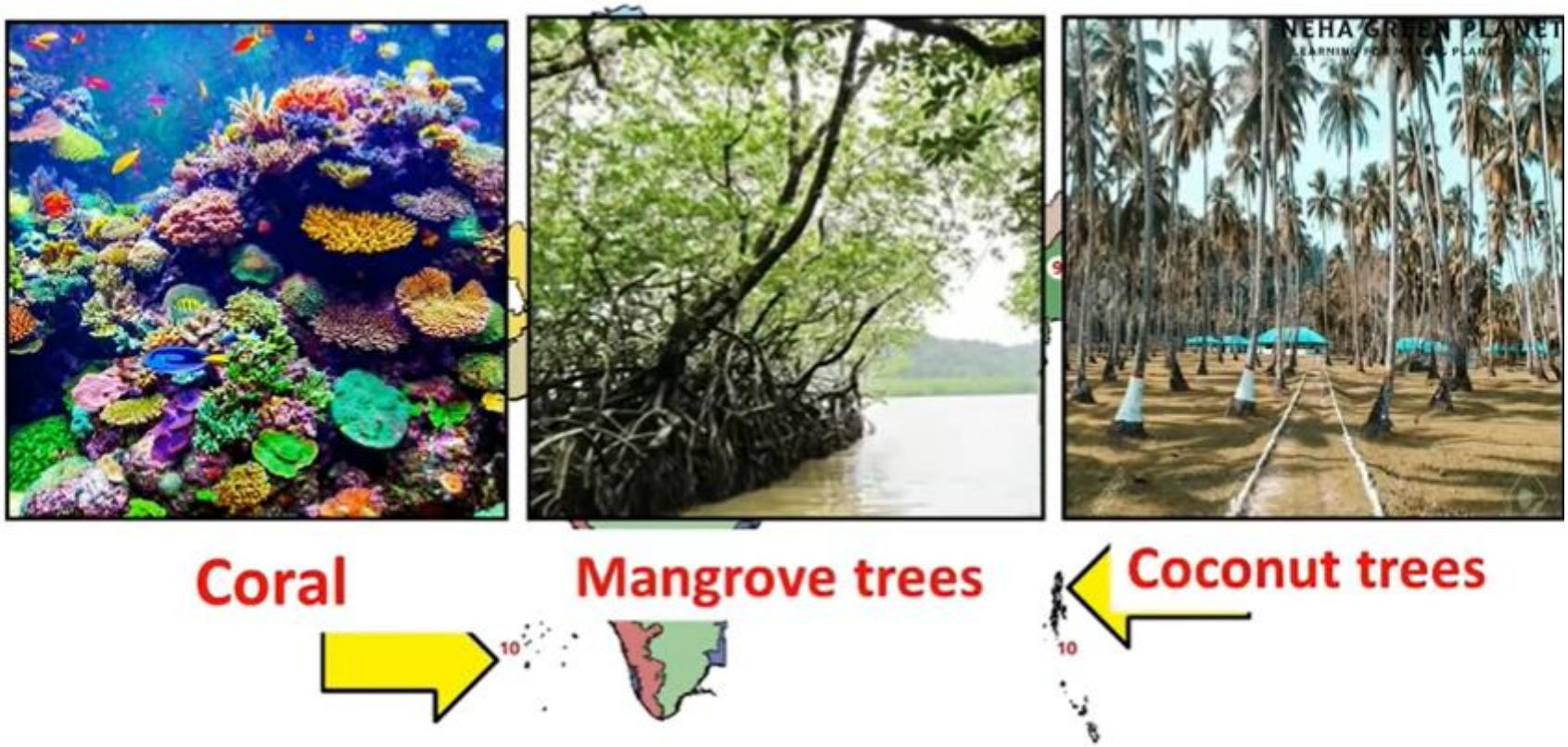
Fish

9. North- East

One-horned Rhinoceros

Orchids

10. Islands



India - Megabiodiverse country

2. Centre of Origin

Rice

Brinjal

Black Pepper

INDIA- A MEGABIODIVERSE COUNTRY

3. Endemism

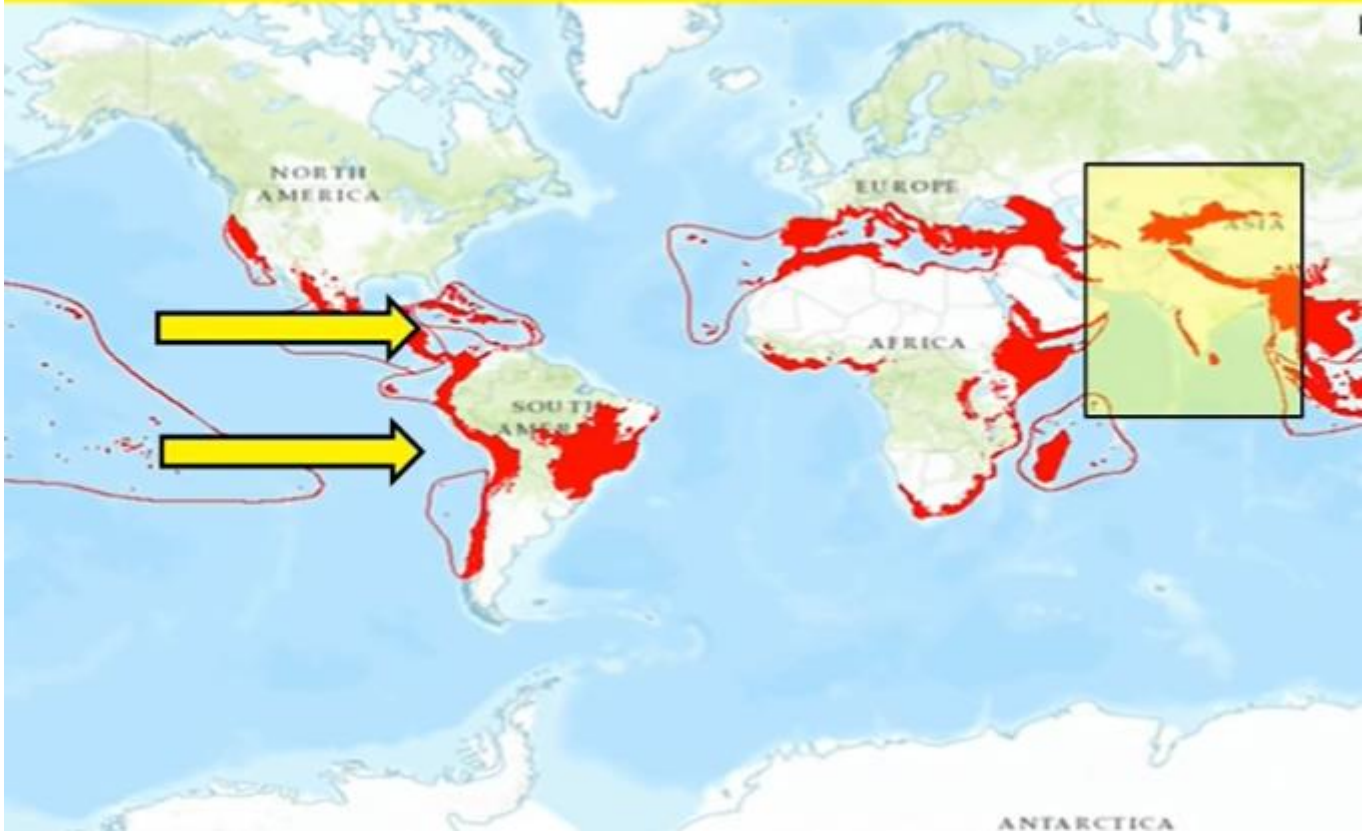
- Species restricted only to a particular area are known as endemic species

Asiatic Lion

Lion-tailed macaque

Nilgiri Tahr

HOTSPOTS OF BIODIVERSITY



HOTSPOTS OF BIODIVERSITY

HOTSPOTS OF BIODIVERSITY

- Areas which exhibit high species richness and species endemism are known as **hotspots of biodiversity**

HOTSPOTS OF BIODIVERSITY

- Term hotspot was introduced by Norman Meyer in 1988.

