Biodiversity

What is Biodiversity?
IS IT:

‘The total variability of life on earth’

A Knowledge of biodiversity, its patterns of loss and effects of that loss?

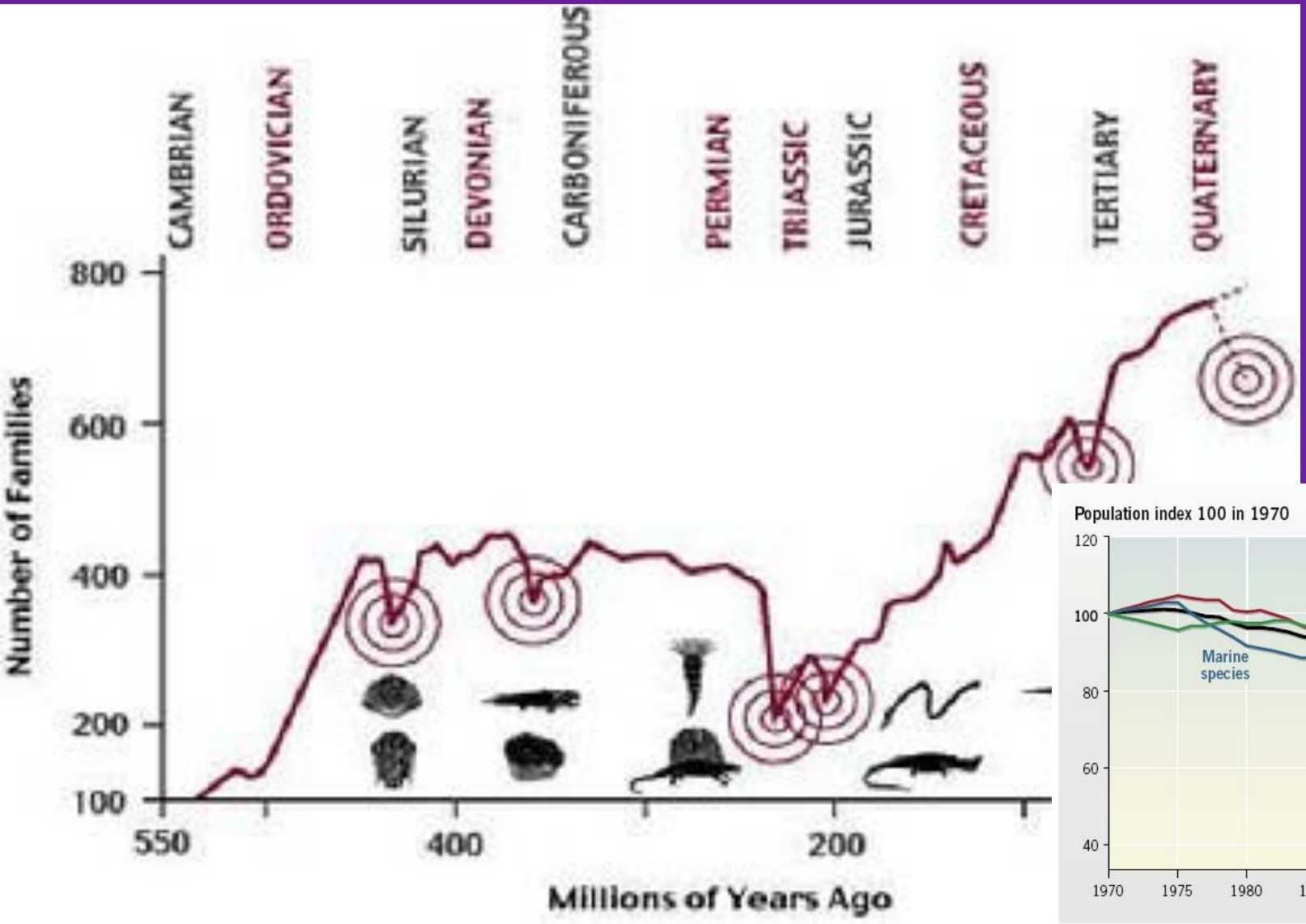
Total Variability Of Life On Earth

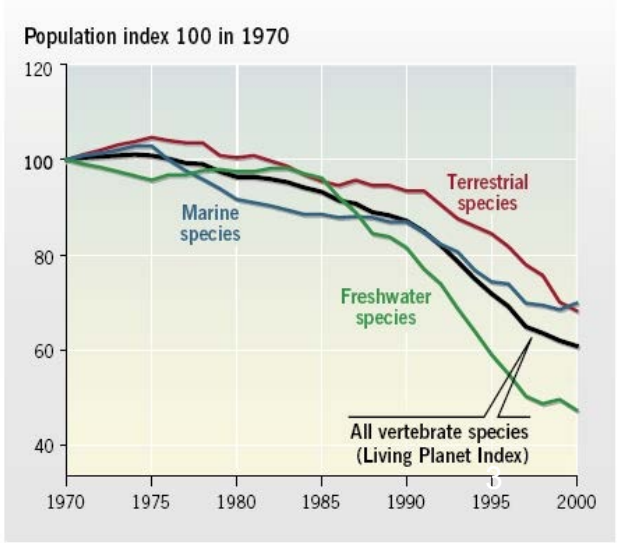
Table 2 Approximate numbers of described species (in thousands) currently recognized and estimates of possible species richness for groups with more than 20 000 described species and/or estimated to include in excess of 100 000 species. The reliability of all estimates is likely to vary greatly. (After Hawksworth and Kalin-Arroyo 1995.)

		Number of estimated species			
	Described species	High	Low	Working figure	Accuracy of working figure
Viruses	4	1000	50	400	Very poor
Bacteria	4	3000	50	1000	Very poor
Fungi	72	2700	200	1500	Moderate
'Protozoa'	40	200	60	200	Very poor
'Algae'	40	1000	150	400	Very poor
Plants	270	500	300	320	Good
Nematodes	25	1000	100	400	Poor
Arthropodsi					
Crustaceans	40	200	75	150	Moderate
Arachnids	75	1000	300	750	Moderate
Insects	950	100 000	2000	8000	Moderate
Molluscs	70	200	100	200	Moderate
Chordates	45	55	50	50	Good
[Others	115	800	200	250	Moderate]
Totals	1750	111 655	3635	13 620	Very poor

The sixth great (anthropogenic) mass extinction?

Are humans on the verge of triggering a sixth worldwide collapse in species diversity? Wiping out ½ of the worlds species?





WHAT IS BIODIVERSITY, ANYWAY?

