

A vibrant underwater scene featuring a sea turtle, a striped butterflyfish, and a large school of orange fish swimming over a diverse coral reef. The word "BIODIVERSITY" is overlaid in the center in a white, bold, sans-serif font with a thin orange outline.

# BIODIVERSITY

# Biodiversity

What does “Bio” mean?

**Bio**= **Life**

# Biodiversity

What does “Diversity” mean?

**D**iversity = variety

# BIODIVERSITY

- In simple term, biodiversity means **the large variety of flora and fauna** on this planet earth.
- In other word we can say that, biodiversity is **the variety of life on earth and its myriad of process.**
- It includes all life forms- **the unicellular fungi, protozoa and bacteria to complex multicellular organisms such as plants , birds , fishes and mammals.**
- According to the world resources **“Biodiversity”** is the **variety of the world’s organisms** including their **genetic diversity and the assemblage they form.**
- The term **‘BIODIVERSITY’** gained immediate acceptance and was brought to popular attention by the world media during **the Earth Summit in Rio De Janerio in the year 1992.**

# **Biodiversity is the variety of life on Earth and the essential interdependence of all living things**

- **Scientists have identified more than 1.4 million species. Tens of millions -- remain unknown ([www.thecatalogueoflife.org](http://www.thecatalogueoflife.org))**
- **The tremendous variety of life on Earth is made possible by complex interactions among all living things including micro-organisms.**

# Which do you like better?



**A**



**B**

# Which do you like better?



**A**



**B**

# What do we get from biodiversity?

Oxygen

Food

Clean Water

Medicine

Aesthetics

Ideas



# Types of Biodiversity

- Biodiversity can be divided into three levels:

1. GENETIC DIVERSITY

2. SPECIES DIVERSITY

3. ECOSYSTEM DIVERSITY



# Biodiversity

Variety of living things, number of kinds

- **Ecological diversity**
  - different habitats, niches, species interactions
  - an assemblage of species living in the same area and interacting with an environment.
- **Species diversity**
  - different kinds of organisms, relationships among species
  - refers to the number of kinds of species being found.
- **Genetic diversity**
  - different genes & combinations of genes within populations
  - allows population of a species to adapt to environmental changes.



Ecosystem diversity



Species diversity



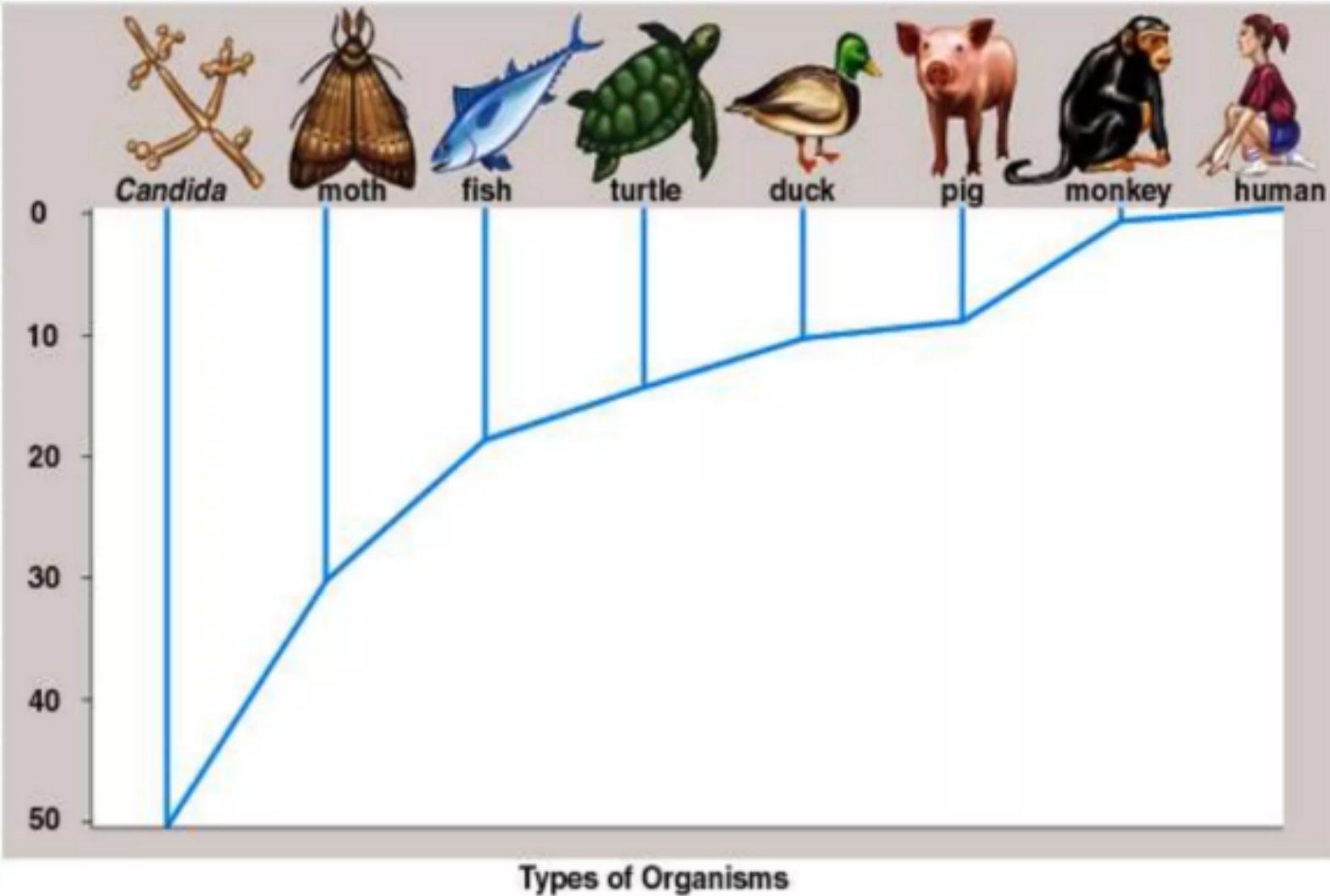
# 1. GENNETIC DIVERSITY:

- **GENETIC DIVERSITY** is the **variety present at the level of genes**
- Genes, made of **DNA (right)**, are the **building blocks** that determine **how an organism will develop** and what its traits and abilities will be.
- **Genetic diversity** can be measured at many different levels including population, species, community .



# Types of organisms

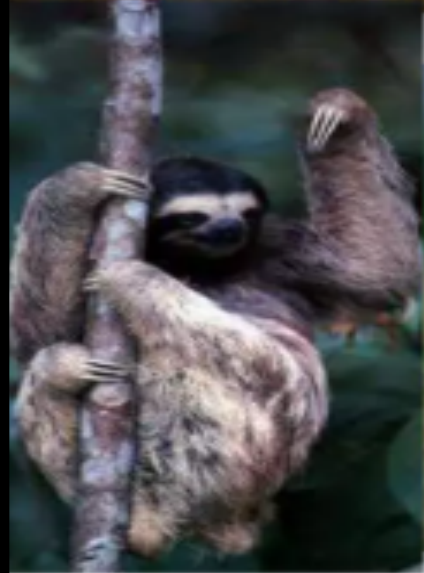
Number of Amino Acid Differences Compared to Human Cytochrome C



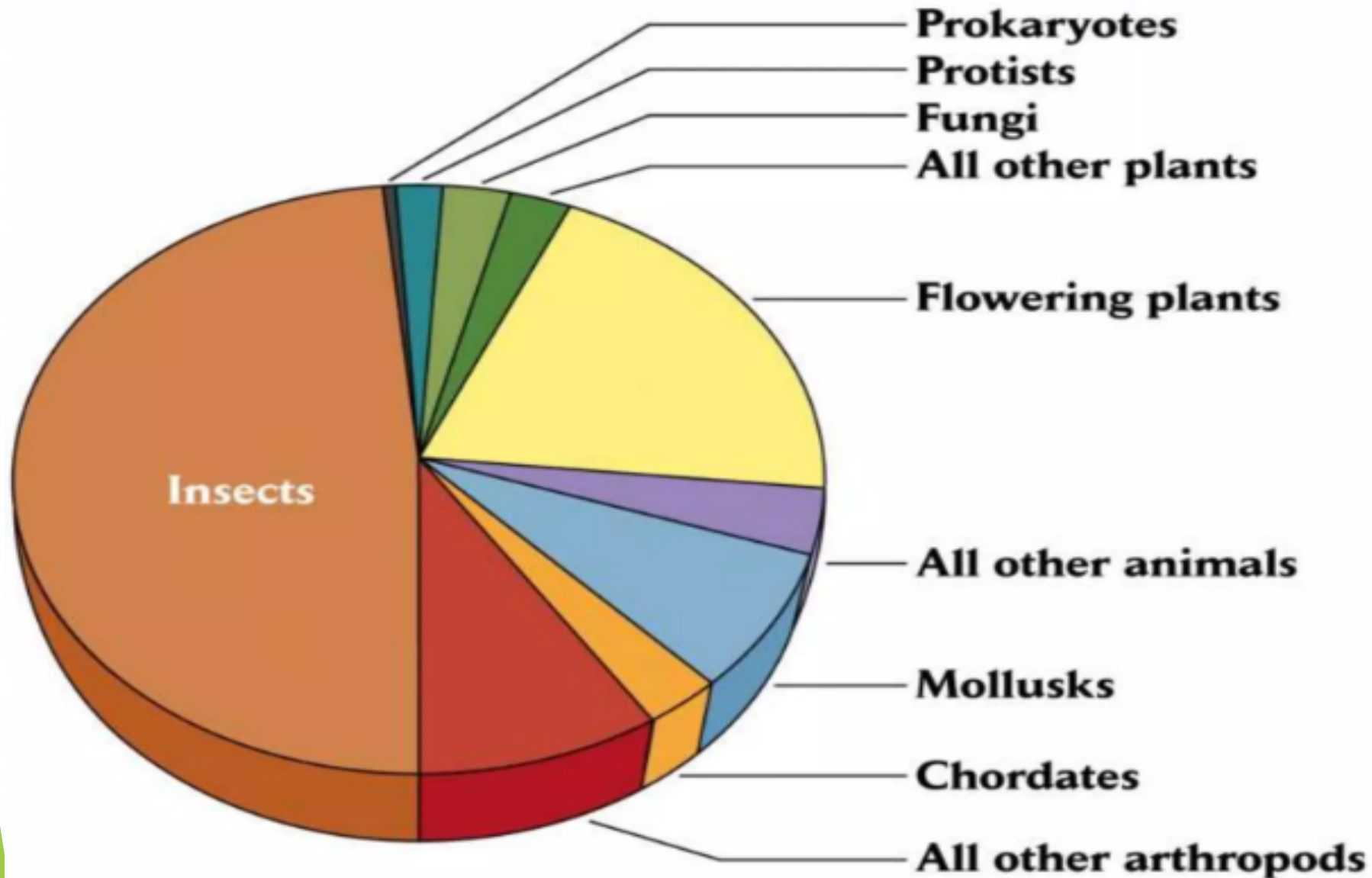
## 2.SPECIES DIVERSITY:

- Species diversity refers to **the different types of living organisms on Earth.**
- This includes **the many types of birds, insects, plants, bacteria, fungi, mammals, and more.**
- Many differing species often **live together in communities depending on each other to provide their needs.**
- **A species can be defined as a group or population of similar organisms that reproduce by interbreeding within the group.**
- Members of a species **do not normally reproduce with members of any other species.**
- Members of a specific species possess common characteristics that distinguish them from other species and this remains constant regardless of **geographic location.**





# Diversity of organisms



# How many different species are there?

- **The number of species identified and named is more than 1.7 million, including:**
  - 950,00 species of insects
  - 270,000 species of plants
  - 19,000 species of fish
  - 10,500 species of reptiles and amphibians
  - 9,000 species of birds
  - 4,000 species of mammals
- **The rest includes mollusks, worms, spiders, fungi, algae, and microorganisms.**



# Biodiversity: # of species estimates



- Most estimates of the total number of species on Earth lie between 5 million and 30 million.
- Of this total, roughly 2 million species have been formally described, the remainder are unknown or unnamed.

