

Bio-diversity uses, threats and conservation



- The word “biodiversity” is a contraction of “biological diversity”.
- The father of biodiversity **Edward O. Wilson** (an eminent entomologist) first coined this term in 1986.
- Diversity is a vast concept refers to **the range of variations or differences among some set of entities**; biological diversity thus refers **to varieties within the living world**.
- The term 'biodiversity' is generally considered as an '**Umbrella term**' referring to organisms found within the living world.
- It is commonly **used to describe the number, variety of life and variability of living organisms**.

- **Bio-diversity:**

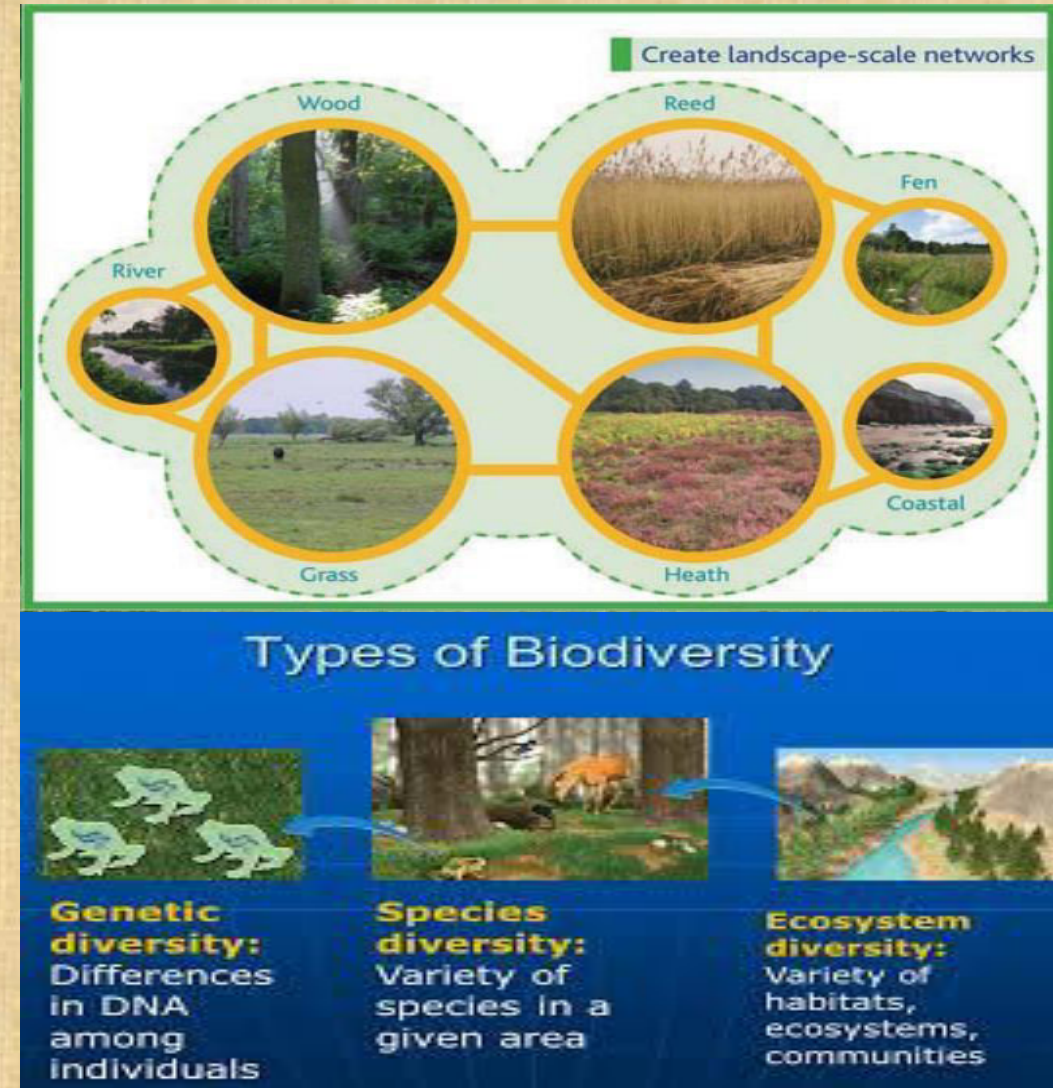
The variability among living organisms from all sources including, inter alia (among other things), terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes **diversity within species, between species and of ecosystems.**



