

Biodiversity & Conservation

Biodiversity = variety of life forms found at all levels of biological ~~system~~ organisation.

Term coined by Edward Wilson (1992).

Three Levels of Biodiversity

1. Genetic diversity - within a species^{within sp.}
e.g. Rauwolfia vermitoria growing in diff. Himalayan ranges shows variation in reserpine (a chemical) ; 750,000 genetic strains of rice in India.
2. Species diversity - variety of species^{between sp.}
• in a region, e.g. amphibians in Western Ghats > those in Eastern Ghats.
3. Ecological diversity - variety of ^{<-habitat level} ecosystems / habitats. India with deserts, rain forests, mangroves, coral reefs, wetlands, alpine meadows has greater eco diversity than Norway.

(IUCN-2004 : 1.5 million species described)

How Many Species on Earth ?

Robert May : global estimate 7 million.

More than 70% of all species = animals,
plants (incl. fungi) only ~~30%~~ 22%.

Among animals, INSECTS are the largest
group - more than 70% of all animals ?

INSECTS	70% of animal kingdom ^{largest group}
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India's Share

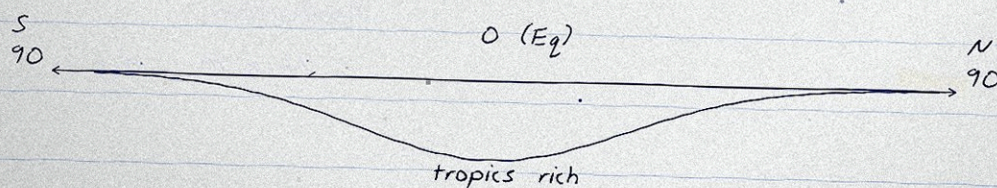
India has only 2.4% of world's land area but
accounts for 8.1% of global species diversity

- a mega-diversity country ?

(45,000 plants + 90,000 animals so far).

Patterns - Latitudinal Gradient

Species diversity decreases as we move
from equator towards the poles.



Why? more time, stable climate, more energy.

Species-Area Relationship

Alexander von Humboldt - explored S. American jungles ; found species richness rises with area but only up to a limit.

$$S = C A^z$$

<- power function
<- (arithmetic form)

Taking log on both sides :

$$\log S = \log C + z \log A$$

<- straight line :
<- slope = z

Where

S = species richness ; A = area

z = slope (regression coeff) ; C = Y-intercept

Values of Slope z

Small areas (regional) : $z = 0.1 - 0.2$
(taxa & region independent ?)

Very large areas (continents) : $z = 0.6 - 1.2$
e.g. frugivorous birds & mammals in tropical forests of diff continents : slope 1.15.

Loss of Biodiversity

Recent IUCN data (2004) :

- 784 species extinct in last 500 yrs
(338 vert + 359 invert + 87 plants)
e.g. dodo (Mauritius), quagga (Africa),
thylacine (Australia), Steller's sea cow
(Russia), 3 sub-sp. of tiger.

Currently ~~12.5%~~ 12.5% birds, 23% mammals,
32% amphibians, 31% gymnosperms threatened.

The Evil Quartet (causes)

1. Habitat loss & Fragmentation

- the most important cause ;
Amazon 'lungs of the planet' cleared
for soya cultivation, cattle ranching.

2. Over-exploitation

- Steller's sea ^{*}cow, passenger pigeon ;
marine fish stocks crashing today.

3. Alien species invasions

- Nile perch in L. Victoria wiped 7200
native cichlid fish ; parthenium, lantana.

Evil Quartet (cont.) & Why Conserve

4. Co-extinctions

when one sp. goes extinct, the dependant sp. also dies out - e.g. host fish lost \Rightarrow its obligate parasites vanish too ;
plant-pollinator mutualism breakdown.

Why Conserve Biodiversity ?

(a) Narrowly utilitarian - food, fibre, fuel,
timber, drugs, resins (725% world drugs from 25,000 plants ; bio-prospecting).

(b) Broadly utilitarian - ecosystem services :
Amazon produces 20% atmospheric O₂ ;
pollination, climate, water cycle.

(c) Ethical - every species has ~~an~~ intrinsic value ; moral duty to pass on a healthy biological legacy to next generation.

IUCN Red List - Categories

EX - Extinct EW - Extinct in wild
CR - Critically Endangered EN - Endangered
VU - Vulnerable NT - Near Threat LC - Least Conc.

In-Situ Conservation

Saving species in their own natural habitat.

Cheap, sustainable, whole community is saved.

Biodiversity Hotspots

Term : Norman Myers (1988).

Regions with very high endemism + serious habitat loss. Initially 25 ; now 34 world-wide.

34 hotspots	2% land,	> 50% plants	<-huge !
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India has 3 hotspots :

- (1) Western Ghats & Sri Lanka
- (2) Indo - Burma
- (3) Himalaya

Legally Protected Areas (India)

14 biosphere reserves, 90 national parks,
448 wildlife sanctuaries (2002) (NCERT).

Sacred groves . - patches of forest set aside on religious grounds. e.g. Khasi & Jaintia hills (Meghalaya), Aravalli (Rajasthan), W Ghats of Karnataka & Maharashtra, M.P, Chhattisgarh.

Ex-Situ Conservation & Treaties

Threatened animals / plants taken out of natural habitat & placed in special settings for protected care.

Examples :

<-off-site

- Zoological parks, botanical gardens, wildlife safari parks.
- Gametes of threatened sp. in viable & fertile condition for long periods using cryopreservation ($-196 \text{ deg } ^\circ\text{C}$) ^{germplasm} in liq. N_2 .
- Eggs hatched ~~in lab~~ in vitro ; plants by tissue culture ; seed banks store seeds for long-term (e.g. Svalbard).

Global Treaties

1. Convention on Biological Diversity

Earth Summit Rio de Janeiro 1992 -

'conserve, sustainable use, equitable'

- sharing of benefits.'

2. Johannesburg 2002 + Nagoya 2010

- ABS (Access & Benefit Sharing) protocol.