




BIODIVERSITY AND CONSERVATION

Topics to be discussed

1. LEVELS OF BIODIVERSITY
 2. NUMBER OF SPECIES ON EARTH
 3. PATTERNS OF BIODIVERSITY
 4. LOSS OF BIODIVERSITY
 5. BIODIVERSITY CONSERVATION
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- An aerial photograph of a winding asphalt road on a steep, lush green mountain slope. The road curves through dense vegetation, with a few vehicles visible. The background shows more of the mountain range under a clear sky.

- **Biodiversity** is the diversity of biological organisation ranging from cellular macromolecules to biomes.
- **Edward Wilson** popularized the term 'biodiversity'.



LEVELS OF BIODIVERSITY



LEVELS OF BIODIVERSITY

1. Genetic Diversity

- ❖ Diversity shown by a single species at **genetic level**.
- ❖ E.g. *Rauwolfia vomitoria* (Himalaya) shows genetic variation in potency and concentration of the chemical **reserpine**.



Rauwolfia vomitoria (Apocynaceae)



LEVELS OF BIODIVERSITY

1. Genetic Diversity

❖ India has more than **50,000** different strains of **rice** and **1000** varieties of **mango**.



Pusa Surya



Kesar



Alphanso



Neelum



Neelgoa



Pusa Aruima



Mallika



Chausa



Karanjio



Vanraj



Hybrid 11-2



Moti Chur



Totapuri



Kanchan



Aam Ber

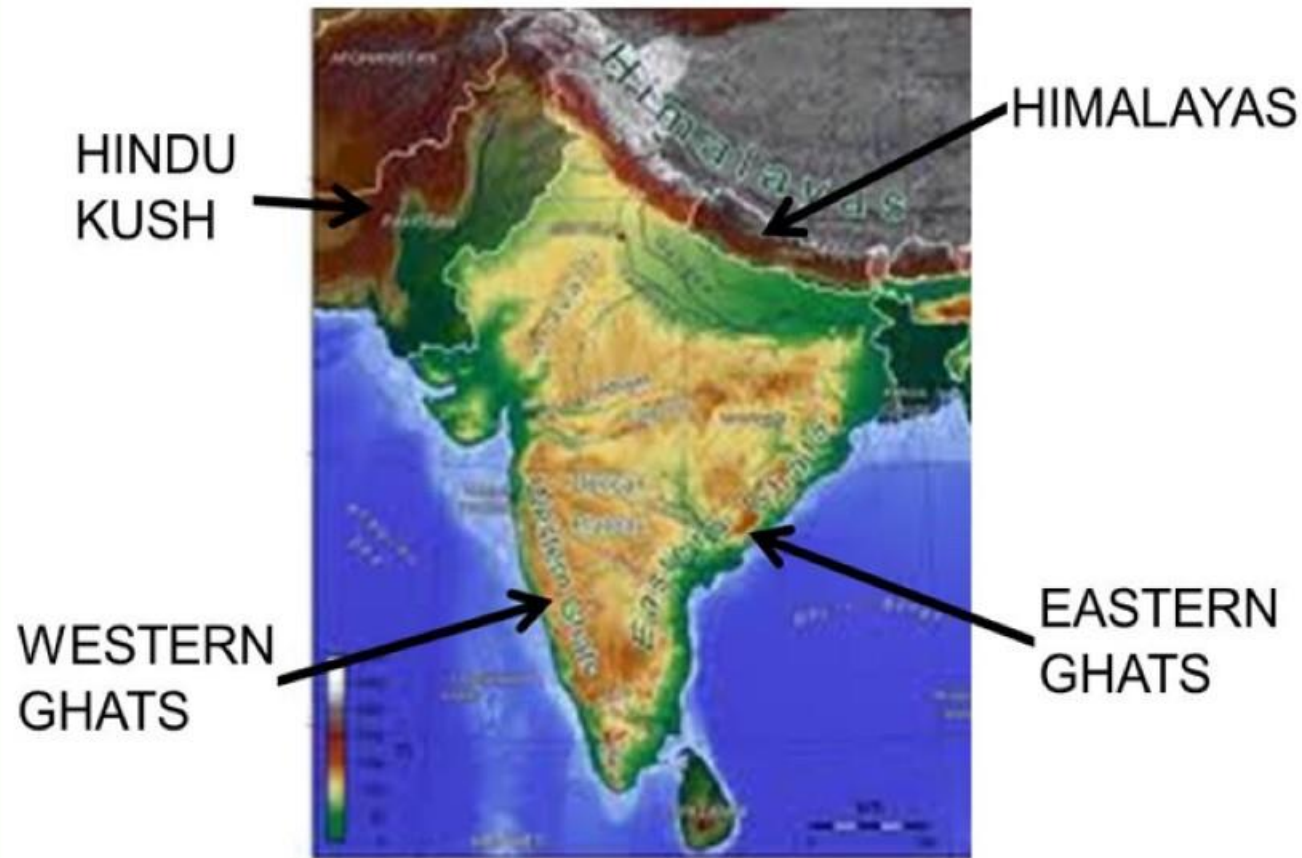


Swarn Jenhagir

LEVELS OF BIODIVERSITY

2. Species Diversity

- Diversity at **species level**.
- E.g. **Western Ghats** have greater **amphibian species diversity** than **Eastern Ghats**.