Types of Biodiversity:

- Genetic Diversity ‘
  - variation within populations of animals measured in variation between genes or DNA sequences

- Species diversity – ‘alpha’ biodiversity’:
  - Diversity within a given place or area
  - ‘richness’ (number of species) versus ‘evenness’ (relative abundance, question of species dominance)

- Ecological diversity (community diversity, beta diversity, ‘rollover’ diversity): how much does diversity vary across space?

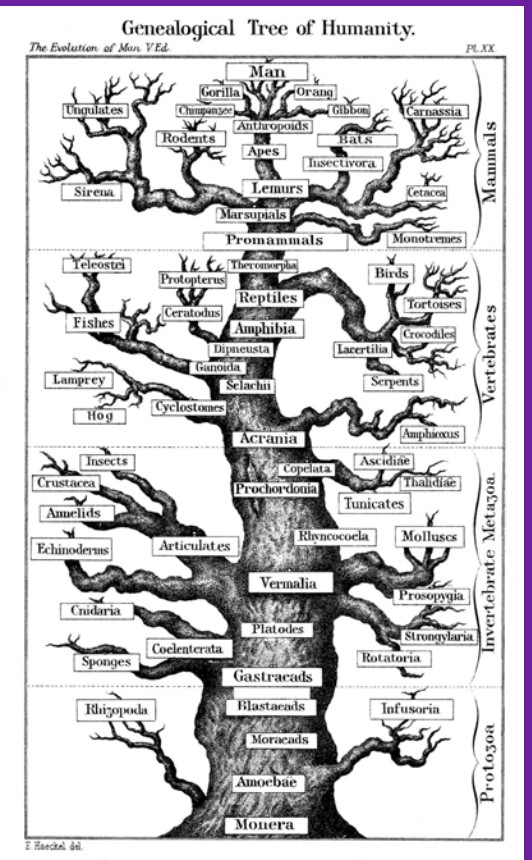
- landscape biodiversity – ‘gamma biodiversity’
  - biodiversity by increasing the complexity of niches across space

Where does diversity come from?

basic mechanisms of evolution produce contemporary biodiversity

Human evolution and diversity

i. Variation
ii. selection

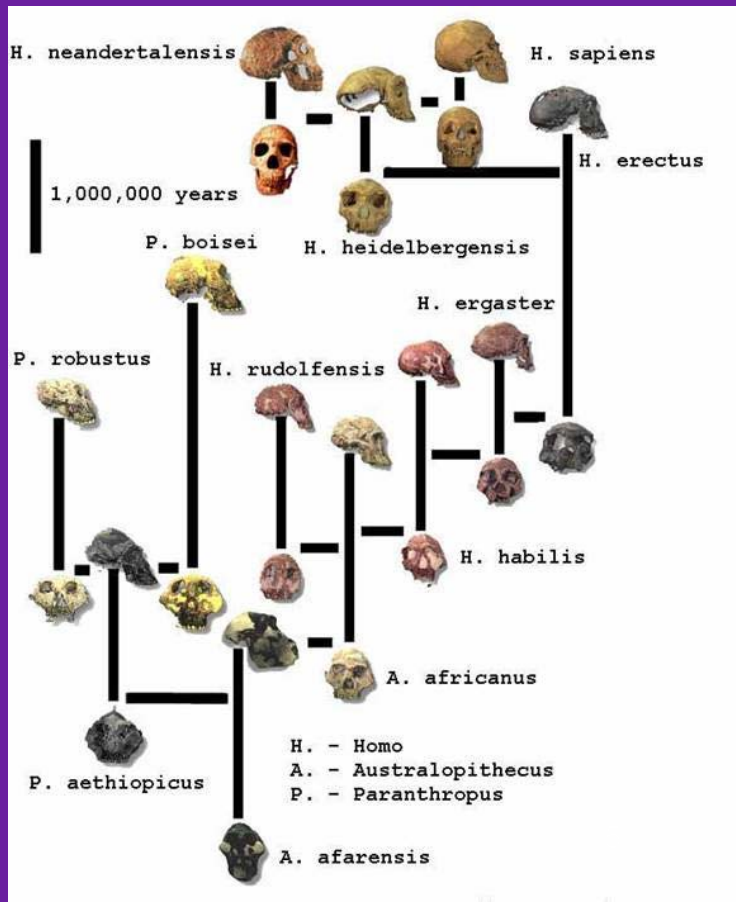


Views of evolution:

Tree
(dated

versus

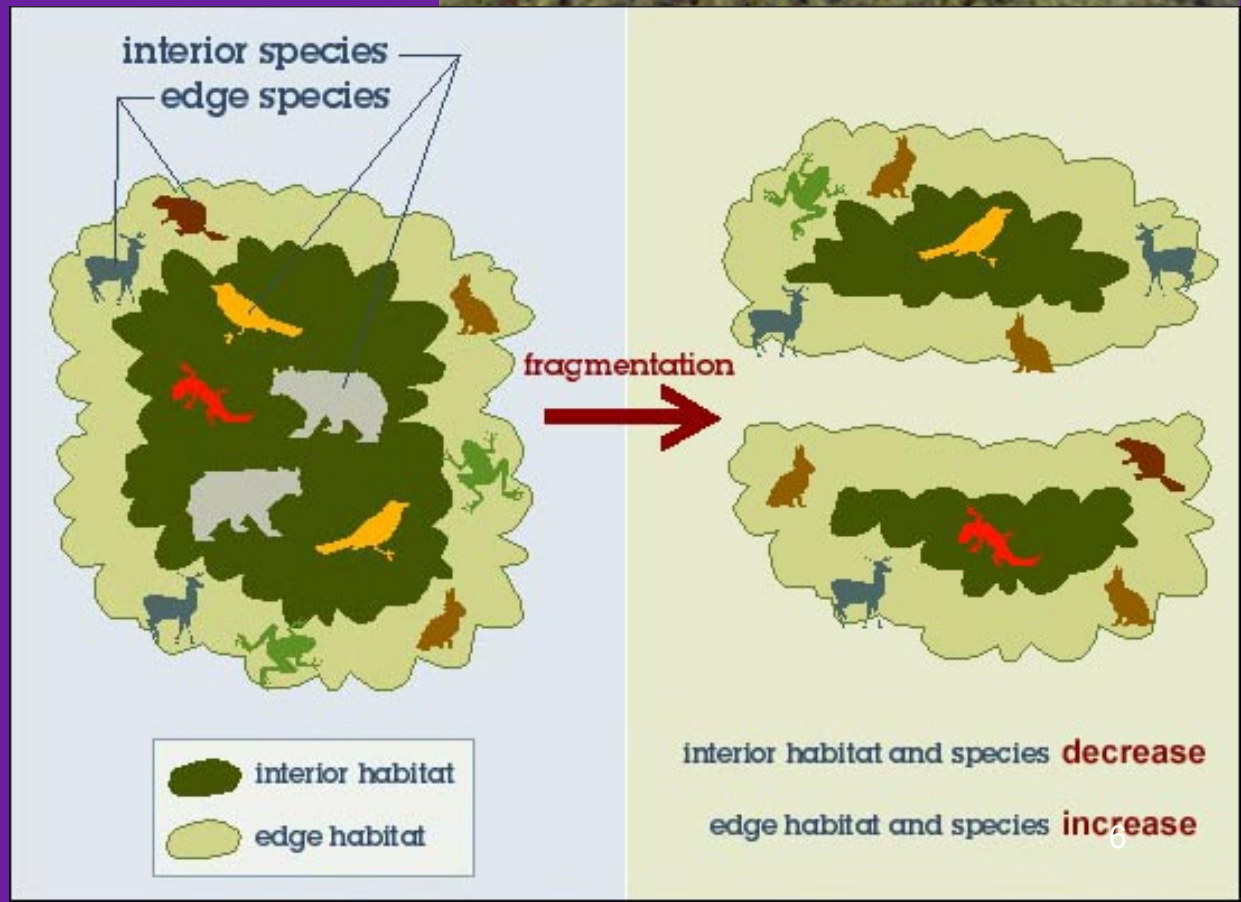
bush
(contemporary



Where does Biodiversity come from?

Relations *between* species:

- coevolutionary relationships: mutualism, symbiosis,
- Allopathy – Separation of species



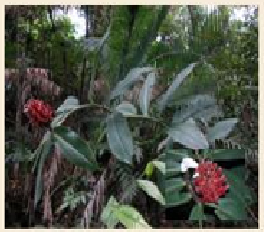
Why is Biodiversity Important?

Economic Values: Lifeforms provide important sources for medicines, fibers, materials:

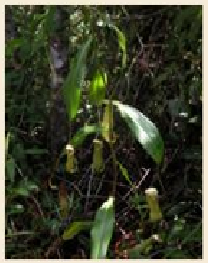
losing biodiversity means also a loss in access to important biologically active compounds

25% of medicines currently in use are plant-based

SOME
MEDICINAL PLANTS IN
SANDAKAN RAINFOREST PARK
(By Julius Kulip & Julius Kodoh)

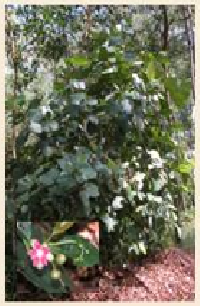


Costus speciosus
(Sap used to treat asthma)



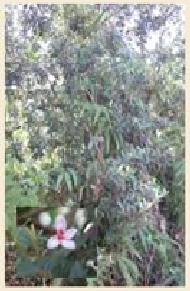
Nepenthes gracilis
(Fluid in pitcher used to treat skin disease)

Passiflora foetida
(Fruit used to treat insomnia)



Dillenia excelsa
(Sap used to treat high BP)

Alstonia angustiloba
(Sap used to treat malaria)



Rhodomyrtus tomentosa
(Fruit used to treat stomach-ache)

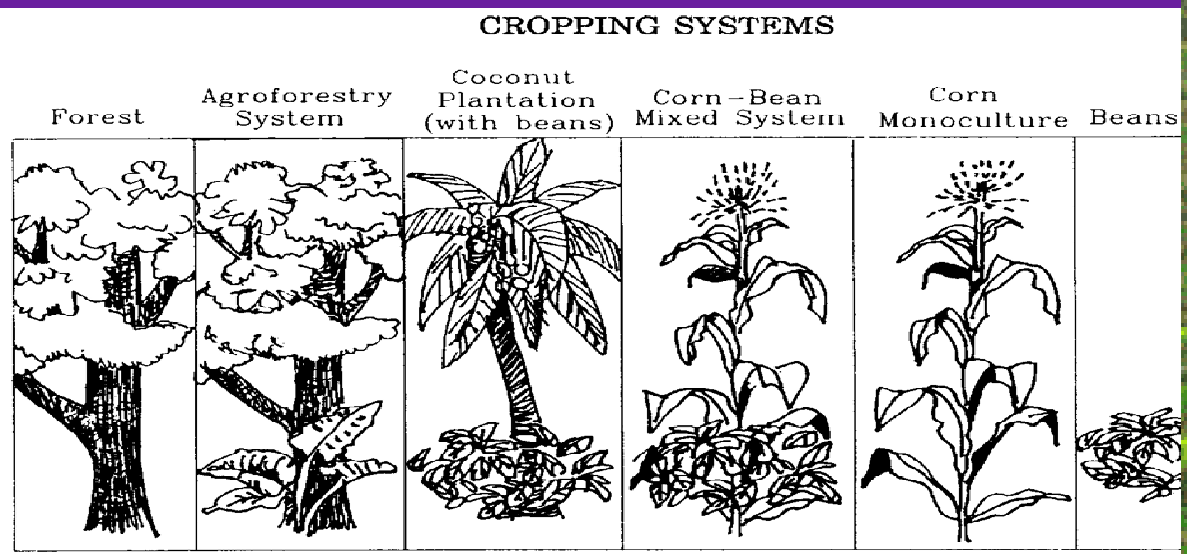
Blechnum orientale
(Sap to treat fever)

Why is Biodiversity Important?

Economic Value:

Biodiversity in number of crops increases total productivity by 10% by making better use of space: polycultures