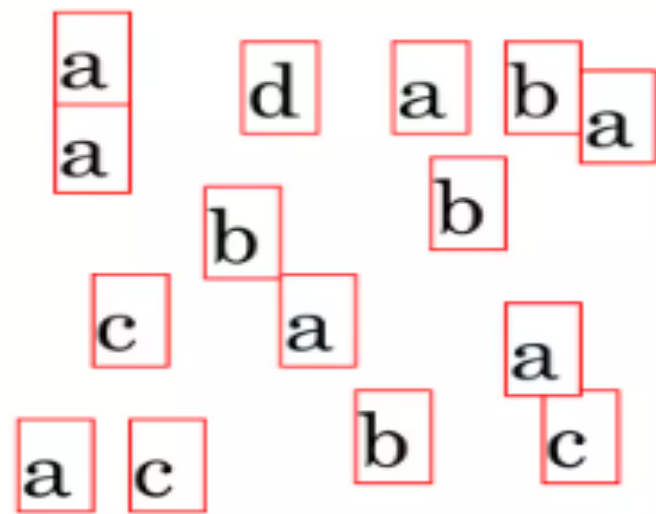
# 3. ECOSYSTEM DIVERSITY:

- ECOSYSTEM level deals with **species distributions and community patterns**.
- It is the variety of different **habitats/ecosystems in a particular area** (e.g.. **wetland, woodland, grassland**).
- The ecosystems of the world are maintained by their biodiversity.
- Every ecosystem can be characterized by its own species composition.
- The ecosystems differ in features such as physical structure, temperature, water availability and food types.
- Ecosystem diversity cannot define itself like genetic and species diversity. Ecosystem diversity needs many complex measurements to be taken over a long period of time.
- Ecosystem diversity is a distinctive assemblage of species that live together in the same area and interact with their physical environment in unique ways.



# 1. Scales of diversity

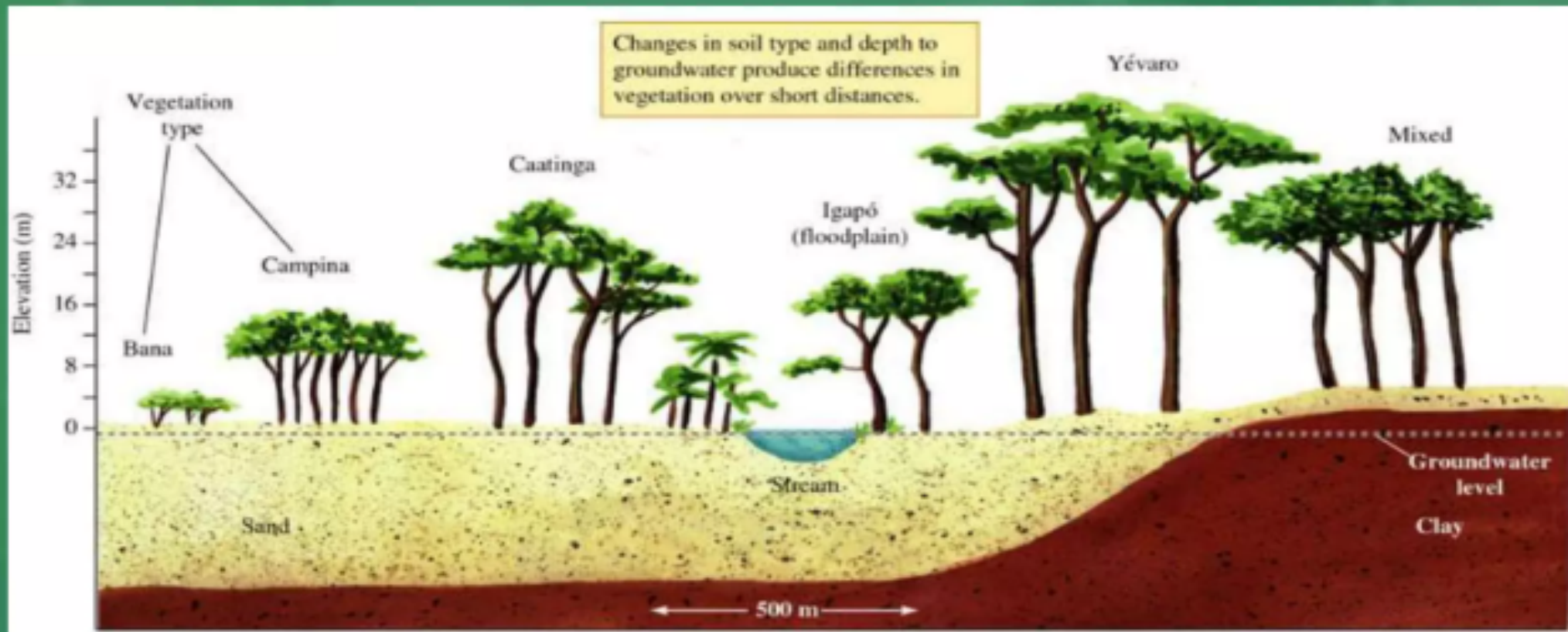
Alpha – number of species in a given plot or area



A collection of 18 small red-outlined boxes containing the letters 'a', 'b', 'c', and 'd' scattered on a white background. The letters are: 'a' (2), 'b' (3), 'c' (3), and 'd' (1).