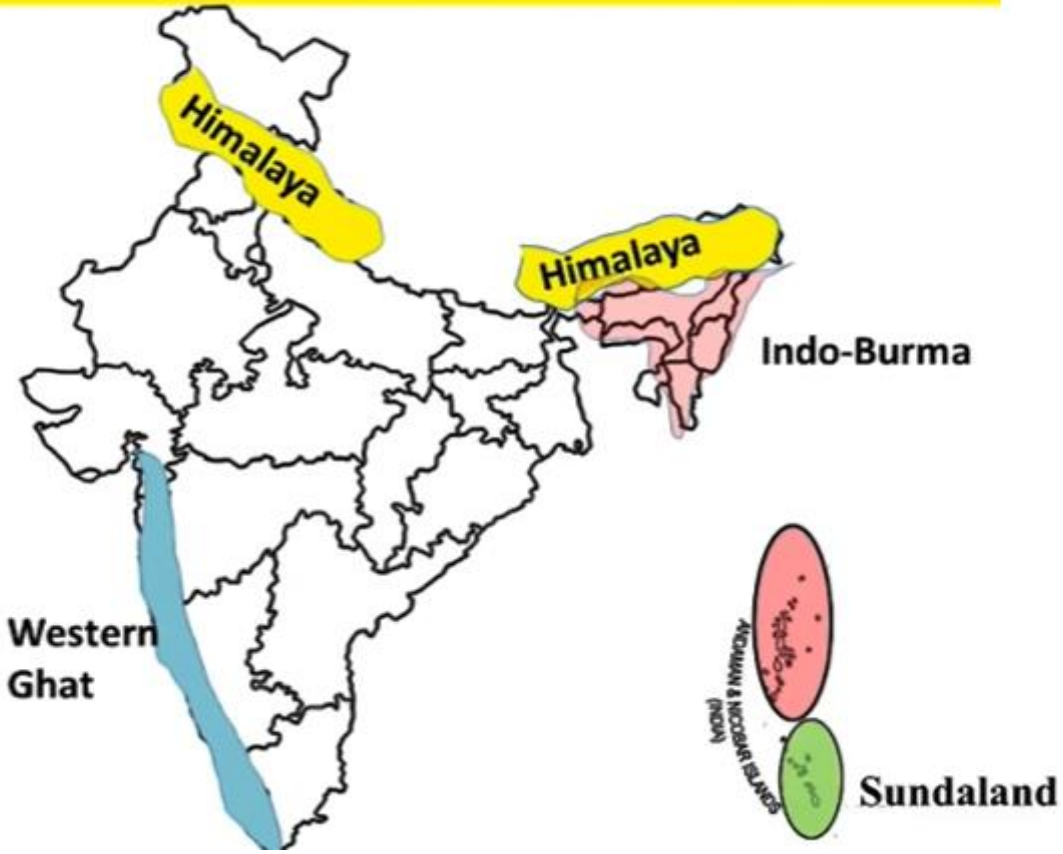
<u>Criteria for hotspots</u>

(i) It must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics

(ii) It has to have lost ≥ 70% of its original native habitat.

BIODIVERSITY HOTSPOTS IN INDIA

1. Himalaya
2. Western Ghat
3. Indo-Burma
4. Sundaland



BIODIVERSITY HOTSPOTS IN INDIA

The Himalaya hotspot stretching in an arc over 3,000 km of northern Pakistan, Nepal, Bhutan and the northwestern and northeastern states of India.

The Himalayan mountain range covers almost 7,50,000 km^2, and has been divided into two regions:

1. **Eastern Himalaya**
2. **Western Himalaya**

The geographical position, physiography climatic and altitudinal variations of Himalayas have contributed to high level of plant diversity and endemism.

WESTERN GHATS

(*b*) ***Western Ghats***: It extends along a 17,000 Km^2 strip of forests in Maharashtra, Karnataka, Tamil Nadu and Kerala and has 40% of the total endemic plant species. 62% amphibians and 50% lizards are endemic to Western Ghats.