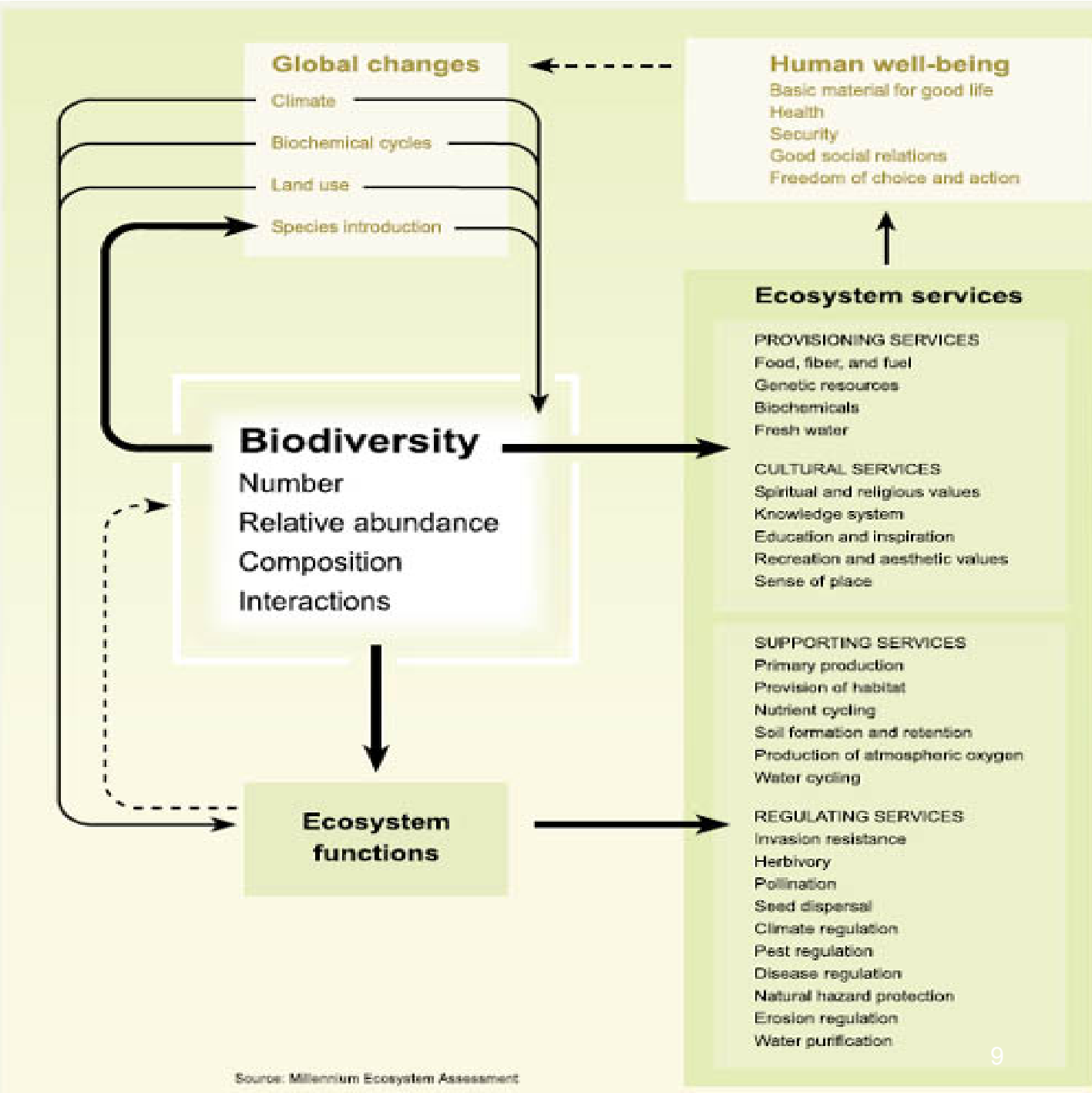
Genetic diversity in crop plants and plants increases the stability of both global and local food sources by protecting populations from diseases.



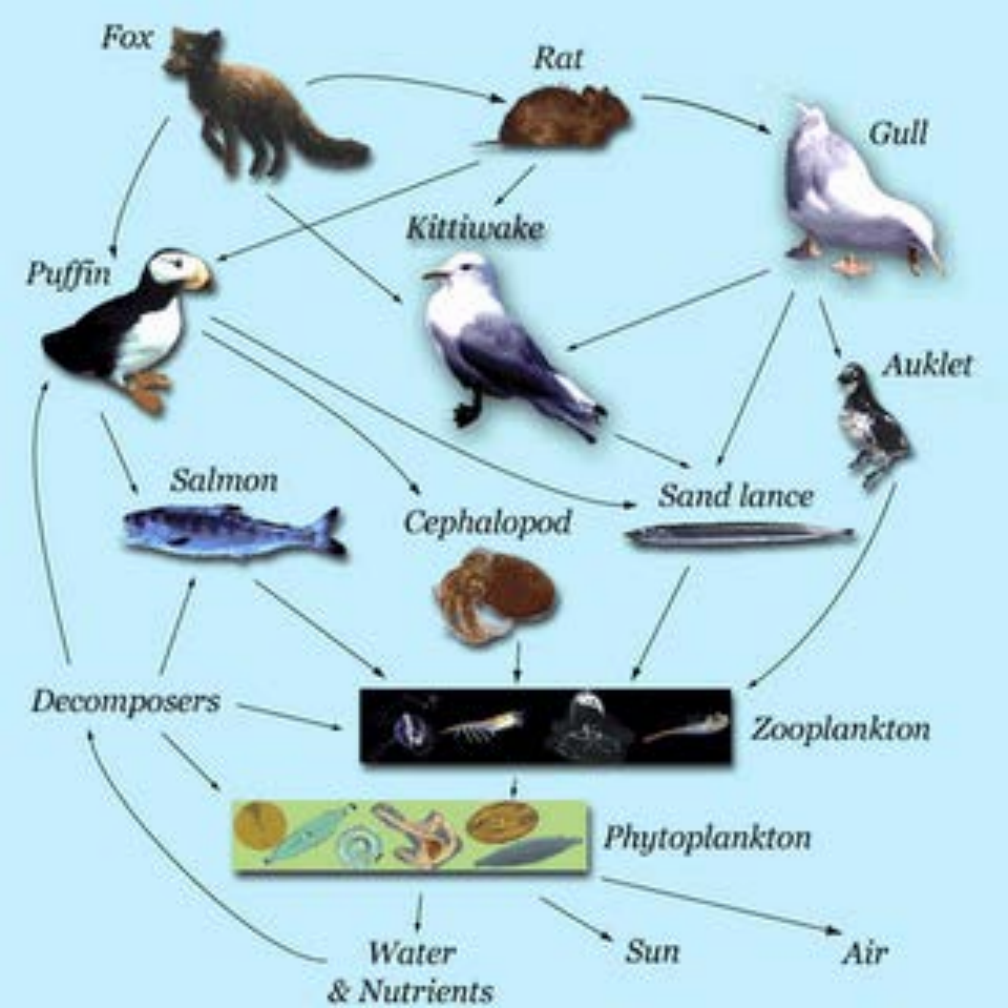
Why is Biodiversity Important?

Economic Values:

Biodiversity provides STABLE environmental services such as carbon sequestration and water capture.



Why is Biodiversity Important?



Back to our initial concern for biodiversity: **Ecological collapse** due to ecological dependency or species interrelations: how many species may be lost before the web of life begins to collapse?

Do we really want to reduce redundancy and ecological stability?

Why is Biodiversity Important?

beauty of biodiversity, the 'spice of life', children develop better when exposed to greater diversity, both microbiologically and psychologically.