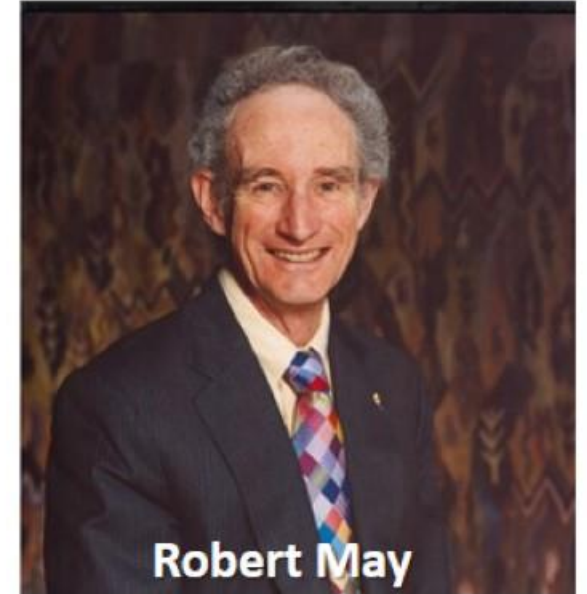
LEVELS OF BIODIVERSITY

3. Ecological Diversity

- Diversity at **ecosystem level**.
- E.g. In India, deserts, rain forests, mangroves, coral reefs, wetlands, estuaries and alpine meadows are seen.



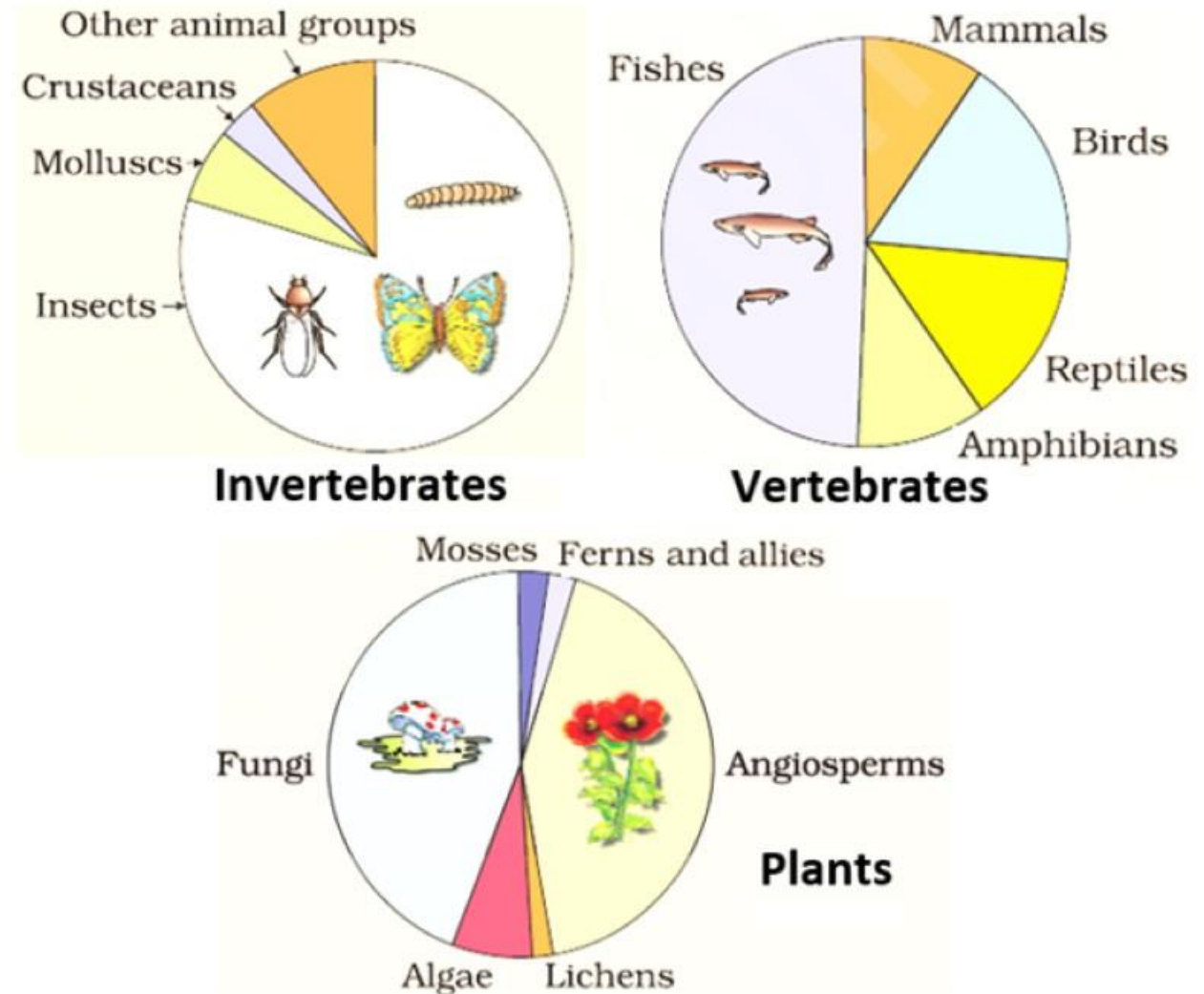
NUMBER OF SPECIES ON EARTH (GLOBAL SPECIES DIVERSITY)