Forest tracts upto 500 m elevation covering 20% of the forest expanse are evergreen while those in 500-1500 m range are semi-evergreen. The major centers of diversity are ***Agastyamalai Hills*** and ***Silent Valley—the New Amambalam Reserve Basin***. It is reported that only 6.8% of the original forests are existing today while the rest has been deforested or degraded, which raises a serious cause of alarm, because it means we have already lost a huge proportion of the biodiversity.

INDO-BURMA

(c) **The Indo-Burma hotspot** encompasses 2,373,000 km² of tropical Asia east of the Ganges-Brahmaputra lowlands. It includes:

- Eastern Bangladesh
- **North-eastern India,**
- **Myanmar,**
- part of southern and western Yunnan Province in **China**,
- all of the **Lao People's Democratic Republic**, **Cambodia**
- **Vietnam**,
- **Thailand**
- part of Peninsular **Malaysia**.
- **Andaman Islands (of India)** in the Andaman Sea.

- It includes mixed wet evergreen, dry evergreen, deciduous, and montane forests, shrublands and woodlands.
- In addition, a wide variety of distinctive, localized vegetation formations occur in Indo-Burma, including lowland floodplain swamps, mangroves, and seasonally inundated grasslands.

SUNDALAND

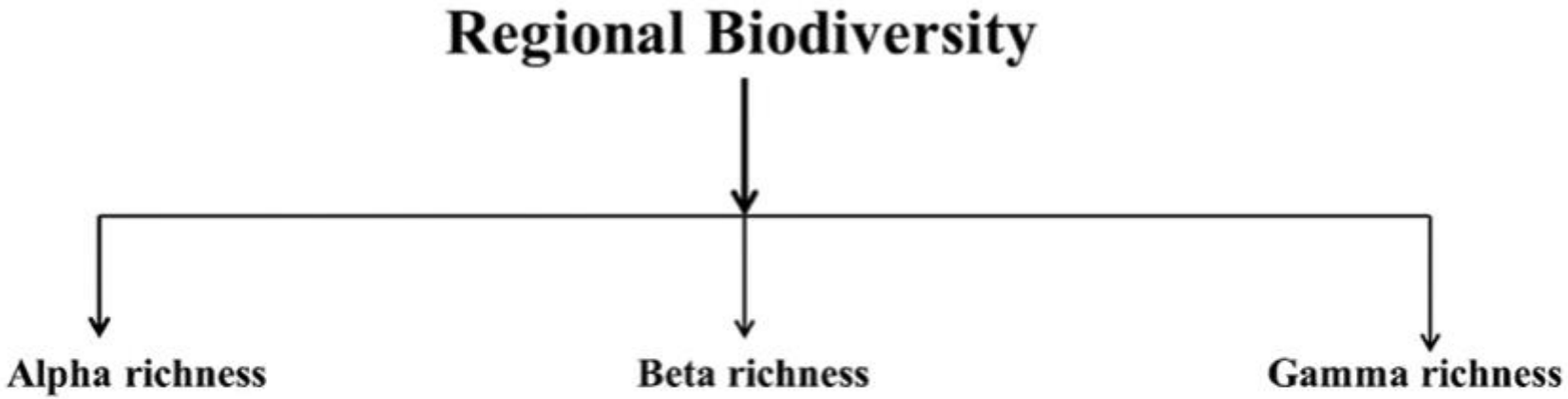
(d) **The Sundaland hotspot**

- Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines).

- Sundaland is one of the biologically richest hotspots on Earth, holding about 25,000 species of vascular plants, 15,000 (60%) of which are found nowhere else.

- The most significant threat facing Sundaland's biodiversity is forest destruction. Some of the threats to the region's forests include rubber production, pulp production, and commercial and illegal logging.

