BIODIVERSITY AND CONSERVATION

→ More than 20,000 species of ants.
→ 3,00,000 species of beetles
→ 28,000 species of fishes.
→ 20,000 species of Orchids.

→ Biodiversity term = Sociobiologist Edward Wilson

Biodiversity

→ Occurs at macromolecular levels, species level.

(1) Genetic Diversity.

Single species → High diversity at genetic level, over it's distributional range

→ Medicinal plant (Rauwolfia Vomitoria)
active chemical (reserpine) ← potency.

→ >50,000 → diff rice.
1,000 → varieties of mangoes.

(2) Species Diversity.

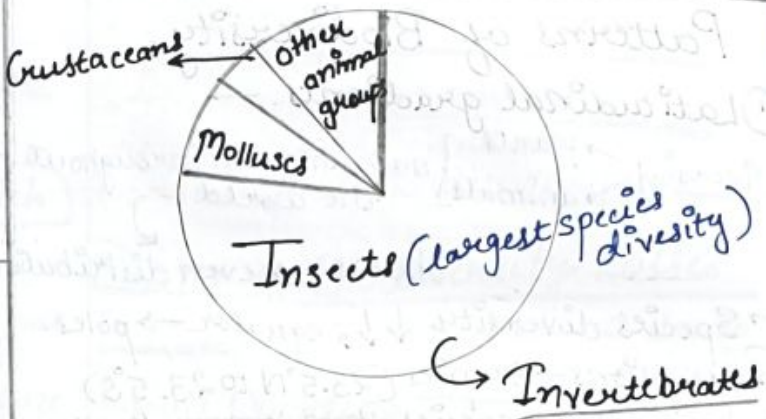
Diversity at species level.

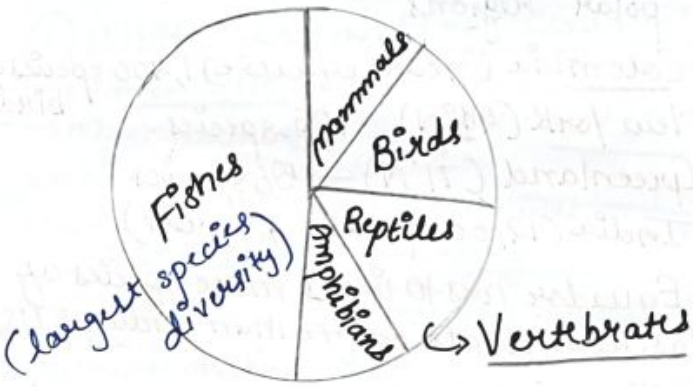
e.g. → Western Ghat > Eastern Ghat
amphibian diversity.

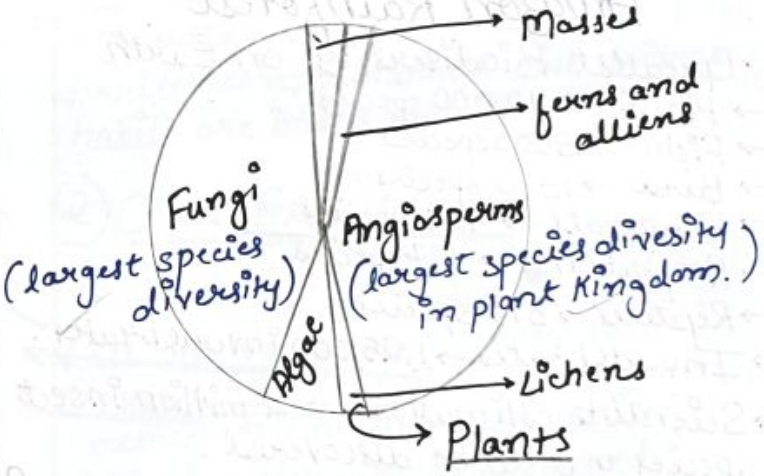
→ Because Western → Rainfall ↑↑.