Elements of bio-diversity

- The predicted number of **total species varies from 5 to 50 million and averages at 14 million.**
- Out of the total known species, about **60 % are insects, about 16 % are higher plants and only about 0.3 % is mammals.**
- The most unique feature of Earth is the **existence of life** and the most extraordinary feature of life is **its diversity.**
- Bio-diversity is normally treated in terms of **genes, species and ecosystems** in correspondence with three fundamental hierarchical levels of biological organization.
- The three diversities are referred as **genetic, species and ecosystem diversity.**

- Sometimes **landscape** (is a heterogeneous land area composed of cluster of interacting ecosystems that is repeated in similar form throughout or **mosaic of heterogeneous land forms, vegetation types and land uses**) or **pattern diversity** is considered as **fourth** forum of biodiversity.
- **Diversity:**
 - **Within the species is genetic diversity**
 - **Between species is species diversity or taxonomic diversity or organismal diversity**
 - **At ecological or habitat level is ecosystem or ecological diversity.**



- **Interaction** is the principal intrinsic mechanism that shapes the characteristics and functions of biodiversity.
- These interactions are a **hierarchical nature**.

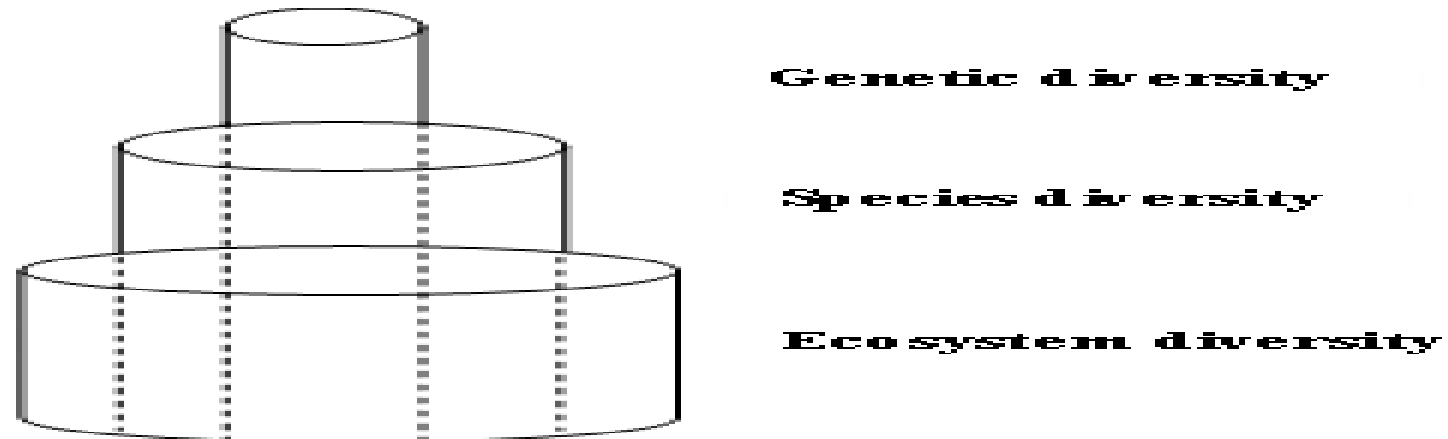
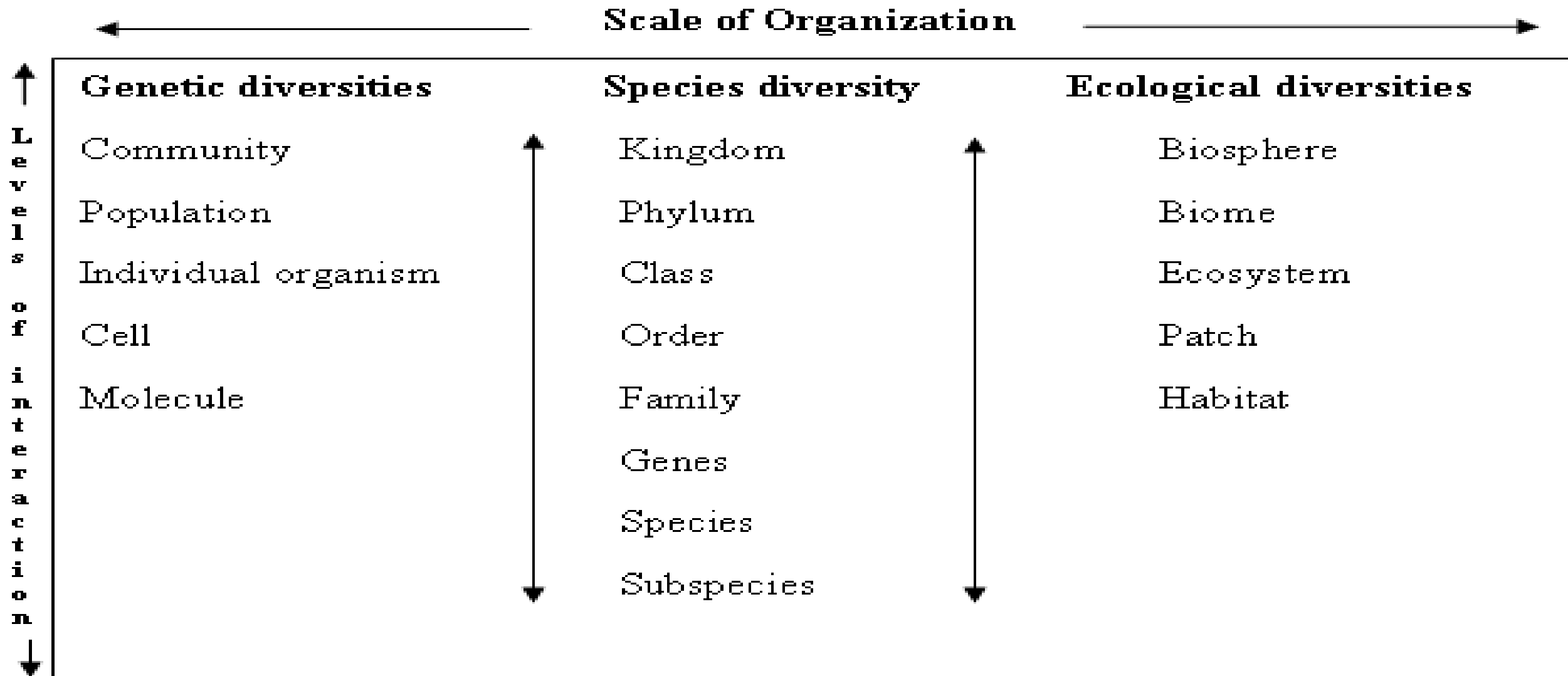
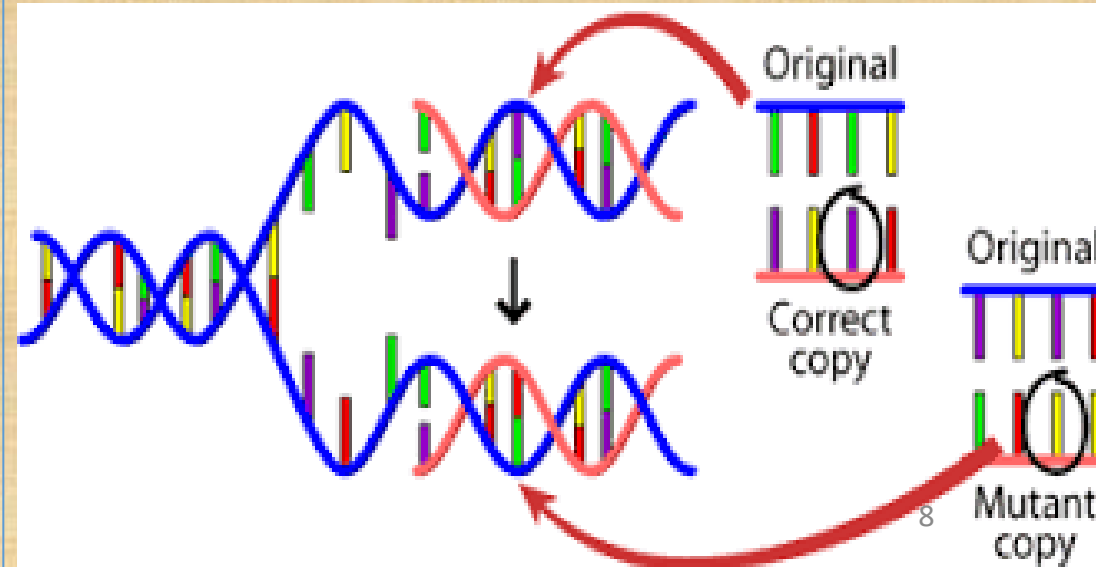


Fig.: Hierarchical levels of bio diversity and their interrelationship



Genetic diversity

- Referred as the **diversity within the species or intra or infra species diversity.**
- It encompasses the components of **genetic coding** that structures organisms (**nucleotides, genes, chromosomes**) and **variation in the genetic make-up between individuals within a population and between populations.**
- The variation could be in **alleles** (different variants of same genes), in **entire genes** (the traits determining particular characteristics) or in **chromosomal structures.**
- This enables a population **to adapt** to its environment and to **respond to natural selection.**