- According to **IUCN (2004)**, more than **1.5 million** species described so far.
- According to **Robert May's global estimate**, about **7 million** species would have on earth. (He considered the species to be discovered in the tropics. i.e. only 22% of the total species have been recorded so far).

TOTAL NUMBER OF SPECIES ON EARTH (GLOBAL SPECIES DIVERSITY)

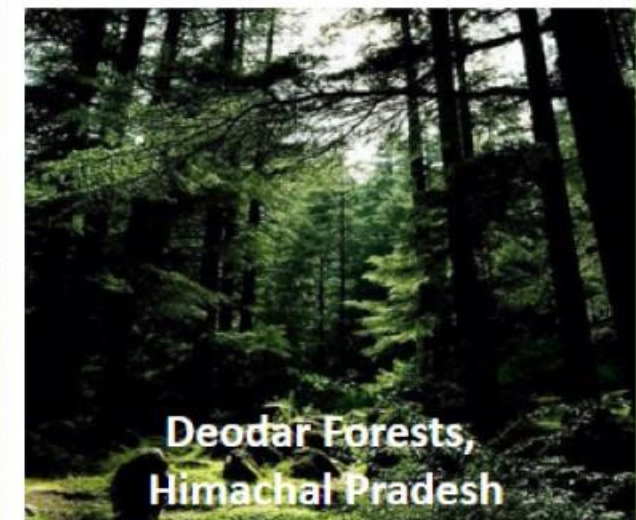
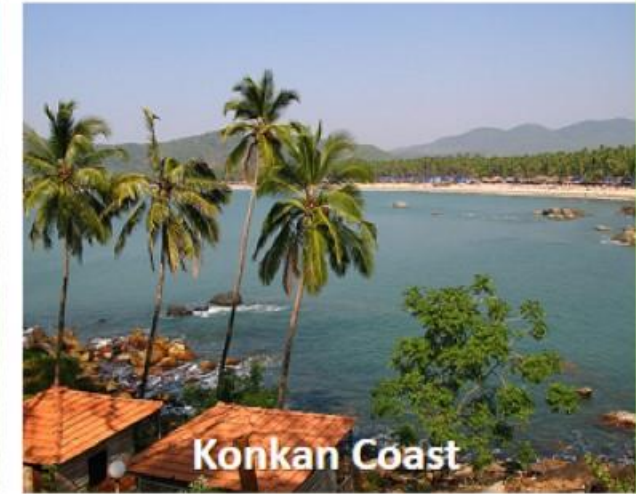
- **Animals** are more diverse (**above 70%**) than plants including **Plantae** and **Fungi** (**22%**).
- Among animals, **insects** are most species rich group (**70%**), i.e. out of every 10 animals, 7 are insects).
- Number of fungi species is more than the combined total of the species of fishes, amphibians, reptiles & mammals.