REGIONAL BIODIVERSITY


Regional Biodiversity
Alpha richness
Beta richness
Gamma richness

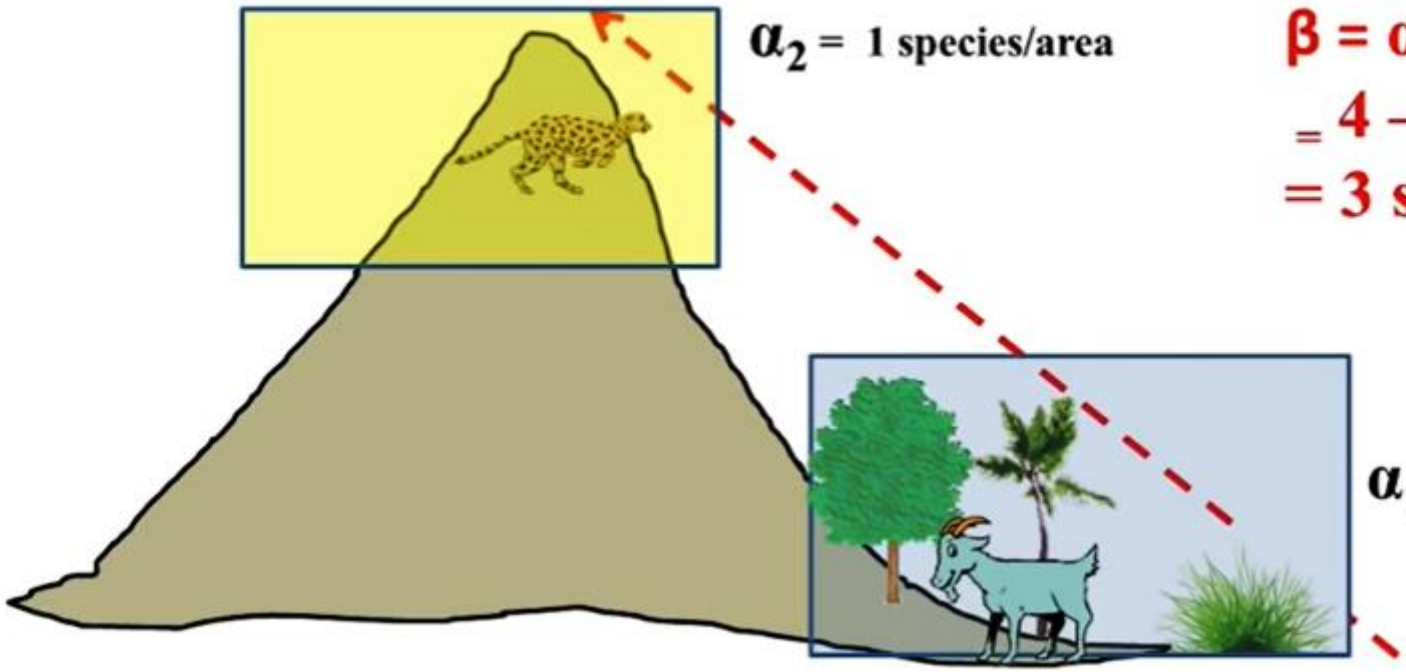
Alpha richness

- Includes number of species found in a homogenous area

Alpha richness $\alpha = 4$ species in area

Beta richness

- Includes rate of change of species across an environment gradient



α_2 = 1 species/area

α_1 = 4 species/area