# 2.Scales of diversity

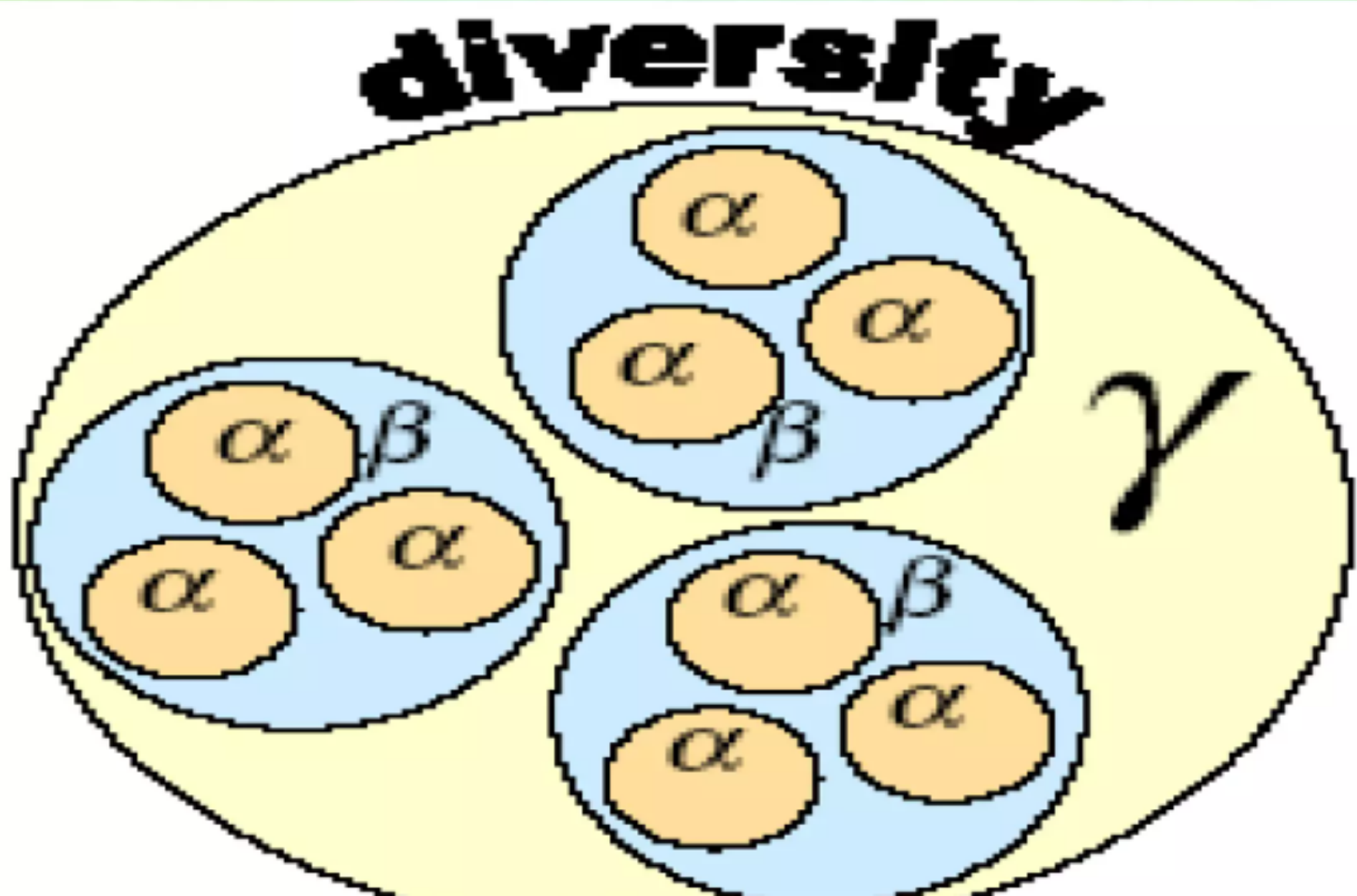
- Beta – species turnover across an environmental gradient



# 3.Scales of diversity

- Gamma diversity: the total biodiversity within a landscape.
- Gamma diversity is a function of local or 'within habitat diversity' (*alpha diversity*) and differences in species composition or 'turnover' of species, between habitats or localities (*beta diversity*).