Diversity is beautiful!

moral: no reason not to expend necessary resources to protect existing diversity of life:

- We have enough food, fiber, and other items without expanding acreages under cultivation or stripping old-growth forests, or drilling new oil wells
- We can't replace lost biodiversity

analyzing biodiversity

How do we **measure** biodiversity?

…biodiversity exercise?

Issue 1. Uncertainty is a central problem
Numbers of species

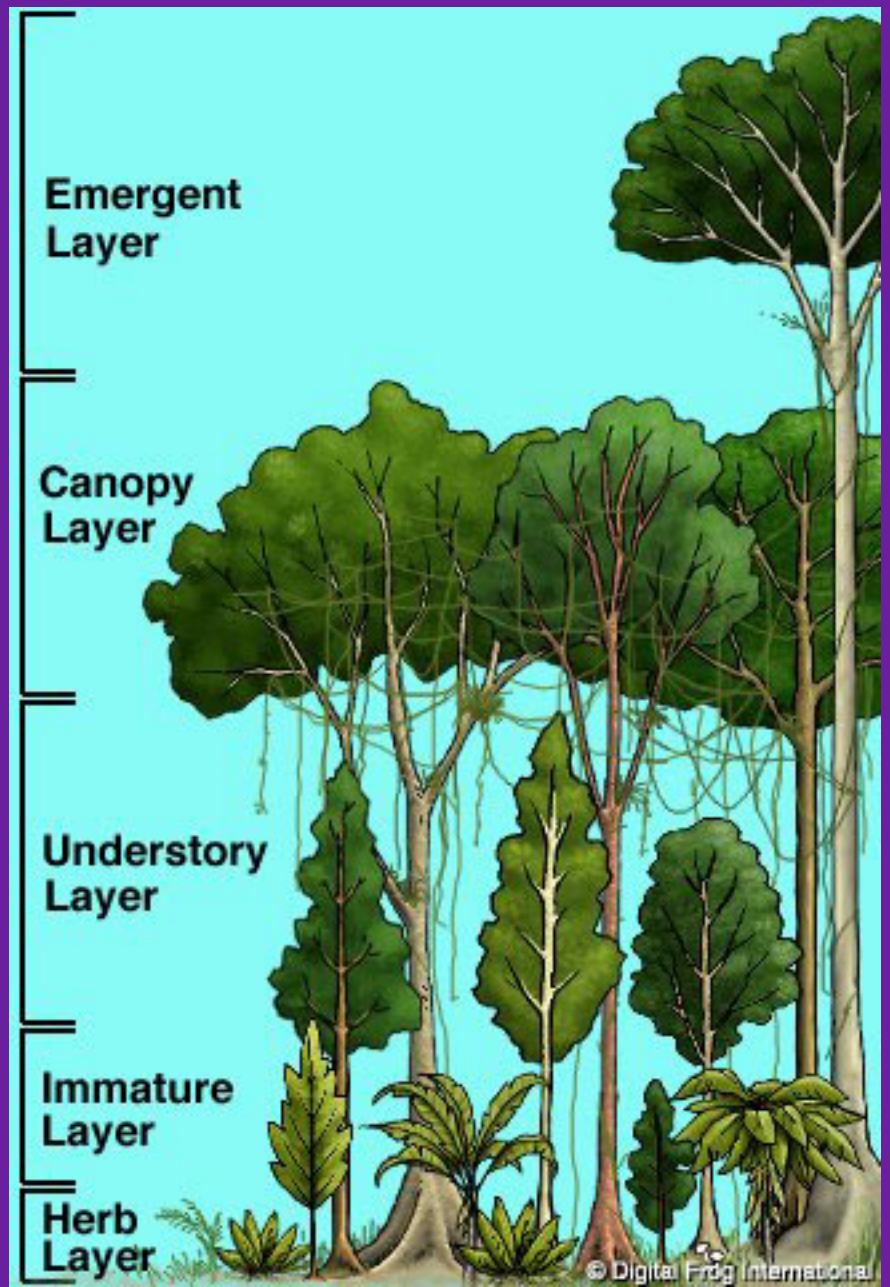
1.75 million species scientifically identified.

estimated 30 million species on earth.

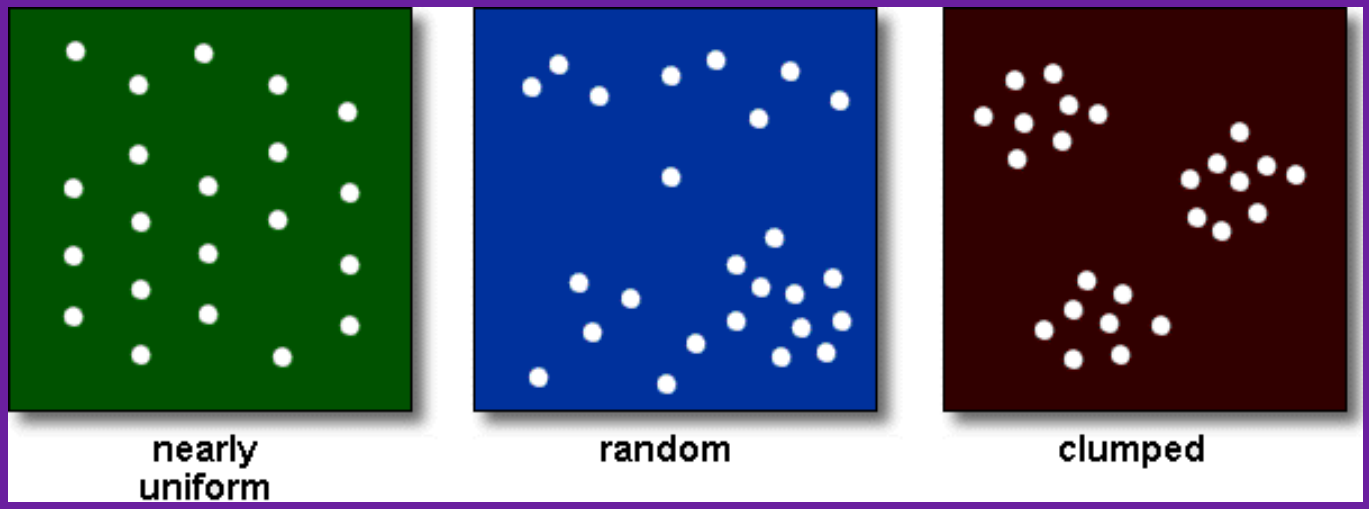
estimated 40,000 species rendered extinct annually.

Issue 2:
Niche complexity & spatial distribution within a patch

What plant biodiversity DIDN'T we measure?