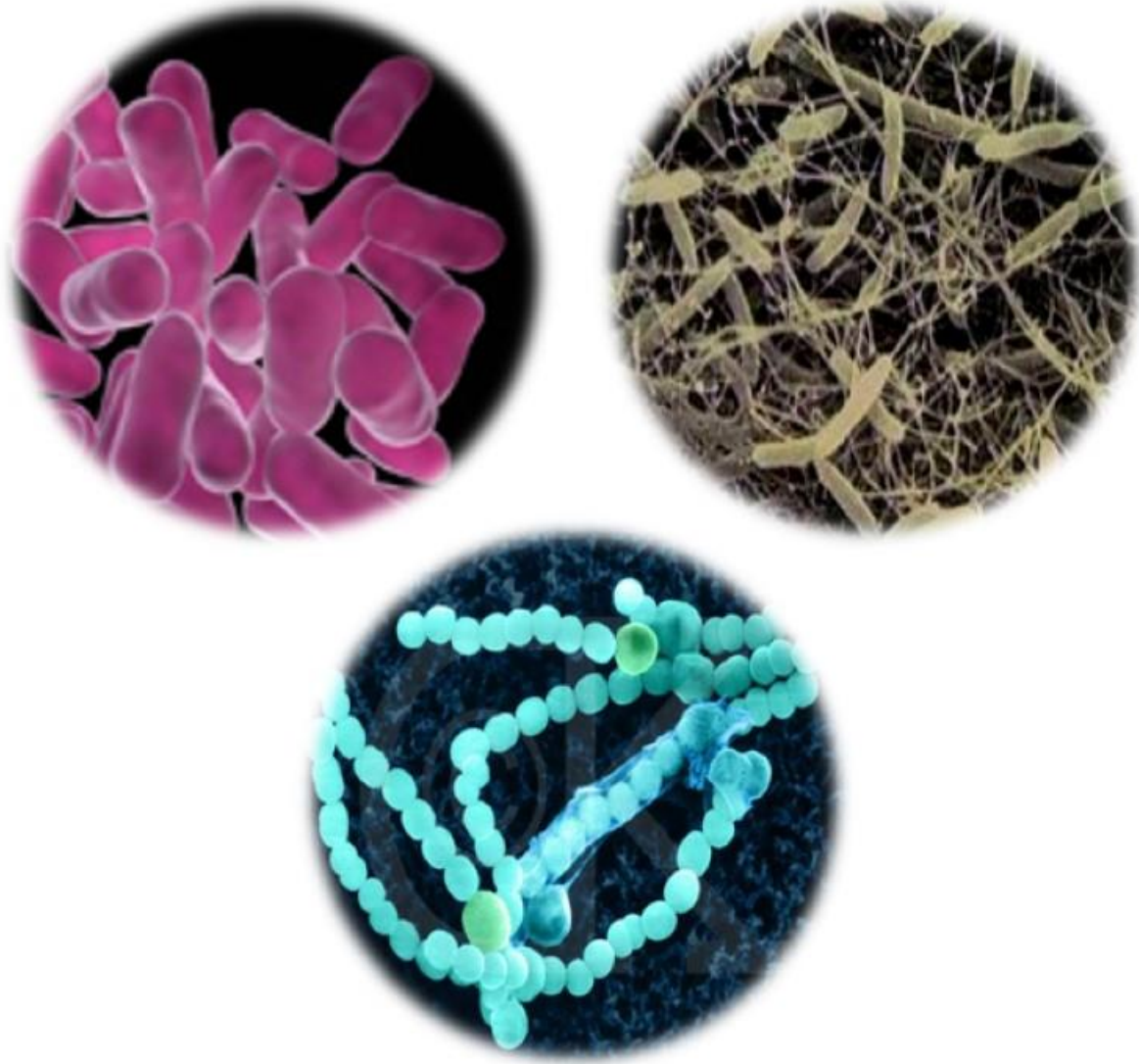
TOTAL NUMBER OF SPECIES ON EARTH (GLOBAL SPECIES DIVERSITY)

Biodiversity in India

- **India** has only **2.4%** of the world's land area, but **8.1%** of the species diversity.
- India is one of the **12 mega diversity countries**.
- Nearly **45,000 species** of plants and **twice** as many of animals.
- Applying **May's global estimates**, India would have more than **1 lakh** plant species and **3 lakh** animal species.



TOTAL NUMBER OF SPECIES ON EARTH (GLOBAL SPECIES DIVERSITY)

