

Biology Handwritten Notes  
On  
Biodiversity and Conservation



## Biodiversity and Conservation

- Ants > 20,000
- Orchids 20,000
- Beetles 3 lacs
- Fishes 28,000

- Edward Wilson popularised the term biodiversity.

- Genetic diversity  
variety of genetic information within a species.

may be w.r.t

- Alleles
- Entire gene
- Chromosomal structure

- Benefits

★ Ability to adapt to changed environment conditions: Better

★ Basis of speciation.

Viruses	10 - 150 genes
Mycoplasma	450 - 700 genes
Oryza	32000 - 50000

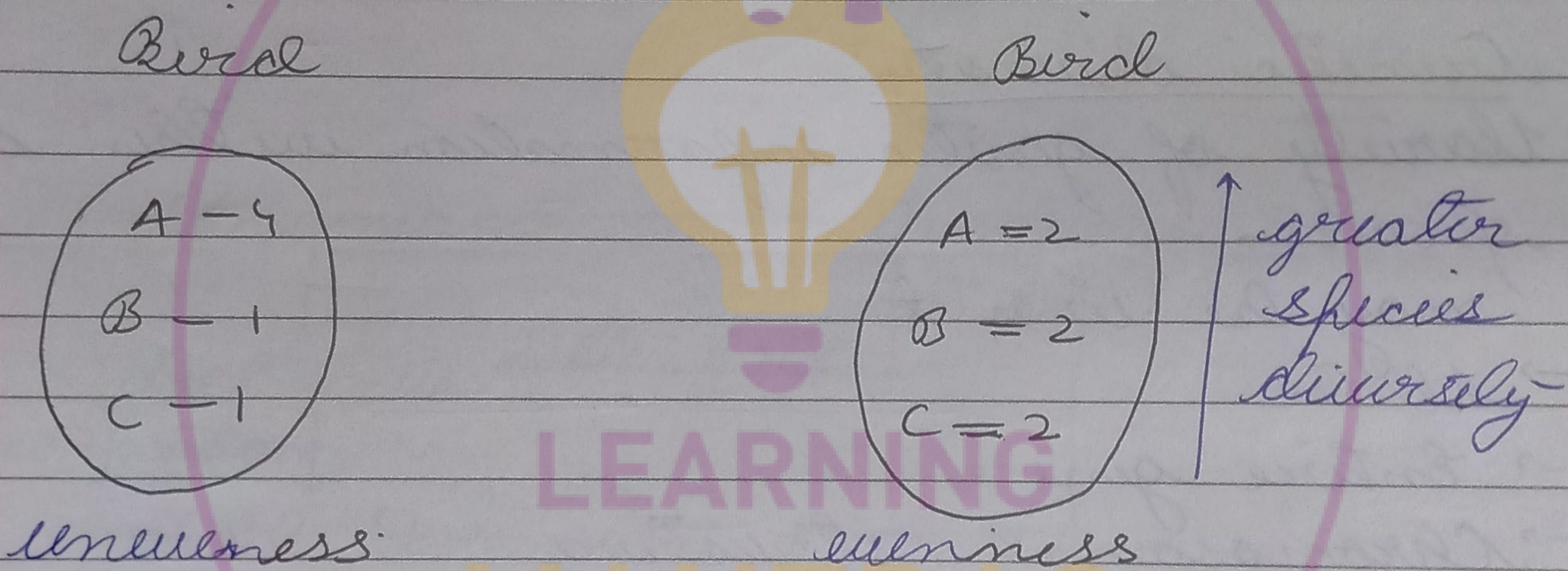
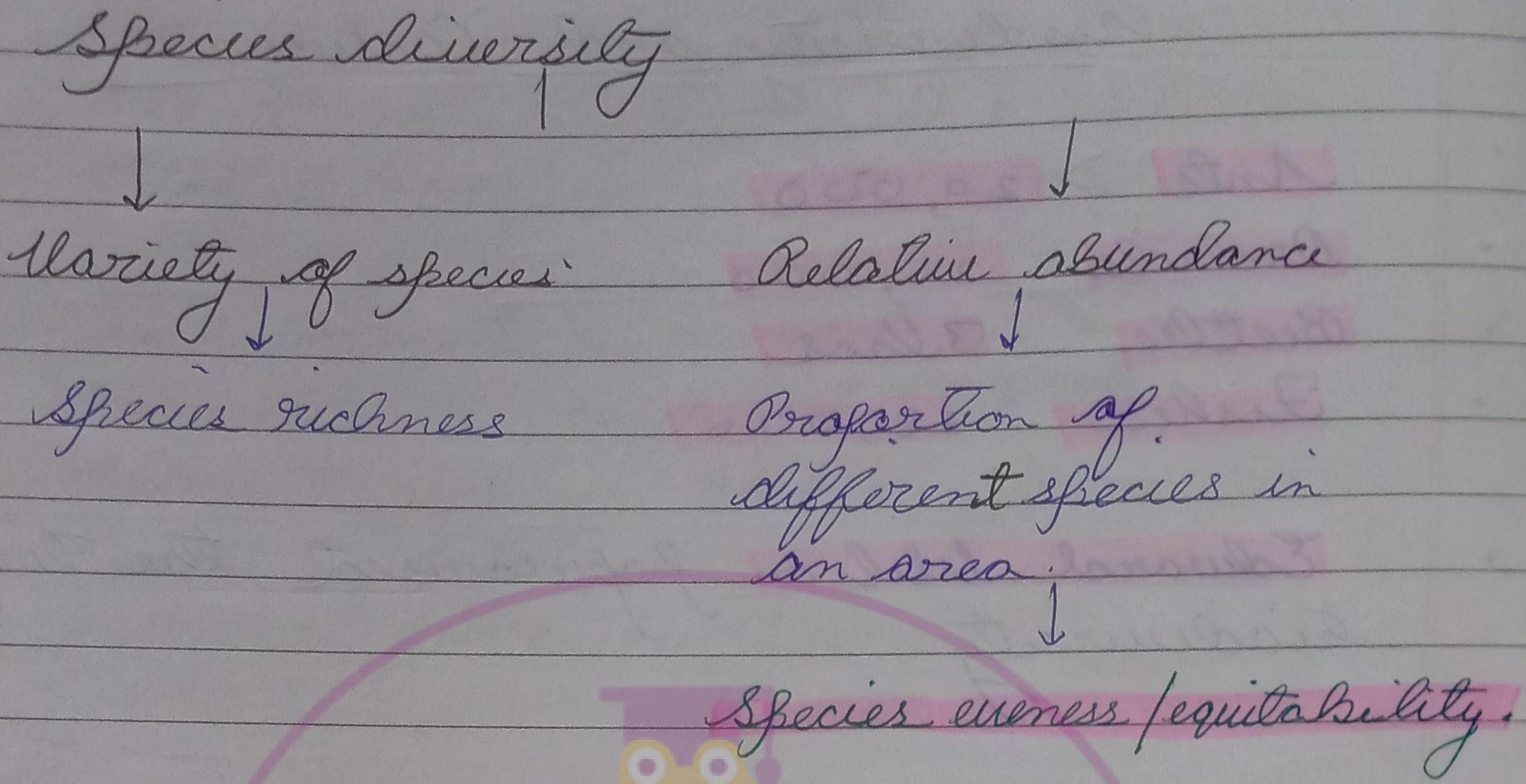
In India