- If a species has **more** genetic diversity, it can **adapt better** to the changed environmental conditions.
- **Lower** diversity in a species leads to **uniformity** and the amount of genetic variation is the basis of speciation (evolution of new species).
- It has a key role in the maintenance of diversity at species levels.
- Genetic diversity within a species often **increases with environmental variability**.
- It can be measured by the methods based on **DNA marker like RFLP, PCR, RAPD, APPCR, PFGE, microsatellite primed PCR and others.**

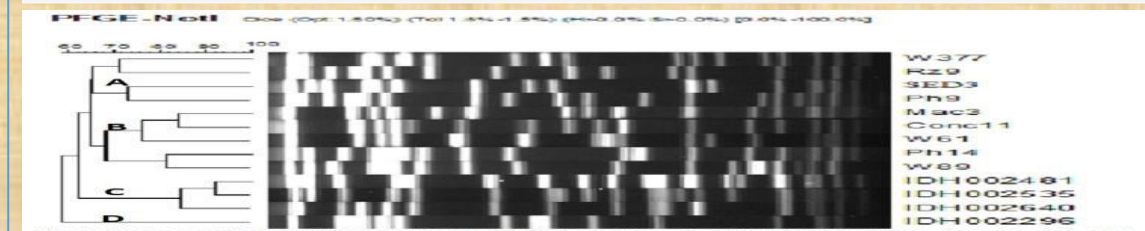
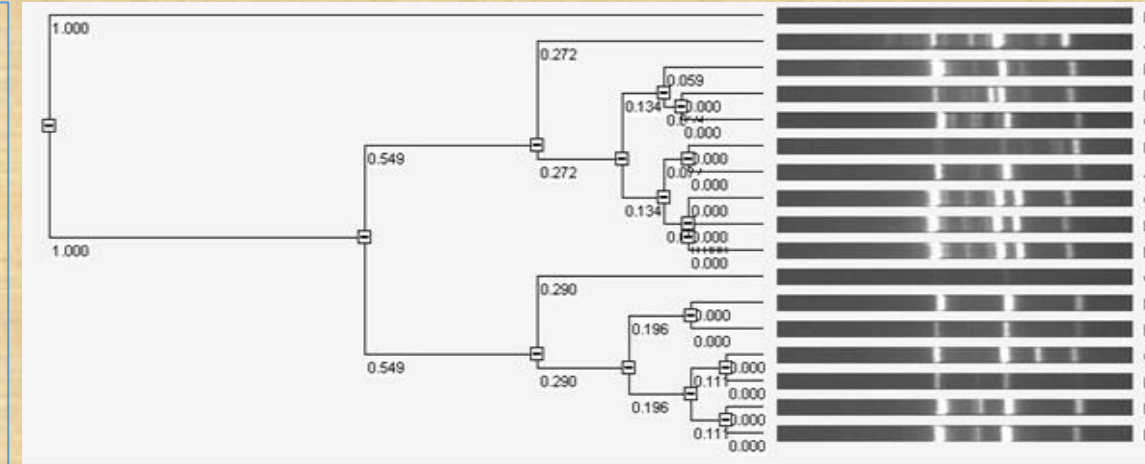
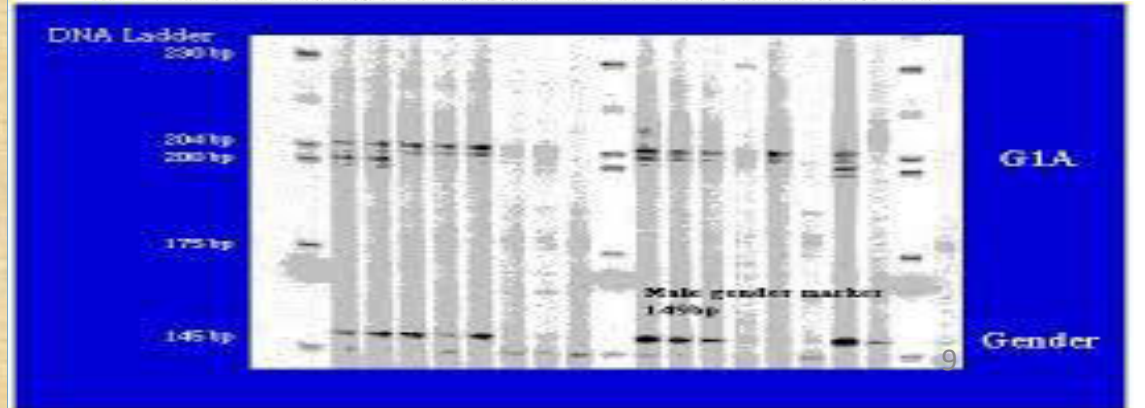