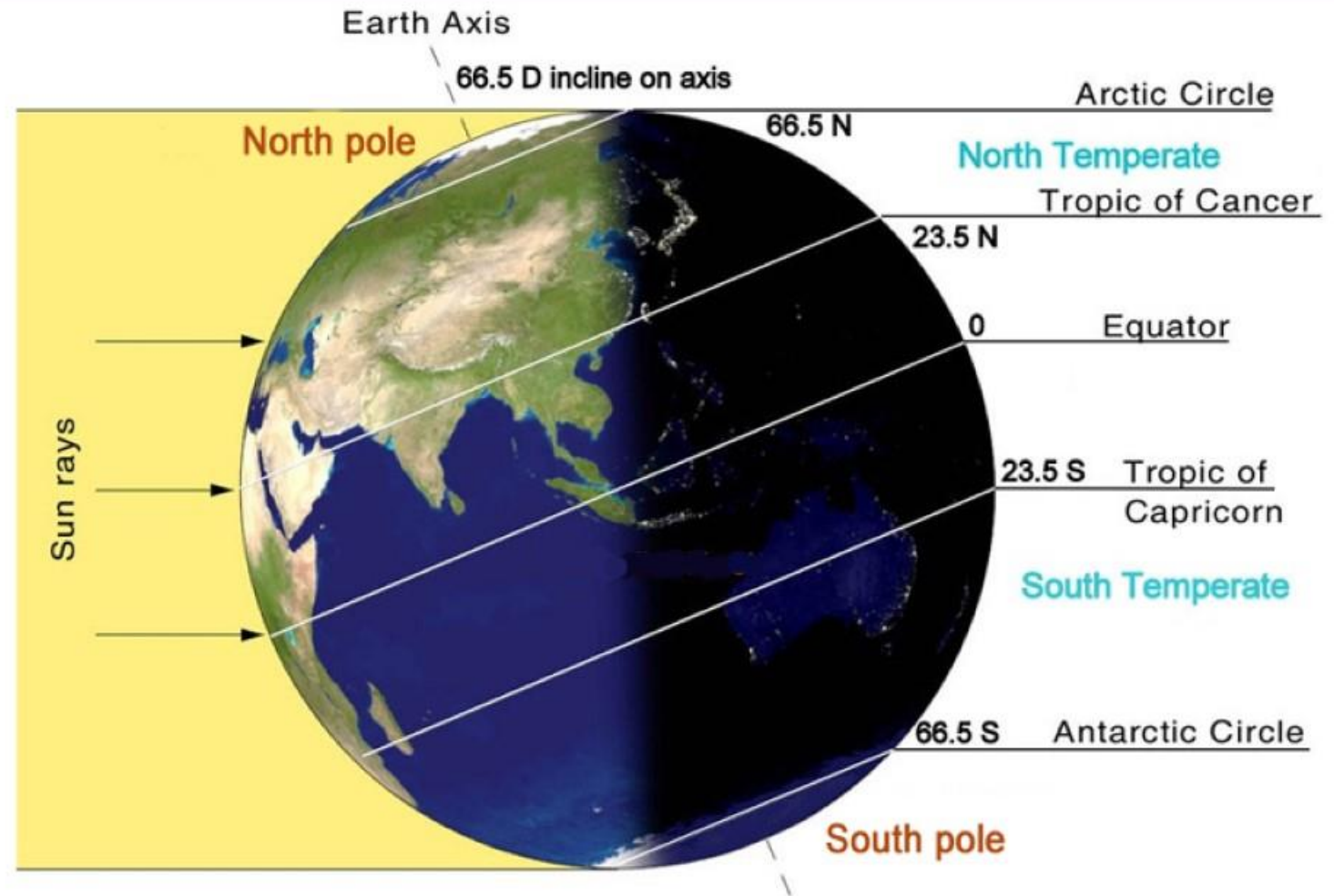


- Biologists are not sure about total number of **prokaryotic species** because
 - ✓ **Conventional taxonomic methods are not suitable for identifying microbial species.**
 - ✓ **In laboratory, many species cannot be cultured.**

PATTERNS OF BIODIVERSITY

1. Latitudinal Gradients

- Species diversity **decreases** from the **equator to the poles**.
- **Tropics** (latitudinal range of 23.5° N to 23.5° S) have more species than temperate or polar areas.



PATTERNS OF BIODIVERSITY

1. Latitudinal Gradients

Examples for latitudinal gradients

1. Number of bird species:
 - ✓ Colombia (near equator): about 1400 species.
 - ✓ India (in tropics): > 1200 species.
 - ✓ New York (41° N): 105 species.
 - ✓ Greenland (71° N): 56 species.
2. Tropical forest region like Ecuador has up to **10** times of vascular plant species as compared to a temperate forest region like Midwest of USA.



PATTERNS OF BIODIVERSITY

1. Latitudinal Gradients

Tropical forest region like Ecuador has up to **10 times of vascular plant species** as compared to a temperate forest region like the Midwest of USA.



PATTERNS OF BIODIVERSITY

1. Latitudinal Gradients



Tropical Amazonian rain forest (South America) is the greatest biodiversity on earth.