Mango - 50,000 - 1000

Rice - 50,000



Higher the evenness greater the species diversity.

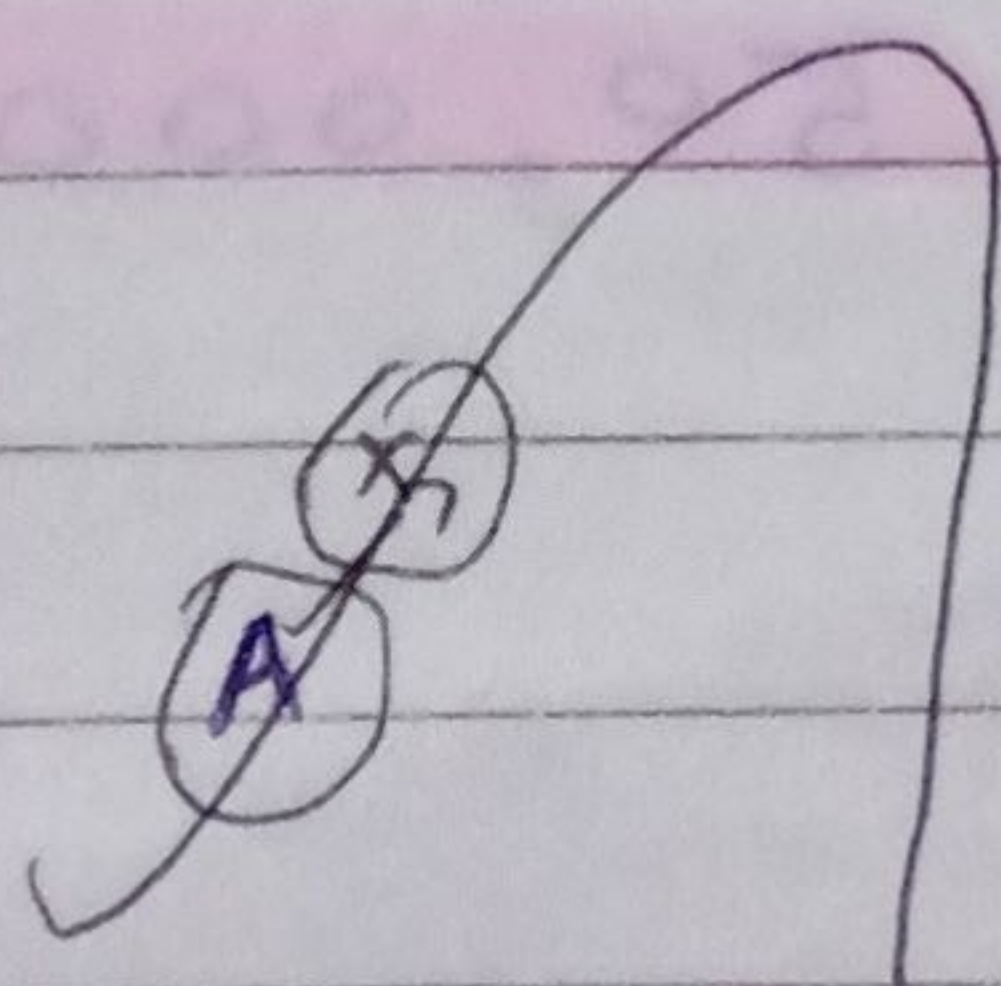


### Ecological diversity

It is at the level of community and ecosystem diversity.

-  $\alpha$  diversity: diversity of organisms within a community.

-  $\beta$  diversity: Rate of replacement of species along a gradient of habitat or community.



i.e. diversity between the community.  
i.e. different type of species b/w two community.



-  $\gamma$  diversity : Total species richness of all the habitat in a larger geographical area.

$$\gamma = \alpha \times \beta$$

India has a greater ecosystem diversity than Scandinavian country like Norway.

How many species are there on earth  
IUCN (2004)

So far - discovered, described > 1.5 million

Total - 40 to 50 million

Robert May - 7 million

> 70% are animals

22% plants

Insects - > 70% among all animal species

Diversity in India

2.4% of area

8.1% of global diversity

among the 12 mega diversity.



• Endemism is higher in western ghats w.r. to amphibians.

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22%

Let to be discovered

Plants - 45000

> 1 lac

Animals - twice

> 3 lac  $\times 10 = 8$

India - 10 Biogeographical regions

- |   |                 |    |                  |
|---|-----------------|----|------------------|
| 1 | Himalayas       | 6  | Deccan Peninsula |
| 2 | Trans Himalayas | 7  | Coastal plains   |
| 3 | Deserts         | 8  | North east       |
| 4 | Semi-Arid       | 9  | Coasts           |
| 5 | Western-Ghats   | 10 | Islands          |

• Endemic Species

Amphibians	—	60%
Fishes	—	53%
Reptiles	—	36%
Angiosperms	—	33%
Mammals	—	10%

• Patterns of Biodiversity

• Master gradients

↳ Latitudinal

↳ Altitudinal



## Latitudinal gradient

↑ Bird species

- Greenland - Arctic ( $71^{\circ}\text{N}$ ) - 56
- New York - Temperate ( $41^{\circ}\text{N}$ ) - 105
- Columbia - Equator - 1400

India - mostly tropic - 1200 species

## Vascular Plants

Equador (Tropic) > 10 times Mid-west USA (Temperate)

Tropical rainforest: Amazon has greatest biodiversity.