Fig.1: Phylogenetic tree (dendrogram) of *Escherichia coli* O157:H7 isolates from human, fish and water using the software Bio-Numerics (CDC, USA). The similarity scale is on the top of figure.
 Lane1: DNA of *Salmonella* serotype Barendse reference strain as standard DNA molecular marker.
 Lane 2-5: Human clinical isolates [IDH 002535, IDH 002640, IDH 002481, IDH 002296].
 Lane 6: 100% LE; Lane 7-12: Fish isolates [RZ 6, Con 11, Ph 9, SRD 3, Ph 14, Mac 3].
 Lane 15: DNA of *Salmonella* serotype Barendse reference strain as standard DNA molecular marker.
 RZ- Razor; Con- Couch; Ph-Phasa; SRD- Sardine; Mac-Mackerel; W-water.

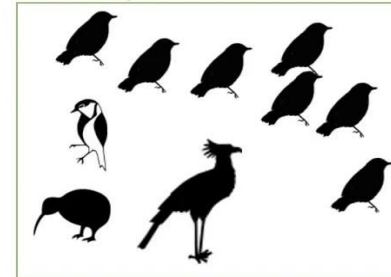


Species diversity

- Species are distinct units of diversity, each playing a specific role in an ecosystem.
- Therefore loss of species has consequences for the ecosystem as a whole.
- Refers to the **variety of living species within a geographic area**.
- It encompasses the taxonomic hierarchy and its components, from individuals upwards to species, genera and beyond.
- The **simplest measures of species diversity (SR+SE)** are:
 - **Species richness** (the number of species per unit area)
 - **Species evenness** (the evenness in number of individuals of each species in the area).
- Generally, **greater the species richness greater is the species diversity**.

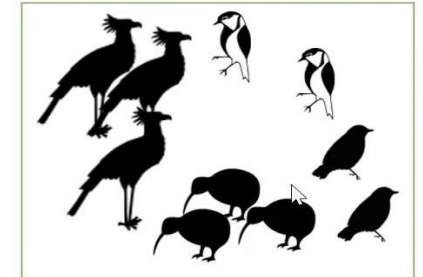


Community A

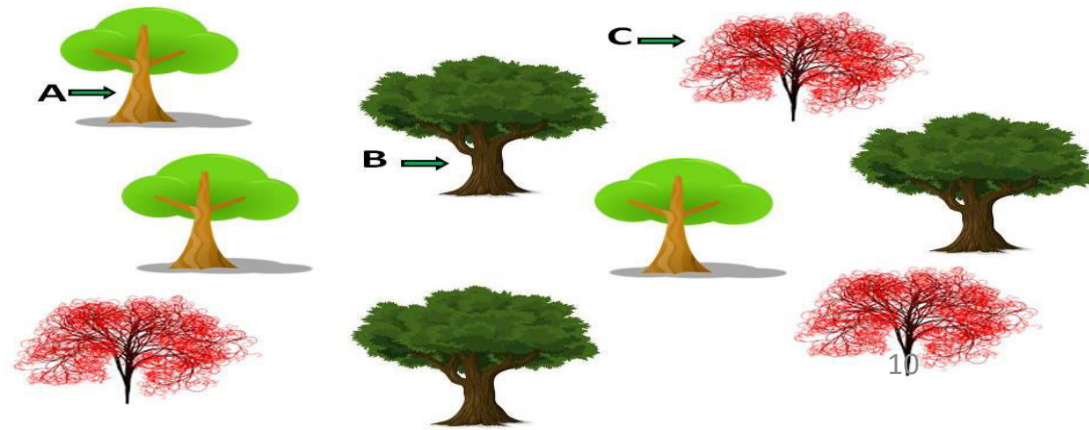


Abundance = 10
 Species Richness = 4
 Diversity = ?