(3) Ecological Diversity

→ Diversity at ecosystem level.
→ Tropical Countries ecosystem ↑↑.
→ Scandinavian Country Norway ↓↓
→ Evoluation - Million of Years







→ No estimations for prokaryotes
↳ Convectional methods are not suitable for identifying microbial species and many species are not culturable in lab

International Union for Conservation of Nature and Natural Resources (IUCN) (2004)

↳ Total no. of plant and animal species described → > 1.5 million
→ some extreme estimates ranges from 20-50 million
→ Estimation by Robert May → 7 million

→ >70% species → Animals
→ Plants → 22% (algae, bryo, pterido, gymno, angio...)
→ Animals = Insects most species rich taxonomic grp. → >70% of total.

India

→ 2.4% World's land area
→ 8.1% species diversity.

One of 12 mega diversity country.

→ 45,000 species of plants (1 lakh estimated)
→ 90,000 species of animals (3 lakh estimated)

→ 22% species recorded as per May's estimation
→ Threat of extintion.
→ Nature's biological library is buring

even before we catalogued the titles of all books stocked there.

Patterns of Biodiversity

① Latitudinal gradients. →

Diversity → plants, animals } not uniform throughout the world. → shows uneven distribution

→ Species diversity ↓↓, equator → poles.

↳ exceptions – tropics (23.5°N to 23.5°S) (habour more species than temperate or polar regions

→ Colombia (near equator) 1,400 species of birds.
→ New York (41°N) – 105 species.
→ Greenland (71°N) – 56 species
→ India (1200 species of birds)
→ Equador has 10 times more species of Vascular plants than midwest USA.

Amazon Rainforest

→ Greatest Biodiversity on Earth
→ Plants → 40,000 species
→ Fish → 3000 species
→ Bird → 1300 species
→ Mammals → 427 species
→ Amphibians → 427 species
→ Reptiles → 378 species
→ Invertebrates → 1,25,000 invertebrates **
→ Scientists estimation → 2 million insect species yet to be discovered.

Why tropics have greater Biodiversity?

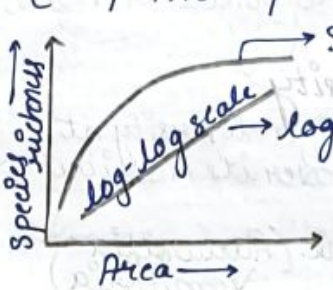
① Temperate areas are prone to glaciation, tropical areas are relatively undisturbed.
② More Solar energy (sunlight)
③ Tropical environment is less seasonable to promote niche specialisation

Species Area Relationships →

→ Alexander Von Humboldt (german naturalist, Geographer)
↳ within a region, species richness increased with increasing explored area but only upto a limit.

→ Species Richness are area Graph is Rectangular Hyperbola.
→ Log Scale – Straight line (*)
→ $\log S = \log C + Z \log A$ (*)

Here, S = Species Richness.
A = Area
Z = Slope (regression coefficient)
C = Y-intercept.



Z lies in range of 0.1 to 0.2
But, for entire continents, Slope is much steeper → 0.6 to 1.2
→ For frugivorous birds and mamm... in tropic forest of different continents is 1.15

Importance Of Species Diversity →

→ Communities with more species are more stable

What is stability for a biological Community?

↳ Should not show too much Variation in productivity from Year to Year.
→ Resistant / resilient to occasional disturbances.
→ Resistant to invasion of alien species.

David Tilman's experiments on outdoor plots showed that →
Plots with more species showed less Year to year Variation in total biomass.
→ ↑↑ Diversity → ↑↑ productivity.

→ Rich Biodiversity → imp. for ecosystem health and survival of human race on this planet.

Stanford Ecologist Paul Ehrlich
↳ Rivet Popper Hypothesis.
Airplane – ecosystem
Rivets – Species
Paul Ehrlich

→ If every passenger starts popping a rivet (extinction of species), it may not affect flight safety initially, but as more and more rivets are removed, plane becomes weak (ecosystem becomes less stable).

→ Loss of critical Rivets (Key Species) will be more series threat to safety than loss of less imp Rivets (Species).

Loss Of Biodiversity

→ How many Species extincted?
↳ Colonisation of tropical Pacific Islands by humans led to extinction of more than 2000 species of native birds.

