Biodiversity and conservation

Any alein earth visit ⟶ large no of biodiversity visible

- more than 20,000 type orchids
- 3 lakh - beetle
- 30,000 type fishes

Q which of the following has max biodiversity?

⟶ Beetle

Earth has large amount of biodiversity. ⟶ WHY? HOW?

⇒ Diversity in earth lead to such enormous diversity.

Edward Wilson # → sociobiologist → Diversity present at every level of biological organization (macromolecule to even habitat)

Different level of Biodiversity

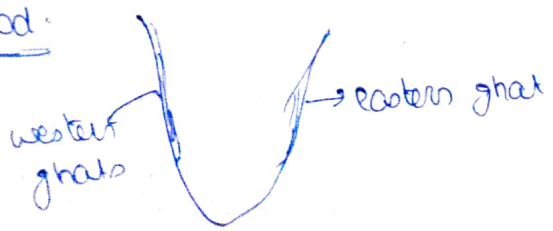
a) ~~Species~~ level of Genetic = within species some differences at genetic level

- Thus biodiversity present at distributional range.

Ex - Rauwolfia vomitoria = Give chemical → Reserpine (Cure B.P)

over distributional range reserpine shows difference in concentration of reserpine and potency

b) Species level of biod.



• More amphibian species than eastern ghat :

iii) Ecological biodiversity - Different type of ecosystem

India - ecological diversity rich - Desert, Rainforest, mountain, estuaries, coral reef, alpine meadows

↓

as compared to scandinavian country.

How much biodiversity is present ?

• IUCN - international union for conservation of nature

↳ Total reported species = more than 1.5 million

↳ Total how much species is present (1.7 - 1.8 million)

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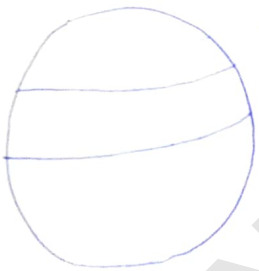
we need to make prediction (many scientist have gave their educated data)

Some of observation # :



Temperate → inventory of taxonomic group is more or less complete.

equator (tropical) → many of species in tropical is not still observed.

• To predict total no of species → temperate - tropical region conicles data is extra polate.

• many scientist gave their prediction (20 - 30 million)

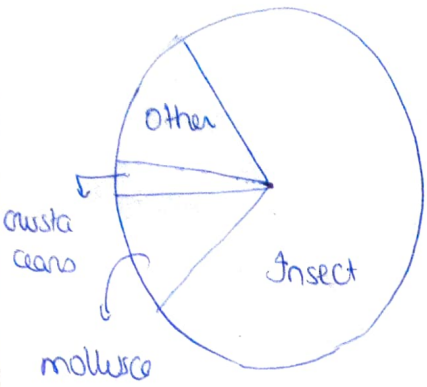
• Nearly correct observation was of Robert May - 7 million species → out of which 1.5 million discovered means 22 %

Some important aspects of biodiversity

① Animals are more as compared to plants

② out of 100 % — 70 % animal
22 % plant
8 % other (not bacteria may be protista)

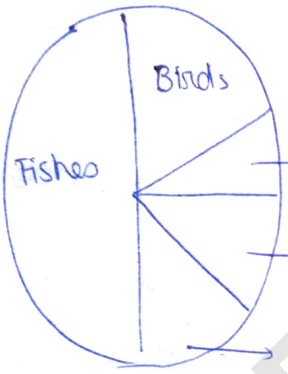
- Out of every 10 animal species → 7 are animals.



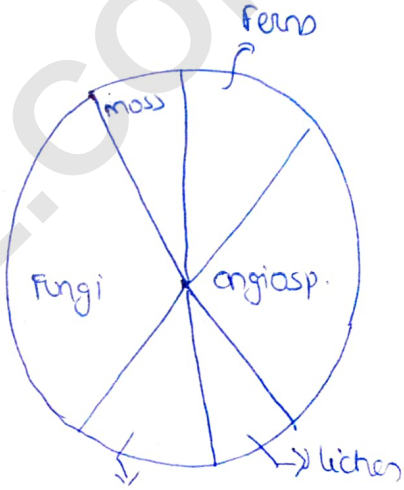
Largest phylum = arthropoda

2nd largest = mollusca

invertebrate



vertebrate



Lowest biod. = Gymnosp.