Lungs of planet = 20% of total atmospheric  $\text{O}_2$

- 40,000 - plants
- 3,000 - fishes
- 13,000 - birds
- 427 - mammals
- 427 - amphibians
- 378 - reptiles
- > 1,25,000 invertebrates

Why species diversity is high in Tropic

- (i) Speciation is a function of time. As compared to temperate, Tropics were relatively



undisturbed. Leading to longer evolutionary time period which resulted in diversification of species.

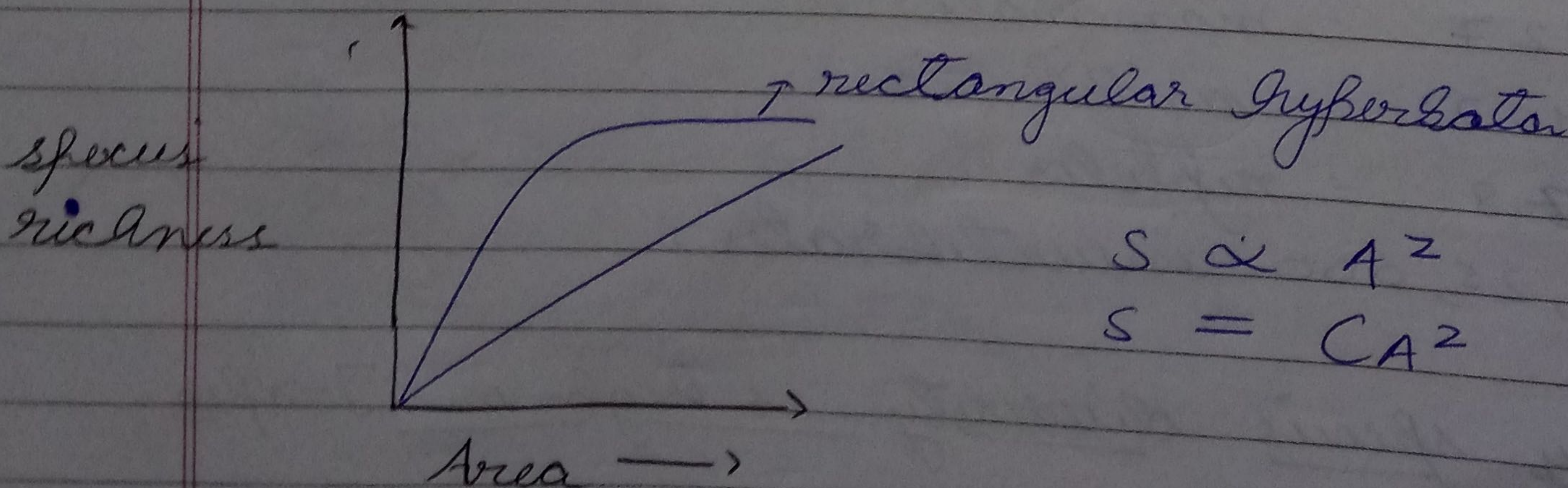
2. Climatic condition: constant i.e. less seasonal. Local species tend to survive.

3. Warm temperature, humid environment favourable for survival of species.

4. Higher solar radiation, greater productivity leading to higher species diversity.

★ 5. Greater insect species which help to pollinate leading to more outcrossing in plants leading to greater genetic variability which leads to speciation.

Species - Area - relationship  
Alexander von Humboldt





$$\underbrace{\log S}_{\text{species richness}} = \underbrace{\log c}_{\text{y intercept}} + \underbrace{z}_{\text{slope of line (Regression coefficient)}} \log A \rightarrow \text{Area}$$