→ IUCN Red list documents → (2004)
(784 species in last 500 years)

Vertebrates → 338 species
Invertebrates → 359 species
Plants → 87 species.
→ Recent extinctions. →
(1) Dodo – Mauritius
(2) Quagga – Africa.
(3) Thylacine – Australia – (Vimp)
(4) Steller's Sea Cow – Russia
(5) 3 subspecies of tiger (Bali, Javan, Caspian)

→ Last 20 Years → 27 species dissapeared

→ 15,500 species worldwide are facing threat of extinction
→ 12% → Birds species
→ 23% → Mammals species
→ 32% → Amphibians species
→ 31% → Gymnosperms species
} face threat of extinction

→ We are witnessing 6th mass extinction which is 100 to 1000 times faster than earlier 5 extinctions.

Loss of Biodiversity may lead to →
→ Decline in plant production
→ Lowered resistance to environmental pertubations.
→ Increased variability in ecosystem processes such as plant productivity, water use, pest and disease cycles.

Causes of Biodiversity Losses

↳ ↑↑ species extinction → largely due to human activities
↳ Evil Quartet

(1) Habitat Loss and Fragmentation

→ No. 1 cause
→ Most dramatic examples comes from tropical rain forests. →
Earlier 14% of Earth's area was covered by rainforest, but now only 6%
→ Amazon Rain Forest (Lungs of Planet) habouring million of species is cutted for soya bean cultivation, grassland → beef cattle.
→ Mammals and birds requiring large territories and animals with migratory habits are badly affected.

(2) Over-Exploitation

Need → Greed > Over-exploitation of natural resources.

Last 500 Years →
↳ Steller's Sea Cow, Passenger pigeon were extinct due to over-exploitation.
→ Marine fish are endangered

(3) Alien Species Invasion

Alien Species introduced unintentionally or deliberately → invasive and cause decline/extinction of indigenous species.

(1) Nile perch → Introduced in Lake Victoria in East Africa
↓
200 species of cichlid fish went extinct.

(2) African Catfish (Clarias gariepinus) illegally introduced as threat to our indegenous Catfish

③ Invasive Weeds – Carrot Grass (parthenium)
→ Lantana (Bengal)
↳ Water hyacinth (Eicchornia)

④ Co-extinction
↳ Obligatory associations lead to co-extinctions.
→ eg. – Host fish and parasites
Plant pollinator Mutualism

Biodiversity Conservation

① Narrowly Utilitarian →
→ for Ordinary people.
→ Direct economic Benefits.
→ Food (cereals, pulses, fruits)
→ Firewood, fibre, construction material
→ Industrial products (tannins, lubricants, dyes, resins, perfumes).
→ Medicinal importance (25,000 species)
→ >25% drugs → plants.
→ Bioprospecting – Exploring molecular, genetic and species level diversity for products of economic importance. (*)

② Broadly Utilitarian →
→ for mature people
→ ecosystem services that nature provides
→ O_2 → Amazon produced 20% of it.
→ pollination
→ Aesthetic pleasures

③ Ethical Arguements →
→ for Saints.
→ We owe to million of species with whom we share this planet.
→ Every species has an intrinsic value, even if they don't have economic Value to us.

How do we Conserve?

① In-Situ Conservation (on site)

① Biodiversity Hotspots (25+9) = 34 (*)
→ High level of species richness.
→ High degree of endemism.
→ Accelerated habitat loss.
→ India have 3 →
→ Western Ghats and Srilanka.
→ Indo Burma.
→ Himalya
→ Cover 2% of area, but reduce extinction by 30%.

② 14 Biosphere reserves
90 National parks
448 Wildlife sanctuaries
} In India

→ 

③ Sacred Grooves →
Khasi and Jaintia Hills – Meghalaya
Aravali Hills – Rajasthan
Western Ghats – Karnataka and Maharashtra
Sarguja, Chanda and Bastar → Madhya Pradesh

② Ex-Situ Conservation
→ Zoological Parks (off site)
→ Botanical Garden
→ Wildlife Safari parks.
→ Cryopreservation of gametes.
→ Seed preservation in seed banks

Historic Convection on Biological diversity → Earth Summit
1992 → Rio de Janeiro
→ World Summit on sustainable development – Johnnesberg (South Africa)
2002.
→ 190 countries pledged to reduce biodiversity loss at global, regional and local level.