Fungi > Algae > > moss > lichen

angiosperm fern

Bacteria is not included in biodiversity counting:

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1. Not easy to culture
2. Two species show difference only in chemical
3. Current taxonomic method is not appropriate

If we consider Bacteria in biodiversity, estimate by Robert may it can go into 1 million

Biodiversity situation in India

Top 12 Biodiversity country - India included

, area of India - 2.4% land area

, Biodiversity - 8.1% of total biodiversity

45000 plant diversity and 1 lakh animal species were reported

↓

If Robert may estimation correct (1 lakh plant & 3 lakh animal)

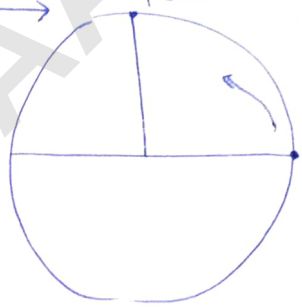
↓

22% percent discovered

Is any pattern in Biodiversity ??

- Plant and animal species - Heterogeneous
- If we consider no. of species → we can observe no of pattern

1) Latitudinal pattern :- →



on moving from equator to pole

↓

no. of species decreases

2) Area of species richness :-

Pattern in Biodiversity ↗

1) Latitudinal behaviour :- as plant and animal show large amount of heterogeneous behaviour,

as we move away from equator → Biodiversity decreases.

maximum biodiversity = 23.5°N to 23.5°S

Other examples :

① Colombia - equator - 1400 species but when we move
41°N → 105 (new york) , 71°N = 56 (Green land)

India - near tropical climate - Biodiversity bird = 1200 species

② Equador (on equator) more vascular than USA.

③ Amazon forest → Large amount of biodiversity.
(South America) 1.25 lakh = invertebrate
40000 = Plant
3000 = Fishes
427 = mammals
amphibians
378 = reptiles

Why equator is biodiversity rich

a) Equator :- not interfere by frequent Glaciation and get sufficient time for speciation. (Speciation is function of time)

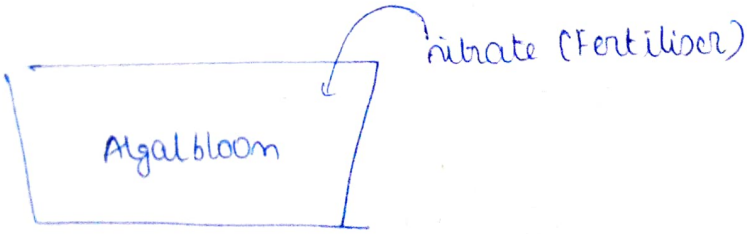
b) Equator is not seasonal → Equator species have sufficient time for niche specialisation.

c) Tropical condition solar input more → more productivity which lead to indirect increase in species formation of biodiversity.

more biodiversity → more is productivity ✓

more is productivity → more is biodiversity ✗

more productivity decrease biodiversity



- Productivity increase
- aquatic lifeharm

→ Biodiversity decrease

Species area relationship

Species richness

A

B

area B have more species richness.

Species evenness

Crow = 5
Parrot = 1
Beetle = 3

P

Crow = 2
Cow = 2
Cockr. = 1

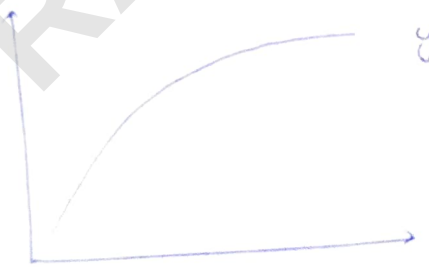
Q

Area Q have more species evenness.

→ A.V Humboldt :- Ans Analyse area of south america forest.

As we increase area species richness increases but upto an extent

Species richness $\propto A^2 \Rightarrow \boxed{S = CA^2}$



graph appeared to be rectangular hyperbola.