Issue 3: Distribution of populations and sampling problematic



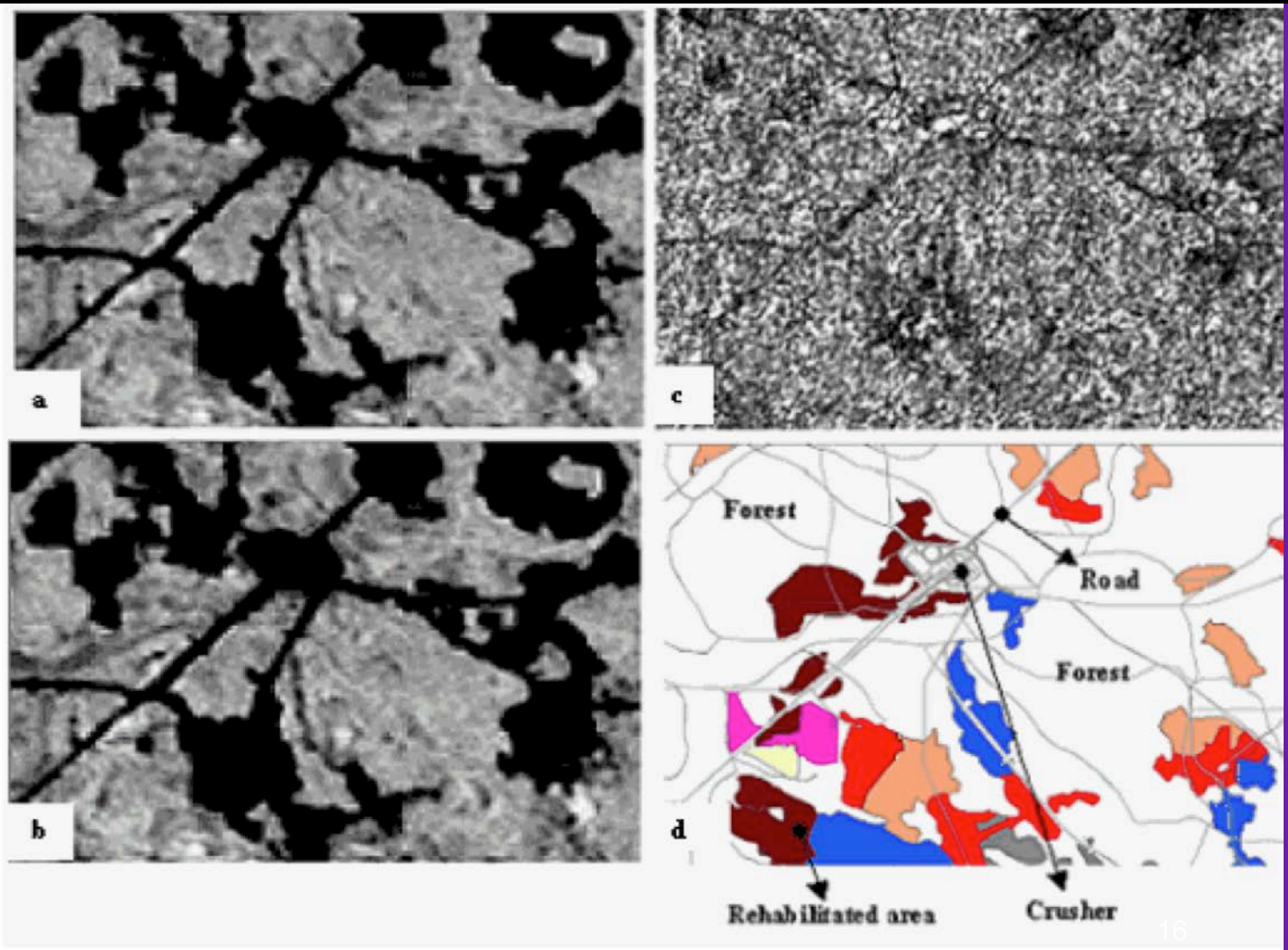
Issue 4: Scale and Geography: evenness versus dominance: Topic Levels

oaks versus lilies.

Patch versus Matrix:

dimensions

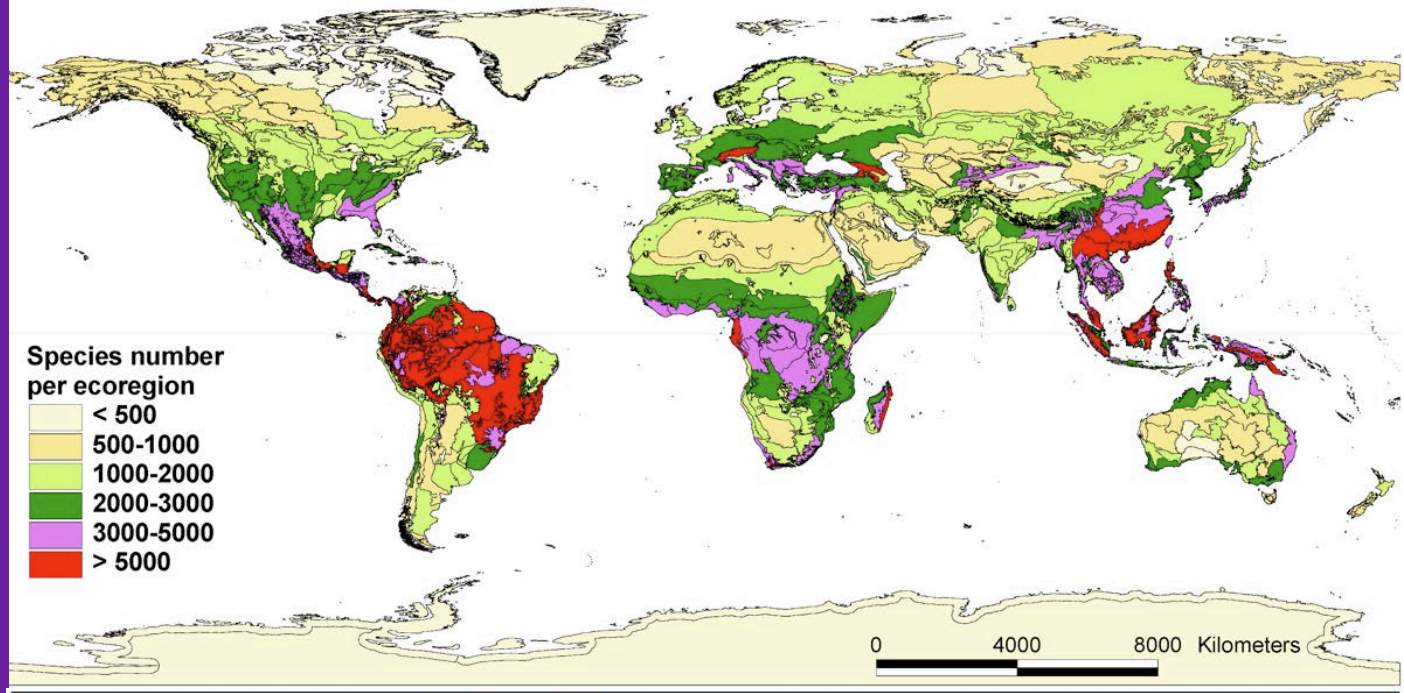
geometry: edge effects

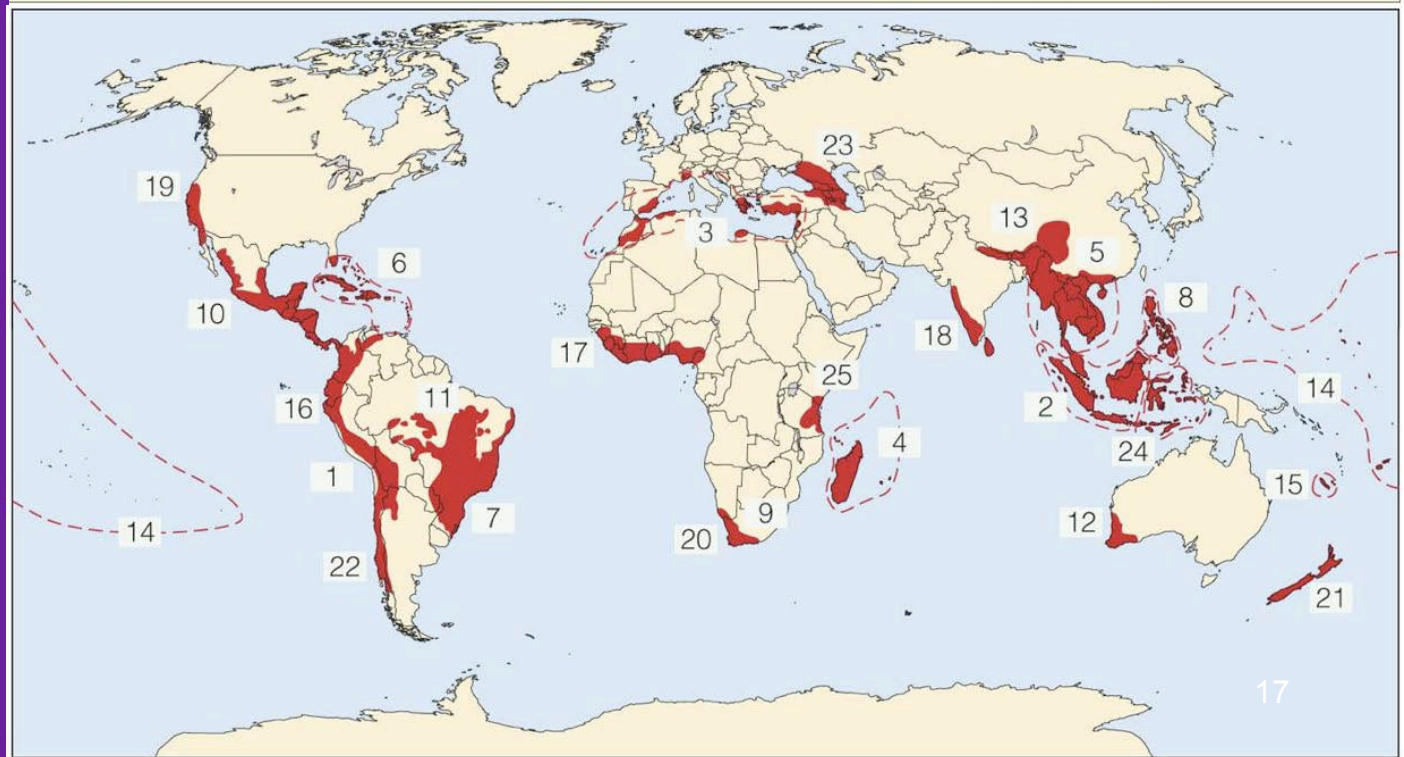


Issue 5: biodiversity hot spots:

what is a biodiversity ‘hot spot’?

how do types of biodiversity and processes of bio-diversification create in hot spots?