Number of species in
Amazonian rain forest

> 40000 plants

3000 fishes

1300 birds

427 mammals

427 amphibians

378 reptiles

>1,25,000 invertebrates

PATTERNS OF BIODIVERSITY

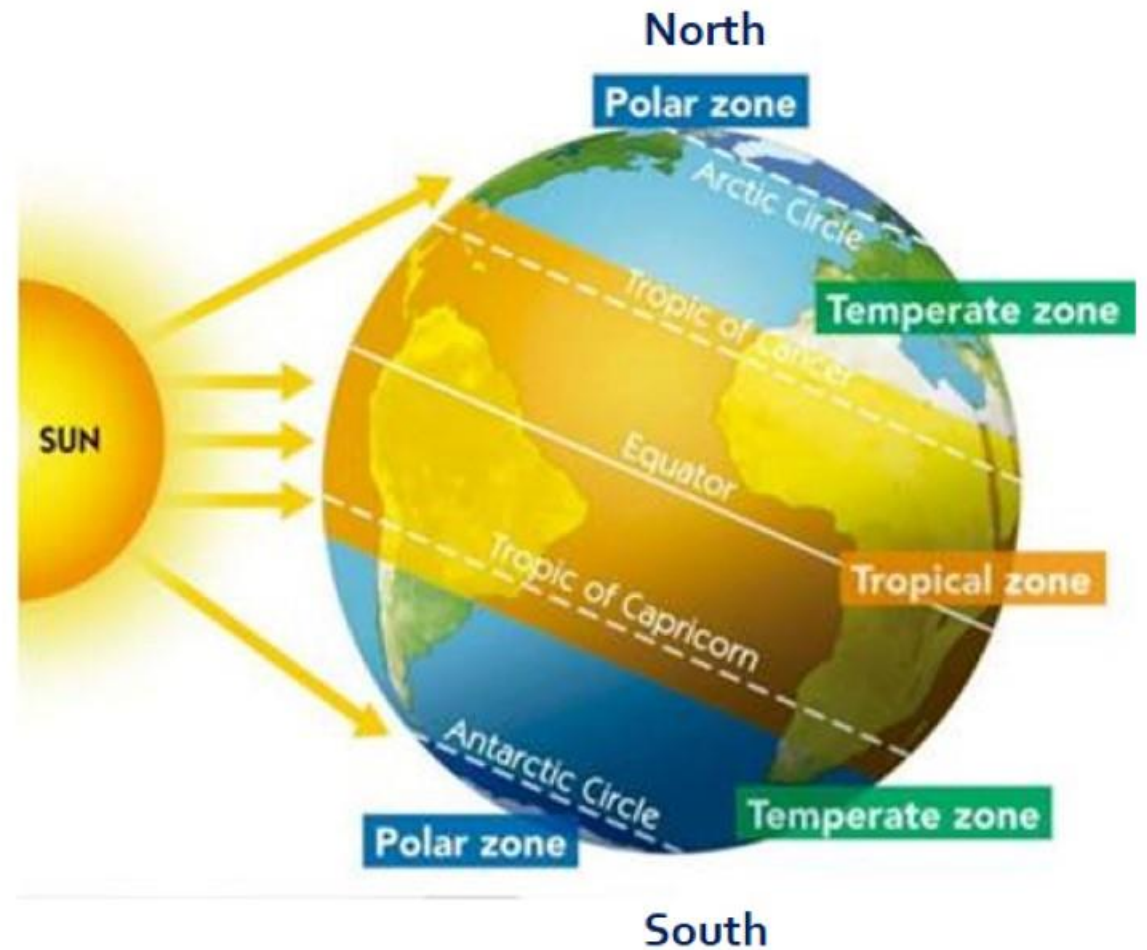
1. Latitudinal Gradients

Reasons for highest Biodiversity (species richness) in the tropics

Tropics had more evolutionary time

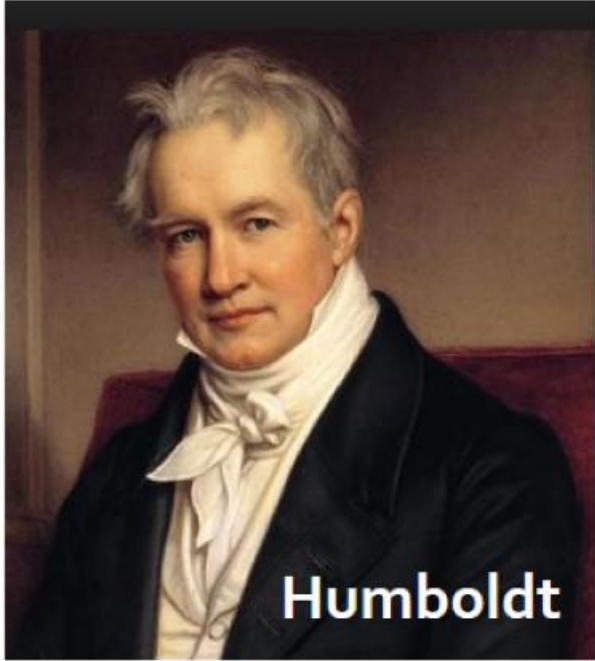
Relatively constant environment (less seasonal).

They receive more solar energy which contributes to greater productivity.