$S = CA^2 \rightarrow \log S = \log C + Z \log A$

$y = c + mx$

Z = regression coefficient

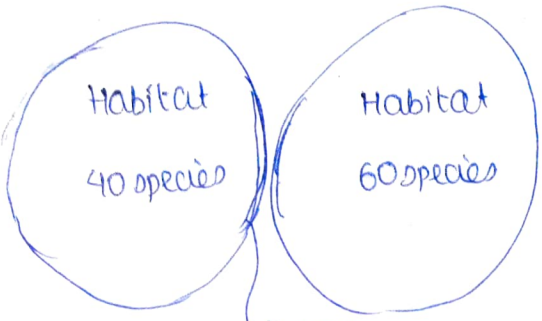
$\boxed{Z = 0.1 \text{ to } 0.2}$

never depend on area & taxonomic Group.

For some taxonomic group value of $Z = 0.6$ to 1.2 higher than normal.

↳ mammals, fruit eating birds, angiosperm

Large continent = value of Z higher.



↳ ecotone corners - biodiversity high

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Edge effect

Importance of Biodiversity

If total ant species = 20000, if 15000 ants would extinct

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How does it effect you?

Ans Paul Ehrlich ⇒ Rivet poppet Hypothesis ⇒ Explain by analogy

Airplane ⟶ Ecosystem

popping of rivet → Extinction of species

wings remove ⟶ keystone species

Stability of airplane weak ⟶ stability of ecosystem weak

- Acc. to this hypothesis airplane passanger while ~~taking~~ travelling back take home some poppets(rivet). Initially not much impact but ultimately airplane get weak.

(Important parts - wings - poppy)

David Tilman :- External plot experiment

Species = 50 → 2017 - annual prod = 100
→ 2018 = 105
→ 2019 = 102

Species = 10 → 2017 = 120
→ 2018 = 60
→ 2019 = 70

Area with more no. of species shows least variation in annual productivity.

If more biodiversity → more stability in terms of

a) any alein species if enter ecosystem with more biodiversity show more resistance.

b) Ecosystem with more biodiversity is resilient to interval disturbance.

c) more biodiversity gur stable productivity.

Loss in Biodiversity

In recent time - we have no evidences of evolution of new species

But we have evidences of extinction

Ex = 2000 species of bird extinction when human inhabited Pacific island.

IUCN - Red data list (2004) :- 784 species extinct → 87 plants
→ 338 verte.
→ 359 in-verte.

Extinct Species

① Bali, Jawan and Caspian - Tiger subspecies which are extinct

② Dodo - Flightless - mauritius

③ Quagga - Africa

④ Thylacine - Australia

⑤ Stellar sea cow - Russia

⑥ Passenger Pigeon

Threat of extinction

15,500 species are facing threat → 12% Birds, 23% mammals (large size)

→ 31% Gymnosperm

→ 32% amphibians – (Fresh water resources are now polluted)

Out of 15,6500 → more than 650 from India

IUCN _ Red data list

1. Extinct species
2. Extinct in wild
3. Critically endangered
4. Endangered
5. Threatness

→ Threatened

6. Lower risk
7. Data not evolved

Rate of extinction → earth = 5 major episodes of mass extinction already occurred.

Previous extinction was not due to human.

we are on sixth episode of mass extinction.

This sixth episode of extinction is 100 to 1000 time faster than previous → we can lost our 50% Biodiversity with this speed in coming 100 year.

Impact of extinction

① Decrease in population productivity

② Disturbance in various ecological process like water cycle, O_2 cycle.

③ Alein species — Invasion Impact

④ Stability decrease.

4 reason loss in Quartret (Evil Biodiversity)

i) Habitat loss and fragmentation (most Imp. Reason)

Habitat loss → Forest are cleared for agriculture & other purpose

Ex - Amazon forest = Initially 14% area of total land
↓
Now occupy only 6%.
↓
cut for soyabean cultivation & Beef cattle.

Fragmentation :- main loss to large size, mammal & bird (migrat.)

ii) Overexploitation :- needs turns into greed

Some animals over exploited and extinct

Ex - Steller sea cow, Passenger pigeon

Marine fish - is over captured.

iii) Alien species invasion :- any species if entered into new habitat (no natural predators)
↓
number increase lead to extinction of others

Ex - Parthenium, Lantana, Eicchornia (ornamental)
(weed) (weed)

Nile Perch → introduced into lake victoria → overfeeding of food leads to extinction of 200 Cichlid fish.