# Scales of diversity



# Types of biodiversity measures

## What is being measured?

- - measures of numbers of things (e.g., number of species)
- - measures of processes (e.g., primary productivity)
- - measures of system properties (e.g., resilience)

## What scale?

- - genetic
- - species
- - community
- - ecosystem
- - landscape

# VARIOUS USES OR VALUES OF BIODIVERSITY

- **1 Timber:** Wood is one of the few commodities used worldwide. It is an important commodity in international trade. Example- Malaysia, Indonesia are major exporters of timber.
- **2 Fishery:** Fish and other products make up commodities of great value. These are also of crucial importance to global food security. Example- Herrings, sardines are the most important fishes.
- **3 Food:** Food plants are the example of the most fundamental values of biodiversity. plants were consumed directly from the wild- 2,50,000 species of angiosperms that are a direct food source.
- **4 Tourism:** Tourism industry is mainly based on observation of wild life with in protected areas & is a major source of income for many developing countries.



- **5 POLLUTION CONTROL:** Plants & microorganism can remove toxic substances from the air ,water, & Soil

- **6 MEDICINAL VALUE:** Living organism provide us with many useful drugs.

Ex.- penicillin is a derivative of fungus.

- **7 POOR AND INDIGENOUS PEOPLE:** Poor and indigenous people of under- developed countries are dependent on diversity in forests and wild life for food , shelter etc .

- **8 EXISTENCE VALUE:** Existence value is based on simply knowing that a species exist and that it is a sufficient reason to preserve and protect it.








- Ex.- Photography, Picnic.

- **9. OPTIONAL VALUE:** Several plants species which edible & superior than currently use.

Ex.- Katemfe plant found in South Africa produce protein 600 times more than sucrose.

# Benefits of Biodiversity

- Medicines
  - Plants
  - Jellyfish & sea anemones
  - Nudibranchs
    - Marine slugs

Medicines and Biodiversity: Natural sources of pharmaceuticals			
Plant		Drug	Medical application
Pineapple ( <i>Ananas comosus</i> )		Bromelain	Controls tissue inflammation
Autumn crocus ( <i>Colchicum autumnale</i> )		Colchicine	Anticancer agent
Yellow cinchona ( <i>Cinchona ledgeriana</i> )		Quinine	Antimalarial
Common thyme ( <i>Thymus vulgaris</i> )		Thymol	Cures fungal infection
Pacific yew ( <i>Taxus brevifolia</i> )		Taxol	Anticancer (especially ovarian cancer)
Velvet bean ( <i>Mucuna deeringiana</i> )		L-Dopa	Parkinson's disease suppressant
Common foxglove		Digitoxin	Cardiac

# Biodiversity Hotspots

- Hot Spot concept-British ecologist, *Norman Myers* (1988)

## *Criteria for designating an area as hotspot*

- (i) richness in endemic species-1500 endemic plant species,0.5% of global total
- (ii) impact by human activities- must have lost more than 70% of its original habitat.

# HOT SPOTS

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- 25 major hotspots together represent 14 % of the earth's land area, they contain 44% of all plant species and 35% of all terrestrial vertebrate species in the world.

## **No of Hotspots in India-3**

1. *Indo-Burma ( earlier Eastern Himalayas )*
2. *Western Ghats and Sri Lanka.*
3. *Himalayas. (Newly added)*

# Western Ghats (Sahyadri Hills)

- **Vegetation types:** scrub jungles and grasslands at low altitudes.
- Dry and moist deciduous forests, S Montane grasslands and Sholas.
- **Tropical evergreen and semi-evergreen forests.**

Complex topography, high rainfall and relative inaccessibility-reasons to retain rich biodiversity.

4,780 species of flowering plants.

Diversity of traditional crop plants and animal life.

Endemic species-amphibians, freshwater fishes and invertebrate groups.

# Indo-Burma (Eastern Himalayas)

- Tropical Asia- East of the Ganges-Brahmaputra lowlands, excluding Malesian region.
- Covers an area of 2,373,000 sq. km.