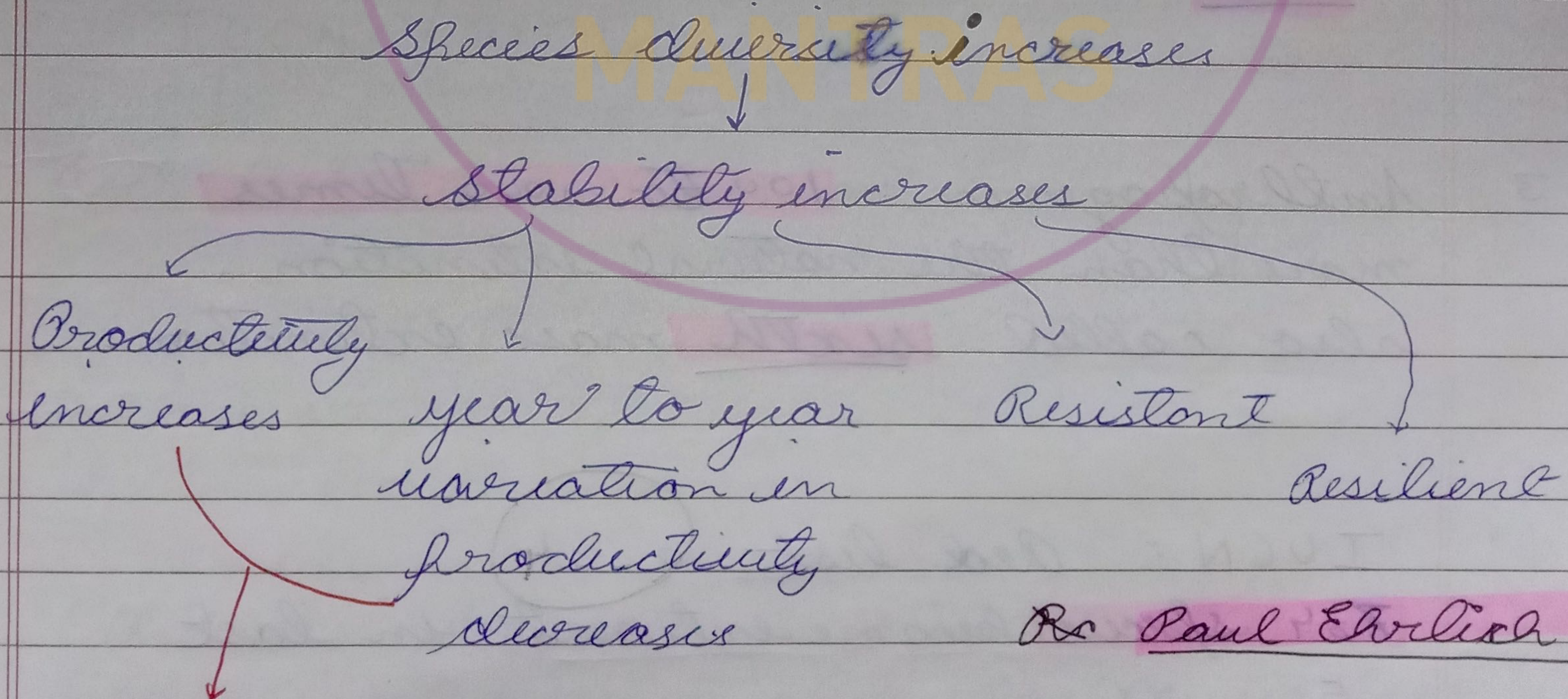
$$z = 0.1 \text{ to } 0.2$$

continent : slope of is steepest

$$z = 0.6 - 1.2$$

for frugivorous birds  $z = 1.15$

### Importance of species diversity to the ecosystem



David Tilman

Long term experiment

Ecosystem - Aeroplane

Species - Rivets

Key species - Allings



## Loss of Biodiversity

Extinction - from earth

Extirpation - Local area

e.g. cheetah in India

## Types of extinction

1. Natural Extinction: slow rate.

2. Mass extinction: Large no. of species are eliminated due to catastrophic events.

• Five mass extinctions have occurred.

3. Anthropogenic: 100 to 1000 times more than the natural extinction. also called sixth mass extinction.

• IUCN: Red list (2004)

784 species became extinct in last 500 yrs

vertebrates - 338

invertebrates - 359 (highest)

plants - 87

(75.1) of the above extinctions were due to human activities.



WCU → world conservation union

classmate

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## Extinction

- Dodo — Mauritius
- Stellar sea cow — Russia
- Passenger Bird — America
- Thylacine (Tasmanian wolf) — Australia
- quaga — Africa

Tiger — Bali, Sumatra, Caspian

• last 20 years — 27 species

• 2000 birds species have become extinct due to colonisation of tropical rain forest.

IUCN / WCU

↓  
Red list / Red data book

↓  
Species, subspecies facing various degrees of extinction

8 Categories

1 Extinct: A taxon is extinct when there is no reasonable doubt the last individual has died.

2 Extinct in wild: A taxon is extinct in wild when after exhaustive survey in known and or expected habitat - none failed



Endangered species

to record an individual.

3

Critically endangered : A taxon is critically endangered when it is facing extremely high risk of extinction in wild in immediate future.