→ African cat fish (Clarias Gariepinus) - introduced into indian water illegally it compete indian cat fish (extinct)

IV Coextinction

- If two species depend on each other extinction of one leads to extinction of other

Ex - Lichen (mutualism)

Pollinator and plant (wasp & Fig)

Obligate parasite if host extinct them parasite also get extinct.

Note: If Co-evolution has occurred then only Co-extinction

Imp :→ Why we need to conserve biodiversity ?

- Three reason :

(1) Narrow utilitarian - Direct benefit

(2) Broadly " = Indirect "

(3) Ethical ways

(1) Narrow Utilitarian : - Direct benefit

→ Biodiversity provide - food, timber, product for industry (Rubber etc.)

25% drugs - directly obtain from plants

- 25000 - plant species - traditional medicinal use

Bioprospecting : - Exploring molecular genetics & species level diversity for economic value -

(In tropical forest - still large no. of plants are undiscovered & have medicinal value.)

Broadly utilitarian # - Some indirect benefit which are product of ecosystem services.

① O_2 = Product of ecosystem (To calculate cost = cost of O_2 cylinder)
(Amazon - 20% O_2)

② Pollination → Fruit & seed for food

③ Aesthetic pleasure :- pleasure you obtain → Blooming flower

Ethical reason

- all living organism microbe, animal plant - share earth
- Some species may not have some economic value but have intrinsic value to exist

How we conserve biodiversity

- Two approach

① In situ conservation

- always conflict between conservation & development
- To conserve tiger → entire forest conserve
- No urgent need of conservation
- Resources are limited for conservation

a) Hotspot

① Meyers (Scientist)
↓
Hotspot are biodiversity rich
- High degree of endemism (limited area)

b) Protected areas

- By law protection is done
- a) Wildlife Sanc
  b) National park

c) Sacred Groves

Rate of extinction is also high.

- Initially -25 Recognised later 9 is added
- Total hotspot = 34 on earth
- Hotspot - total land area - less than 2%

↓

if we were able to save in hotspot, then mass extinction decreases by 30%.

① 3 Hotspot :

- Western ghats & Sri Lanka
- Himalayas
- Indo-Burma region

Protected areas

a) • wildlife sanctuaries (448)

↓

grazing allowed. Human settlement allowed.

• Forest product can be collected

b) National Park (90)

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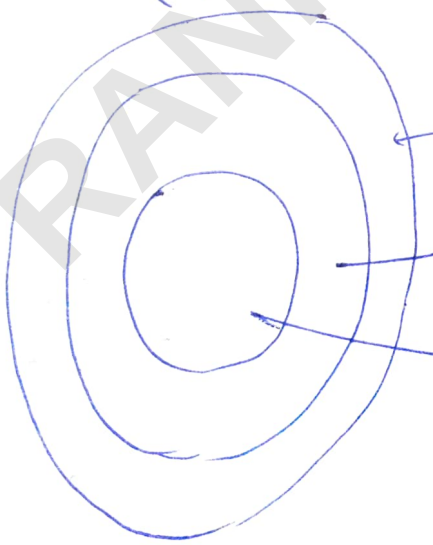
Grazing & Human settlement not allowed.

→ many national park upgraded from wildlife sanc.

→ more animal species specific

c) Biosphere reserve large area (14)



outer area (some intervention allowed)

Buffer - limited activity (Research + studies)

core - dense forest

Even boundaries in more than 2 state.

Sacred Grove

. Some forest tract which are kept for tribes to protect

, Ex - Garo , Khasi, Jaintia hills, Aravalli Hills, Chanda, Bastar, Sargaja, western ghat & M.P

Sacred groves are the last resort for protection of biodiversity in Meghalaya

Ex-situ conservation

- it is off site conservation

→ any organism conserve away from its habitat in Human protection.

Ex - ① Zoological Park

② Wildlife safari Park

③ Botanical garden

④ Cryopreservation (196°C)

⑤ Pollen bank

International efforts for conservation

① 1992 = Rio - conference = Earth Summit

↳ conservation of biodiversity and sustainable development

② 2002 - Johannesburg - world Summit (South Africa)

↳ decrease in rate of biodiversity loss at global, local Regional