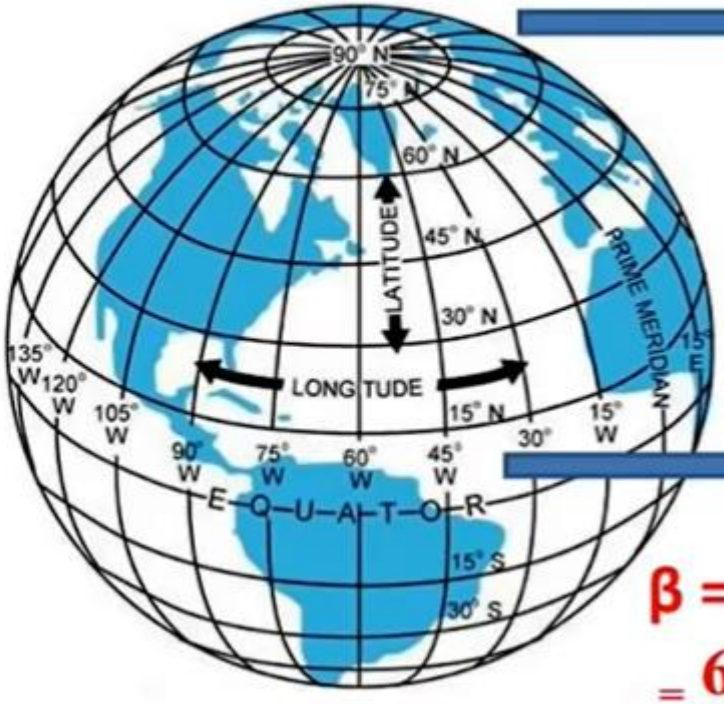
$\beta = \alpha_1 - \alpha_2$

$= 4 - 1$

$= 3$ species

Beta richness

- Includes rate of change of species across an environment gradient



α_{pole} = 1 species/area

α_1 = 6 species/area

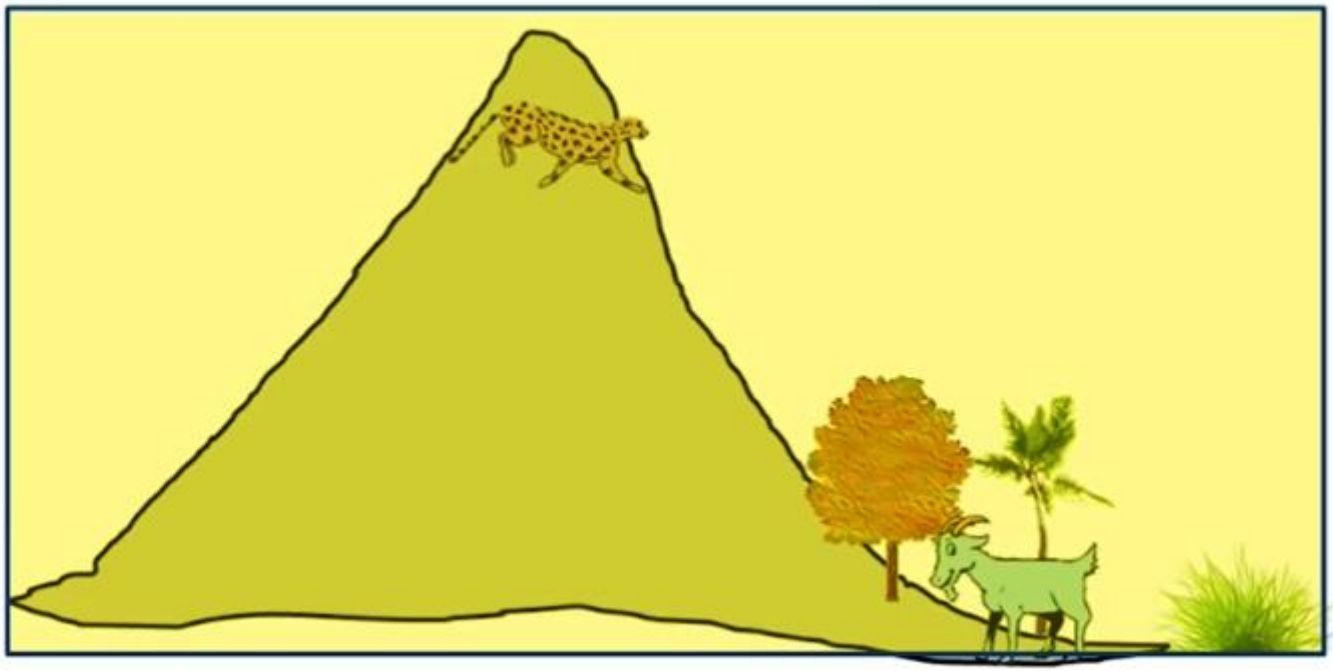
$\beta = \alpha_1 - \alpha_2$

$= 6 - 1$

$= 5$ species

Gamma richness

- Includes species across a large landscape



Gamma = 5 species