4

Endangered : near future.

5

Vulnerable : medium term future

6

Lower Risk : A taxon is lower risk when it does not satisfy the criteria of C, E, V

7

Data Deficient :

8

Not evaluated :

C, E  
↓

Plants

Animals

Berberis  
nilghiriensis

Pegmy Hog  
(Sus)

E

Bentickia  
nicobariensis

Red Panda  
(Ailuurus)

V

Cupressus  
cashmeriana

Black Buck  
(Antelope)



## Loss of Biodiversity

4 Reasons  $\Rightarrow$  Evil quartet

- 1 Habitat loss and Fragmentation (Major reason)  
 Earlier >14% - Tropical Rain forest  
 Present 6-1%

TARF — Richest

- Soybean cultivation
- Grassland for beef cattle.
- Core area decreases and edge areas increase
- Mammals and birds occupying large territory decrease affected.
- Migratory birds affected.

- 2 Overpopulation exploitation

- Need turns to greed
- e.g. stellar sea cow, passenger pigeon
- Marine fish — over harvested — posing threat to their survival.

- 3 Alien species / Exotic species

In natural habitat biological control maintains population size of species.



Introduced <sup>in new</sup> area - Biological control - no  
 Population size increases  
 native species eliminated.

### Exotic species

### Effects

1. Eichornia crassipes  
 Europe  
 • clogged the lake.  
 • Death of aquatic species.
2. Lantana camara  
 America  
 • Forest
3. Parthenium hysterophorus  
 America  
 • herbs shrubs
- ★ 4. Eupatorium odoratum  
 Teak
5. Nile Perch  
 Lake victoria  
 > 200 cichlid fish
6. African cat fish  
Clarias  
 Indegenous cat fish

### 4. Coextinction

• Marine fish (Ext) → Parasite (Ext)

• Plant Pollination



## Reason for conservation

### 1. Narrow utilitarian

#### Economic use

#### ★ Bioprospecting

Food -  $\frac{3}{4}$  th - 3 Main crops  
 • Rice, wheat, maize

Medicines - 25% of plant based  
 25,000 traditional medicine

### 2. Broadly utilitarian

#### Ecosystem services

• Amazon - 20% of atmospheric O<sub>2</sub>

• Pollination: if done by humans cost will be 117 Billion dollars

### 3. Ethical argument

• Every species has Intrinsic value.

• Moral duty to care for their well being.

## Conservation Strategies

↓  
In situ conservation

In Natural habitat

- Natural Park
- Sanctuaries

↓  
ex-situ conservation

Outside natural habitat

- Home garden
- Botanical garden



- Biosphere reserves
- Sacred groves
- Hotspots

- Zoos
- Bone banks

### National Parks

### Sanctuaries

Both flora and fauna

Only fauna

Cultivation, Grazing  
Harvesting of flower  
product -nt (x)

✓

Hunting -nt (x)

x

Boundaries are well  
defined

Not well defined

Private ownership (x)

✓

90

448

### Biosphere Reserves

Started by UNESCO in 1975  
under programme

MAB: Man and Biosphere reserve

1st Biosphere reserve = Nilgiri B.R.