# Biodiversity Profile of India

- India is the seventh largest country in the world.
- Second largest nation in Asia.
- land frontier- 15,200 kms
- Coastline of 7,516 km.
- One of the top twelve megadiversity countries

# Contd...

- **No of plant species- 49,219 (12.5% of the world)**
- **No of animal species- 81,251 (6.6% of world fauna.)**



## Contd....

- Species endemism among plants- 33%.
- Endemism among animals
  1. mammals –low, only 44 species.
  2. Birds-low, only 55.
  3. Reptile-high,187.
  4. Amphibia- high,110
- **National parks-89 &**
- **Wild life Sancturies-497 } 1.56 lkh sq.km-**
- Tiger reserves-27- 37761sq.km

# Biodiversity in India

No.	Category	No of species	%
1	Bacteria	850	0.67
2	Algae	2500	2.00
3	Fungi	23000	18.23
4	Lichens	1600	1.30
5	Bryophytes	2700	2.14
6	Pteridophytes	1022	0.80
7	Gymnosperms	64	0.05
8	Angiosperms	17000	13.50
9	Protozoans	2577	2.04
10	Molluscs	5042	4.00

11	Crustaceans	2970	2.35
12	Insects	50717	40.00
13	Invertebrates including hemichordates	11252	9.00
14	Protochordates	116	0.10
15	Pisces	2546	2.02
16	Amphibians	204	0.16
17	Reptiles	428	0.34
18	Aves	1228	1.00
19	Mammals	372	0.30
	<i>Total</i>	126288	<i>100.00</i>

# THREATS TO BIODIVERSITY...

## 1) CAUSES OF EXTINCTION

- **a. Population risk-** random variation in population rates can cause a species in low abundance to become extinct.
- **b. Environmental risk-** it means variations in the physical or biological environment.
- **c. Natural catastrophe-** it means a sudden change in the environment it includes fires, storms, floods, earthquakes.

## 2) HUMAN ACTION

- **a. Habitat loss & degradation-** it is the major causes of species extinction , **affecting 89% of birds , 83% of mammals, & 91% of plants.**
- **b. Diseases- pathogens or diseases** causing organisms are created by human activities which causes **various diseases and affect all living things.**
- **c. Pollution-** It is the most common form of habitat degradation . **example-pesticides , industrial effluents and emissions and emission from automobiles.**
- **d. Deforestation -** deforestation means **cutting of more an more trees.**

# CONSERVATION OF BIODIVERSITY

- 1) To maintain **essential ecological processes and life-supporting system.**
- 2) To preserve the **diversity of species or the range of genetic material found in the organisms on the planet.**
- 3) To ensure sustainable **utilization of species and ecosystems which support millions of rural communities as well as the major industries all over the world .**

# Protecting Biodiversity

- How can we protect biodiversity
  - **Stop overharvesting**
    - Sustainable yield
    - Hunting & fishing laws (every state ?)
      - in developing nations ?
  - **Protect habitat**
    - Refuges, parks, preserves
  - **Endangered Species Act**



Massachusetts cod fishermen haul in a dwindling catch

# CONSERVATION OF BIODIVERSITY

- **There are two basic strategies for biodiversity conservation, these are**
- **most effective and efficient mechanism for conservation.**
- 1-insitu(onsite) conservation
- 2-exsitu (off site) conservation

# INSITU CONSERVATION

- The term insitu conservation denotes **conservation of species in its natural habitat** ,that is where the species is normally found.
- The insitu conservation strategies stress on **protection of total ecosystems through a network of protected areas.**
- **PROTECTED AREAS**
- To facilitate the **growth and reproduction of plants and animals in their habitat**, the area is protected by restricting human activities like hunting, firewood collection, timber harvesting etc.
- Today, there are **about 37,000 protected areas, parks, sanctuaries and biosphere reserves** all around the world.



# EXSITU CONSERVATION

- **This is a conservation of species outside their habitat.**
- **This includes gene, pollen, seed, tissue cultures and DNA banks and also includes various zoos & botanical gardens etc.**
- =>To conserve all these we have various methods of exsitu conservation:- etc.
- 1. Seed bank, gene bank, germplasm bank
- 2. Translocation area
- 3. Botanical parks
- 4. Zoological parks

# THANKYOU

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