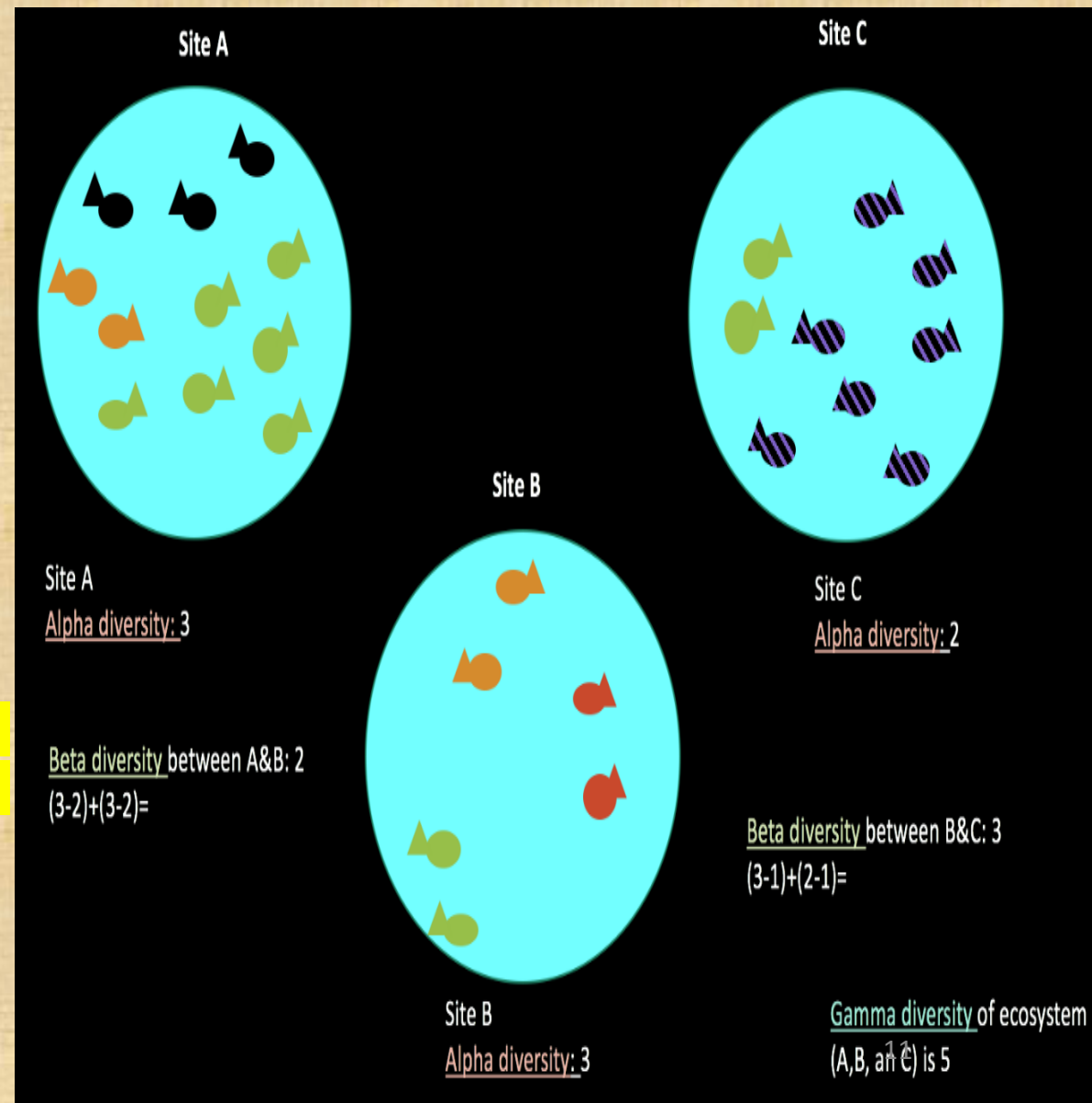
Community B



Abundance = 10
 Species Richness = 4
 Diversity = ?



- **Alpha diversity** refers to the **average species diversity** within a particular area, habitat, community or ecosystem.
- It is measured by **counting the number of taxa** (distinct groups of animals) within the ecosystem.
- **Beta diversity** is **species diversity between ecosystems** refers to the ratio between alpha diversity and regional diversity or comparison of taxa that are unique to each of the ecosystem.
- **Beta diversity = (no. of sps. in Habitat 1- no. of common sps. Habitat 2 & 1)+(no. of sps. in H2- no. of common sps. Habitat 1&2)**
- **Gamma diversity** is the **overall diversity for different ecosystems within a region** or **total diversity over a large area or region.**



Uses of Biodiversity

The different types of the **direct-use** value of biodiversity are for **food, medicine, biological control, industrial materials, recreational harvesting and ecotourism**.

- **Food**: in form of vegetables, fruit, nuts, meat, milk as well as food colorants, flavoring and preservatives.
- **Medicine**: Willow trees (salicylic acid; aspirin), Foxglove (digitoxin), Atropa belladonna (atropine), Opium sativum (codeine), Papaver somniferum (morphine), Chinchona ledgeriana (quinine).
- **Animals source products** (e.g. anticoagulants, coagulants, vasodilator agents) and for models on which to test potentially useful drugs or techniques.
- **Biological control**: Vector Control using biological agent
- **Industrial materials**: building materials, fibers, dyes, resins, gums, adhesives, rubber, oils and waxes, agricultural chemicals (including pesticides) and perfumes.
- **Recreational harvesting**: It is the harvesting of animals (e.g. fish, reptiles, birds, mammals) for display and as pets.