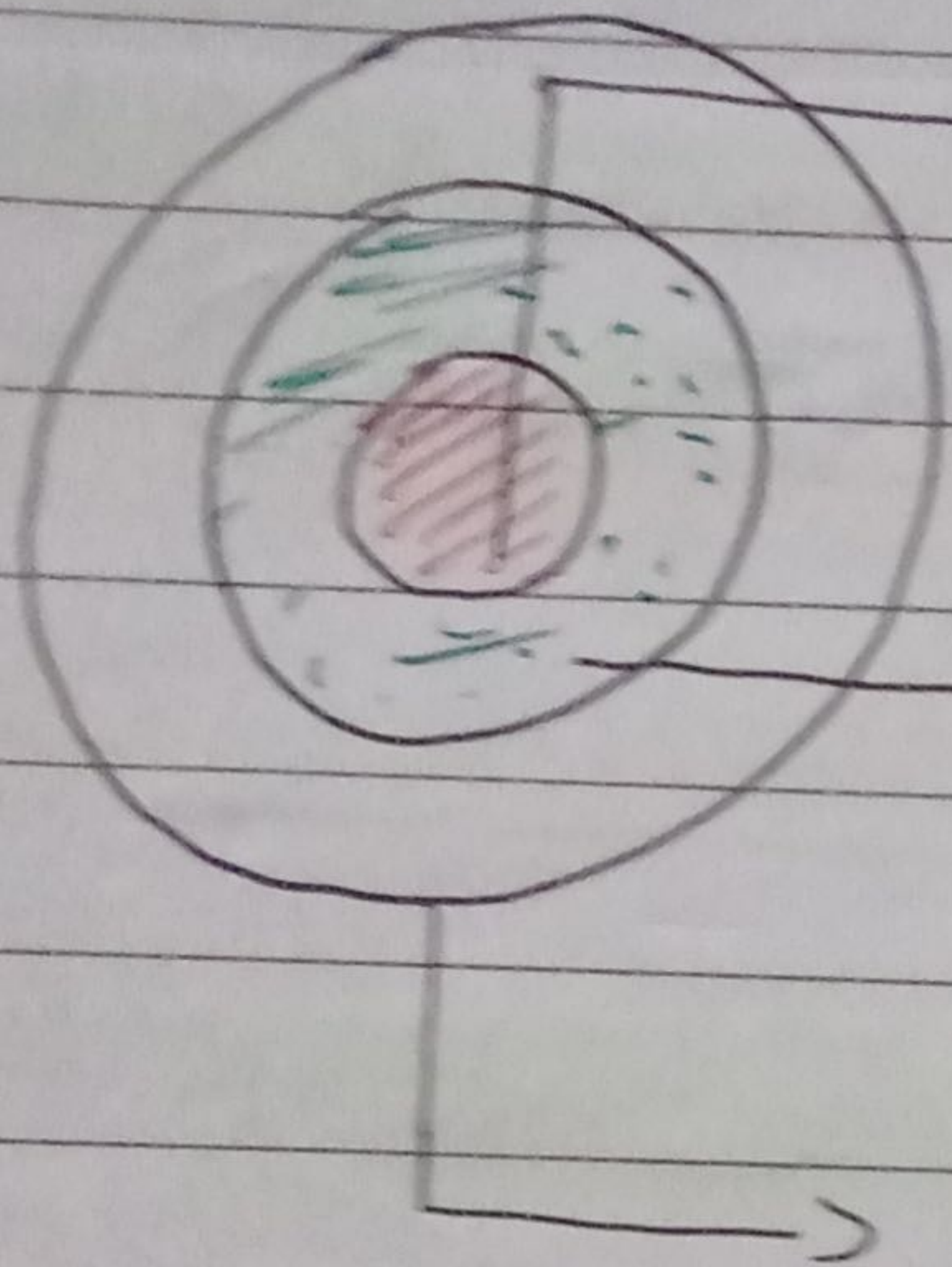
Total = 14

4 are connected at the international level  
which are:



Nulgeri, Gulf of Manar, Sunderban, Nandadwui

### Zones in Biosphere Reserves



① Core Zone / Natural Zone  
Human activities - not

② Buffer Zone  
H.A ✓ Research and Education

③ Transition Zone / Restoration Zone  
H.A ✓

### Uses of Biosphere Reserve

- (i) Biodiversity conservation
- 2 Traditional resource use
- 3 Development
- 4 Research, education, restoration

