Lecture 11: Biodiversity

- **W.G. Rosen** coined the term biodiversity.
- Biosphere has tremendous biodiversity with different lifeforms like 20k ants, 28k of fishes or orchids, Insects - 100k.
- Questions discussed (given in Sir's notes- these are covered in lec12) :
    - Why are there so many species?
    - Did such great diversity exist throughout earth's history?
    - How did this diversification come about?
    - How and why is diversity imp to the biosphere?
    - Would it function differently if diversity is less?
    - How are humans benefited?

What is biodiversity?
(It is synonymous to lifeform or life on earth i.e. how it's existing today and how it evolved?)
It is the variety among living organisms from all the sources including terrestrial, marine ecosystems.
Biodiversity is the "**totality of genes, species and ecosystems(location)**" and can be studied in these 3 angles. These 3 are hierarchical.
The 3 types of diversity:
1.Genetic: Variety of versions of same genes within individual species. Eg: Chihuahua, Beagle, Rottweilers (All are dogs species)
2.Species: No. of diff. Kind of organism within the same ecosystem.They produce fertile offspring. Eg: Monkey, Flower, Skimmer

TABLE 5.1 Estimated Number of Species

CLASS	NUMBER DESCRIBED	NOT YET EVALUATED[1]	PERCENTAGE THREATENED[2]
Mammals	5,491	0%	21%
Birds	9,998	0%	12%
Reptiles	9,084	82%	28%
Amphibians	6,433	2%	30%
Fishes	31,300	86%	32%
Insects	1,000,000	100%	27%
Mollusks	85,000	97%	45%
Crustaceans	47,000	96%	35%
Other invertebrates	173,250	99%	30%
Mosses	16,236	99%	86%
Ferns and Allies	12,000	98%	66%
Gymnosperms	1,021	11%	35%
Flowering Plants	281,821	96%	73%
Fungi, Lichens, Protists	51,563	100%	50%

[1]Evaluated by IUCN for threatened status.

Most threatened species is **Mosses**(86%)- (The species which have a very specific kind of requirement are threatened the most and due to reasons like climate these requirements are not fulfilled and so they tend to extinct)
Birds are least endangered since they can adapt to the environmental changes.

3.Ecological: No. of niches, tropic levels and ecological that capture energy, sustain food webs and recycle materials within systems
(ecosystems have different habitats where different organisms live like Arctic canada is habitat of polar bear Ursa Maritima, Heather moorland is habitat of grouse, freshwater lake and ponds allow fishes like Pike to live in.)
Earth has 1.5 million species of lifeform in 3.5 billion years of evolution.

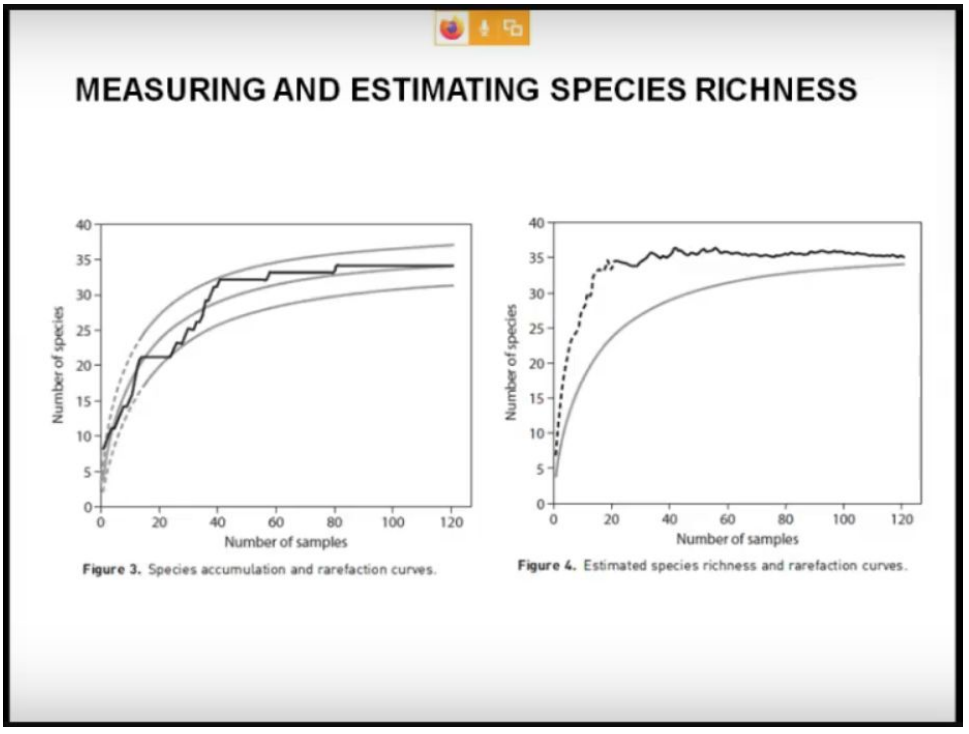
Other 3 types of diversity:
Alpha: (Within community)Diversity where organisms share same community/ Habitat
Eg: High tree diversity in Amazon Rainforests.
Beta: (Between Community) Diversity where organisms share 2 habitats.
Gamma: Diversity of habitat over total geographical area.
Relation: $\beta = \gamma/\alpha$

Measure of Biodiversity:

- **Richness:** No of species per sample.
  (More no of species, richer sample)
- **Evenness:** Measure of relative abundance of particular species in a given sample with equal richness.

  This shows us that the species whose abundance is lesser are more threatened.
  This relative abundance is also a function of 3 things:
  - **Size of geographic range** where it get nutrients and requirements (localised v/s not localised)
  - **Habitat specificity** (like Flamingos prefer shallow waters only)
  - **Local population density** (sparse v/s non sparse)

Richness of species is calculated by the different samples. More the no. of samples more accurately you will get different species.



Biodiversity is expressed as the species richness indices which is the count of no. of diff. Species in a given area. It depends on sampling size and effort.

1) **Margalel's diversity index**

   D_{Mg} =(S-1)ln(N)

2) **Mehinick's diversity index**

   D= S/ $\sqrt{}$(N)

   Where N= total no. of individuals in sample
   S= No. of species

IMPORTANT:

1) Simpson's diversity index:

Measures the probability that 2 individuals randomly selected will belong to the same species or category i.e. D.

$$D = \frac{\Sigma\, n(n-1)}{N(N-1)}$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species

2) Shannon Index or entropy

It quantifies the uncertainty (entropy) associated with prediction.

$$H = -\sum_{i=1}^{s} p_i \ln(p_i)$$

where

H = the Shannon index value
p_i = the proportion of individuals found in the ith species
ln = the natural logarithm
s = the number of species in the community