Threats to biodiversity

- **The global change in the factors responsible for biodiversity results into loss of biodiversity.**
- **Factors:**
 - **Land conversion,**
 - **Greater climatic changes & global warming,**
 - **Pollution,**
 - **Exploitation of natural resources,**
 - **Interference of ecosystem by alien species,**
 - **Habitat destruction**
 - **Genetic manipulation of species.**

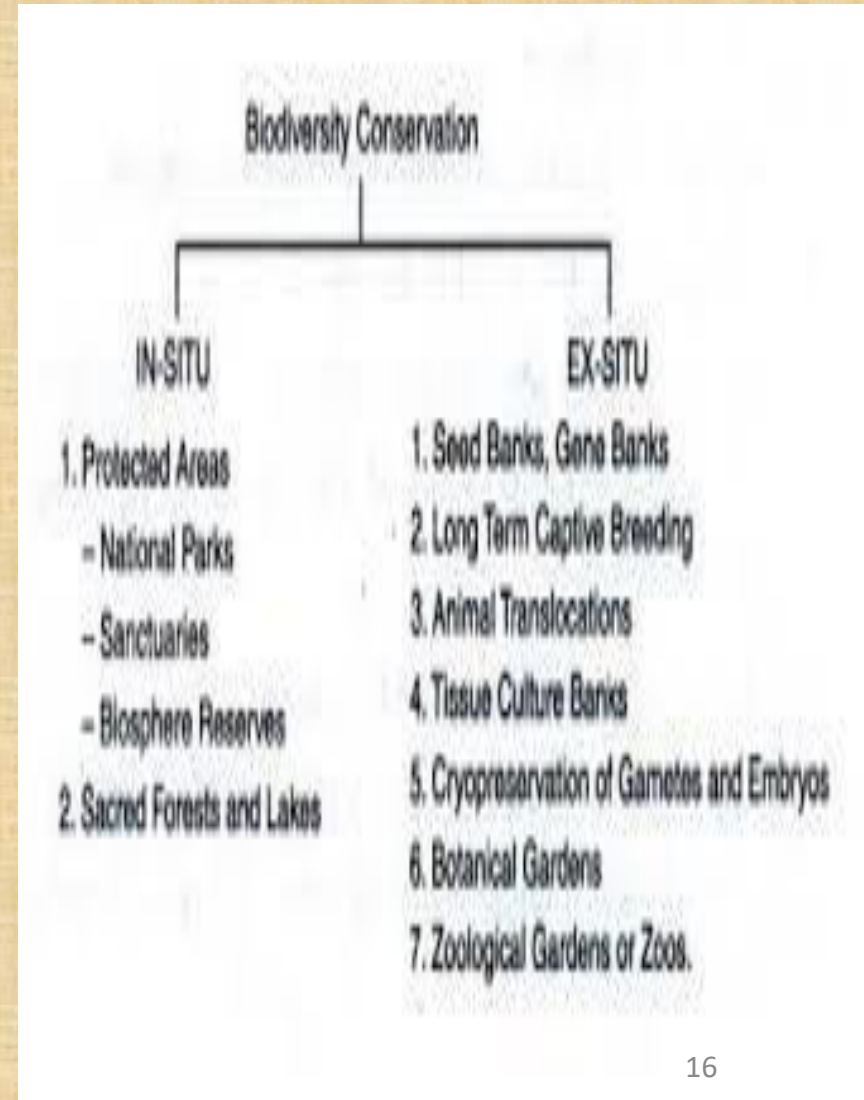
- **The secondary causes:**
- **Population growth,**
- **Unsustainable patterns of consumption,**
- **Increased waste production,**
- **Urban development and**
- **International conflict.**