PATTERNS OF BIODIVERSITY

2. Species – Area Relationship

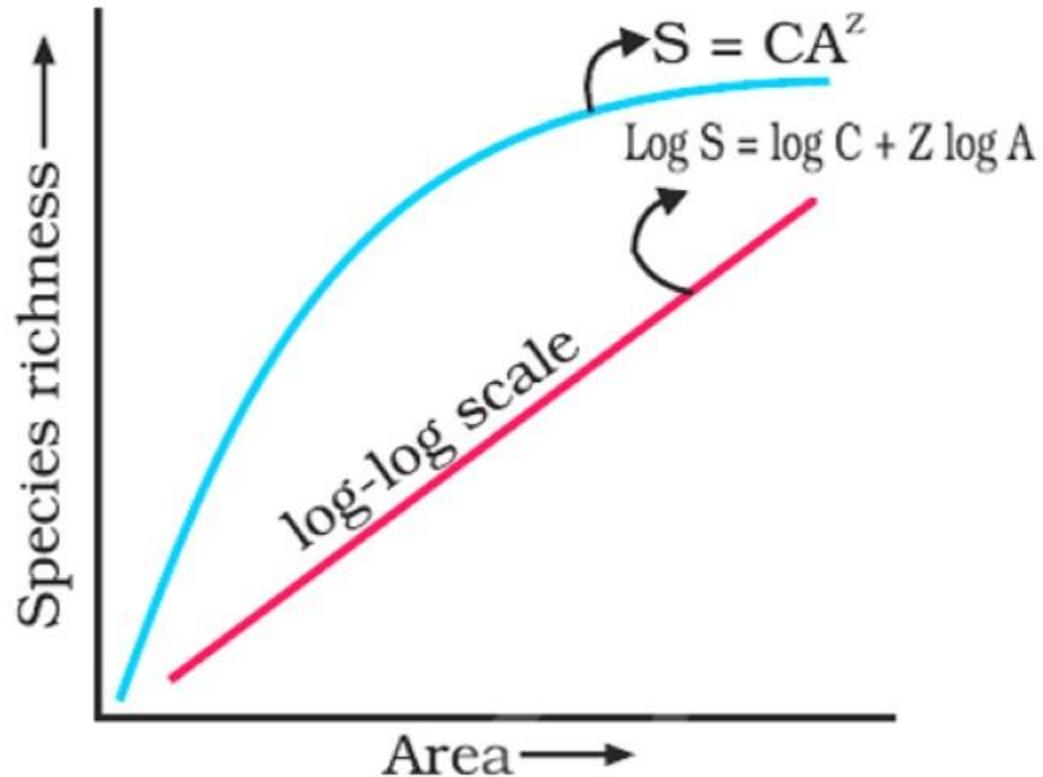


- According to the study of **Alexander von Humboldt** in South American jungles, within a region, **species richness increases with increasing explored area**, but only up to a limit.

PATTERNS OF BIODIVERSITY

2. Species – Area Relationship

- Relation between species richness and area gives a **rectangular hyperbola**.



$$S = CA^z$$

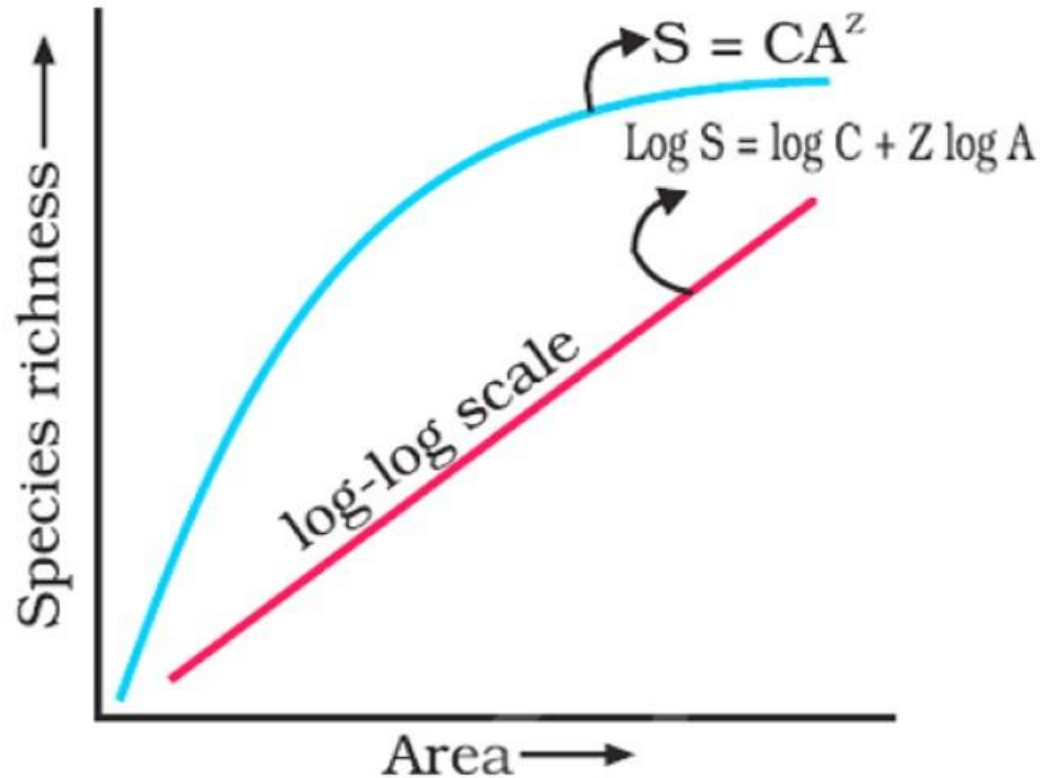
- **Where,**
 $S =$ Species richness $A =$ Area
 $C =$ Y-intercept
 $Z =$ slope of the line (regression co-efficient)
- On a logarithmic scale, the relationship is a **straight line**. The equation is