### Sacred groves

Khasi and Jaintia Hills - Meghalaya

Arawali Hills - Rajasthan

Western Ghats - Maharashtra, Karnataka

Barguja, Chand and Bastar = Madhya Pradesh

### Sacred Lake

• Pushkar Lake - Rajasthan

• Khechopalari Lake - Sikkim

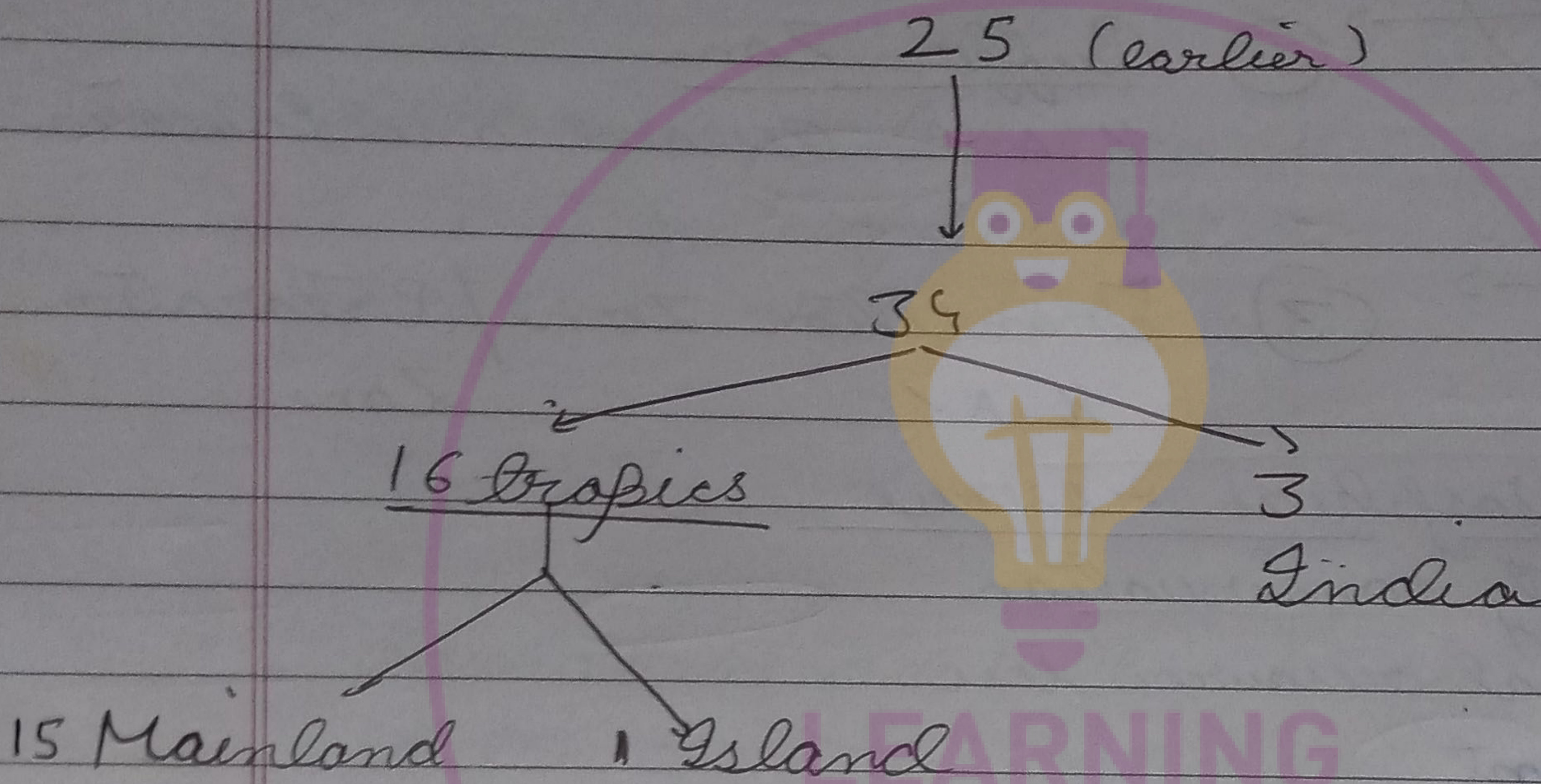


Hot spots :

concept — Norman Myer

Two criteria

- No. of endemic species
- Degree of threat (Habitat loss)



area covered by hot spots = 2.1%

Plant species = 25.1%

Human population = 2.5%

reduction in extinction upto 30%

Western Ghats and Srilanka endemic = 1600 sp plants

Indo Burma 3500 sp

Himalayas richest 3169 (dicots)

- Threatened areas
- Agastmalai hills
- Periyar N.P
- Silent Valley

Important and active centre of evolution of angiosperms. Primitive species: Utriculariaceae

High Himalayan ranges frequent migration hence High Endemism



## Ex - Situ Conservation

### 1 Home gardens

- Aloe
- Murraya (curry leaf)
- Thymus

### 2 Botanical Garden

- Arboreta - Woody plants

> 1500 B-G + nt

### 3 Zoos : > 800

### 4 Gene banks:

- seeds, pollens, gametes, frozen germplasm, gene libraries.
- Cryopreservation =  $-196^{\circ}\text{C}$
- tissue culture.

Earth Summit

Rio de Janeiro  
(Brazil)

1992

170

countries

World Summit

Johannesburg

2002

190

2010

countries