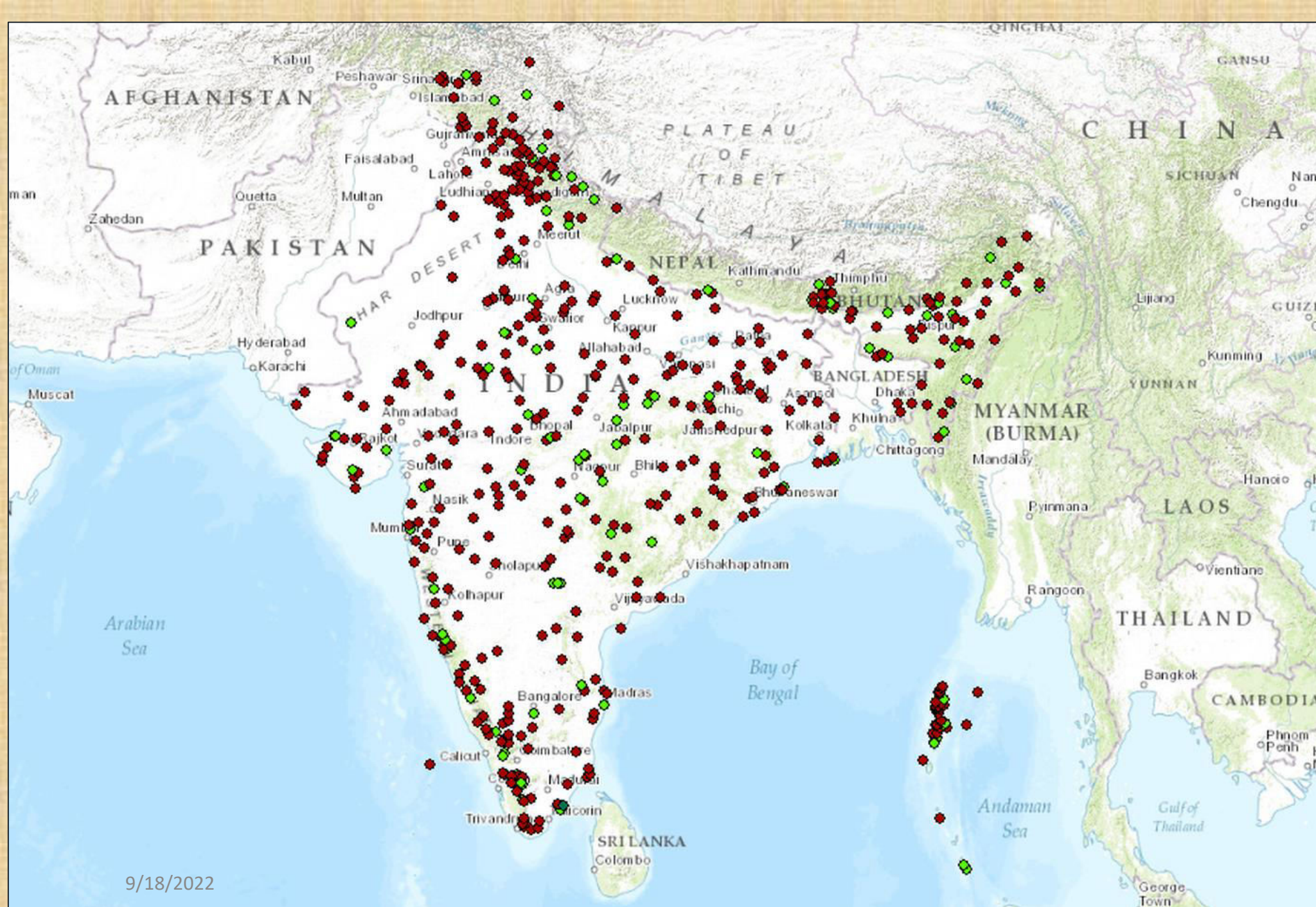
Mega biodiversity and Hot Spots

- Distribution of biological species across the world differs with **some area having full of life and others without life**. However the majority of region falls in between.
- **Mega diversity** zone can be defined as **the regions with large number of species in an ecosystem**.
- **Hot spots** concept was developed by **Norman Myers in 1988**.
- These are **the richest and the most threatened reservoirs of plant and animal life on earth**.
- There are **34 hot spots for conservation of biodiversity** has been identified worldwide, including four Indian hotspots.

Conservation of biodiversity

- **Conservation is defined as management of human use of biosphere so that it may yield sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of posterity.**
- **There are two basic strategies of biodiversity conservation**
 - **In-situ (on site) and**
 - **Ex-situ (off site).**





- + Biosphere Reserve
- ● National Park
- ● Sanctuary

Biodiversity conservation in India

- **India is known for its rich heritage of biodiversity**
- **It is one of the 17 mega-diverse countries in the world with 7–8 % of the world's recorded plant and animal species.**
- **Amongst the existing biota, 91,307 species of animals (2,557 Protista), 12,470 general invertebrates, 69,903 arthropods, 4,994 vertebrates, and 45,500 species of plants as well as 5,650 microbial species have been documented in India.**
- **About 5,150 plant species and 1,837 animal species are endemic to India.**
- **Its cultural and traditional diversity includes over 550 tribal communities of 227 traditional groups spread over 5,000 forested villages.**