$$\text{Log } S = \text{log } C + Z \text{ log } A$$

PATTERNS OF BIODIVERSITY

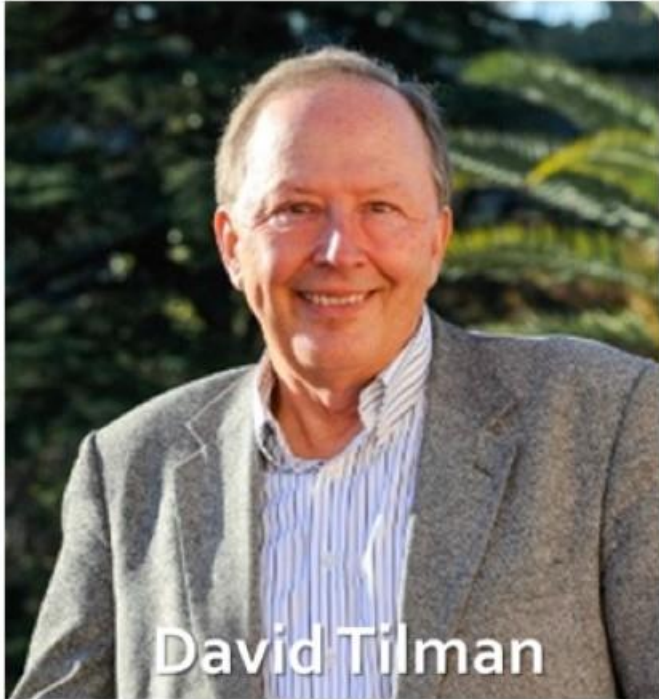
2. Species – Area Relationship

- Relation between species richness and area gives a **rectangular hyperbola**.



- Generally, for small areas, the Z value is **0.1 to 0.2**.
- But for large areas (e.g. entire continents), slope of the line is **steeper** (Z value: **0.6 to 1.2**).
- E.g. for frugivorous birds and mammals in the tropical forests of different continents, the Z value is **1.15**

IMPORTANCE OF SPECIES DIVERSITY



David Tilman

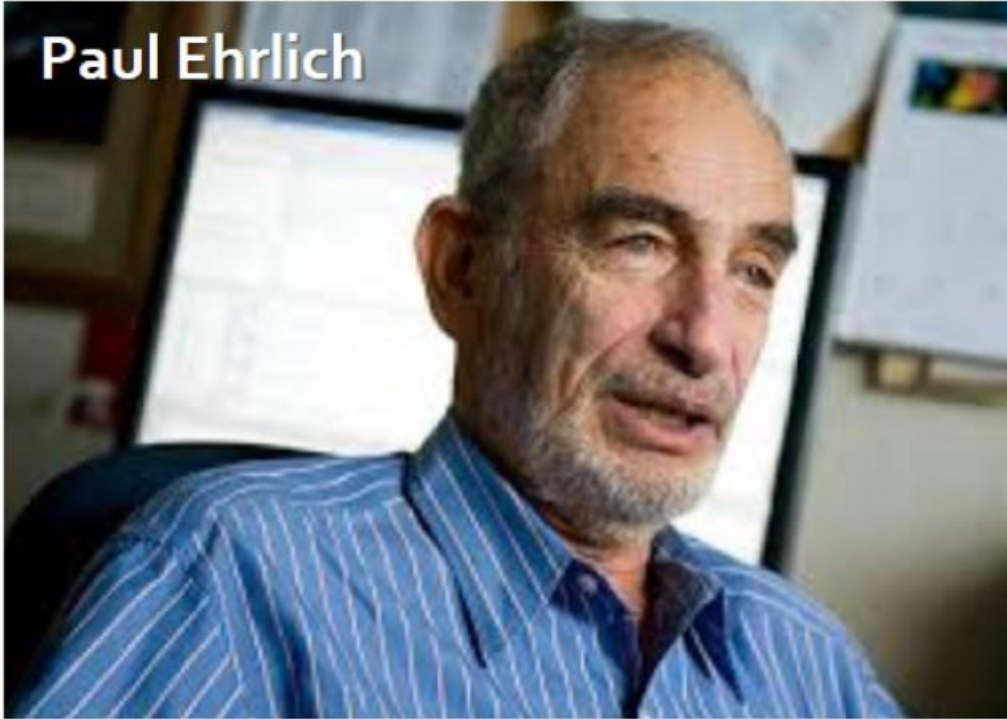


- According to **David Tilman**, plots with more species shows less year-to-year variation in total biomass.
- Increased diversity contributes to higher productivity. It is essential for ecosystem health and survival of human race.

IMPORTANCE OF SPECIES DIVERSITY

'Rivet popper Hypothesis'

Paul Ehrlich



- It is an analogy used to understand the importance of biodiversity.
- It is proposed by Stanford ecologist **Paul Ehrlich**.

IMPORTANCE OF SPECIES DIVERSITY

'Rivet popper Hypothesis'

- In an **airplane (ecosystem)**, all parts are joined together using many **rivets (species)**.
- If passengers **pop a rivet (extinction of a species)**, it may not affect **flight safety (functioning of the ecosystem)**. But as more and more rivets are removed, the plane becomes dangerously weak.



IMPORTANCE OF SPECIES DIVERSITY

'Rivet popper Hypothesis'

- Loss of rivets on the **wings** (key species that drive major ecosystem functions) is more dangerous to flight safety than loss of a few rivets on the seats or windows inside the plane.