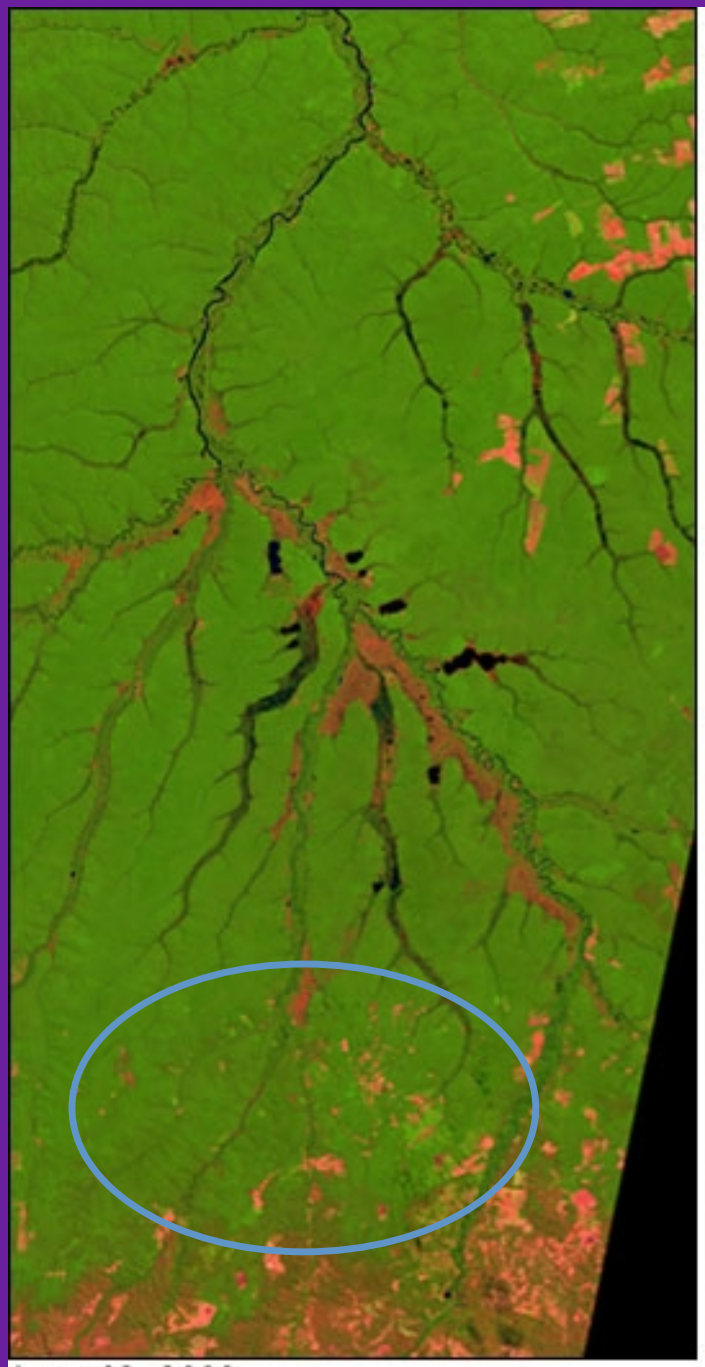


Biodiversity part 3
Threats & Conservation

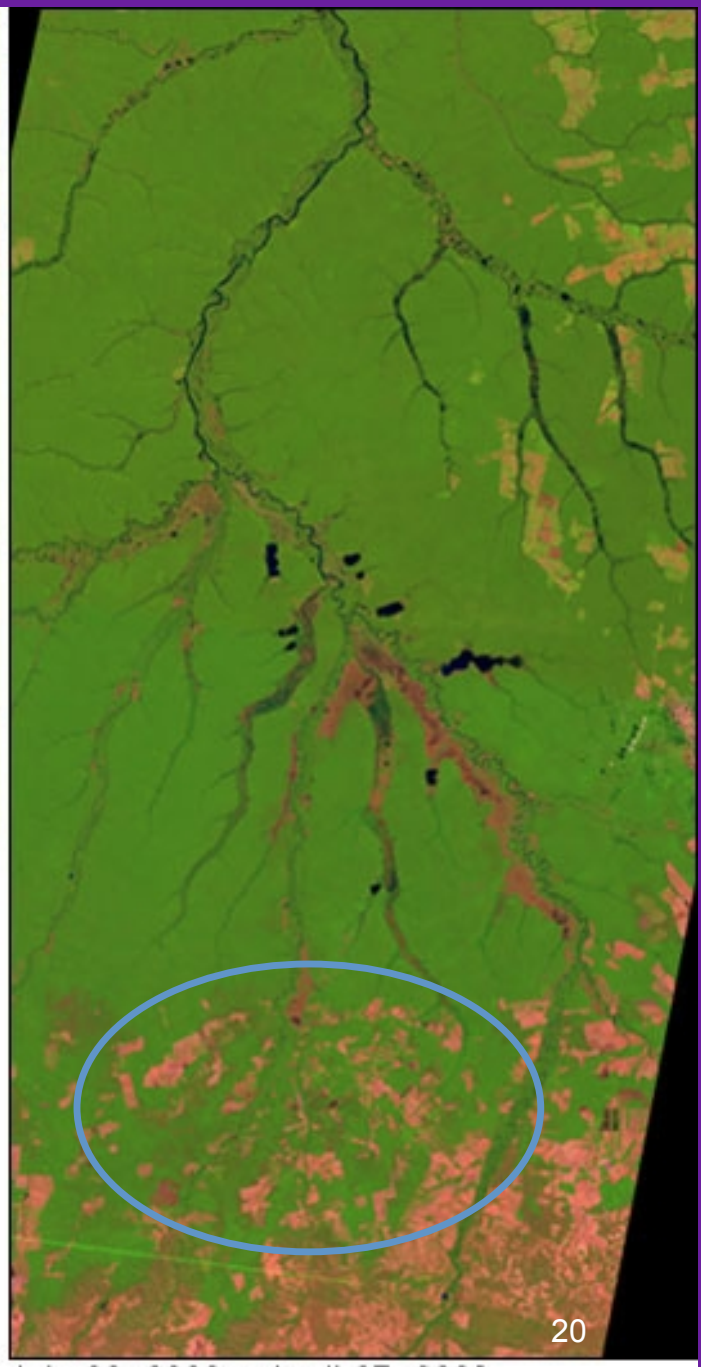
Question 1: What level of biodiversity should be protected?
population? genes? Species? Genera? What is the appropriate unit for conservation?

Question 2 How do we Balance between human exploitation and habitat conservation

Satellite Photo: Spread of farming



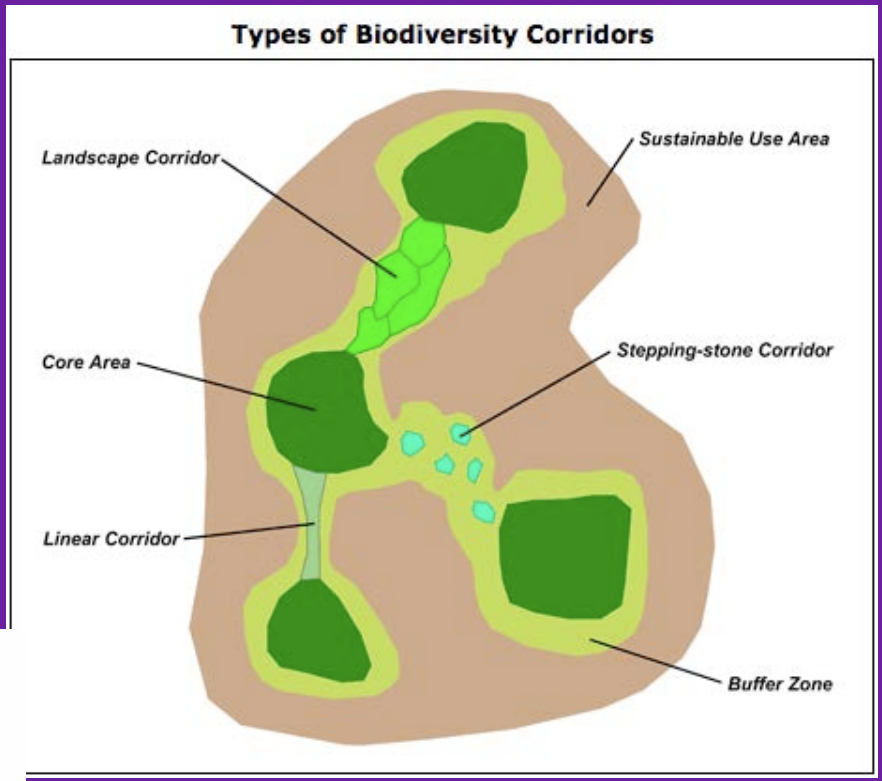
June 21, 1992



July 29, 2000 + April 27, 2001

Question 3: How do we use our knowledge of biodiversity mechanisms to design functional conservation schemes?

Do we mitigate
When to Design conservation areas and policies
Without addressing background causes?



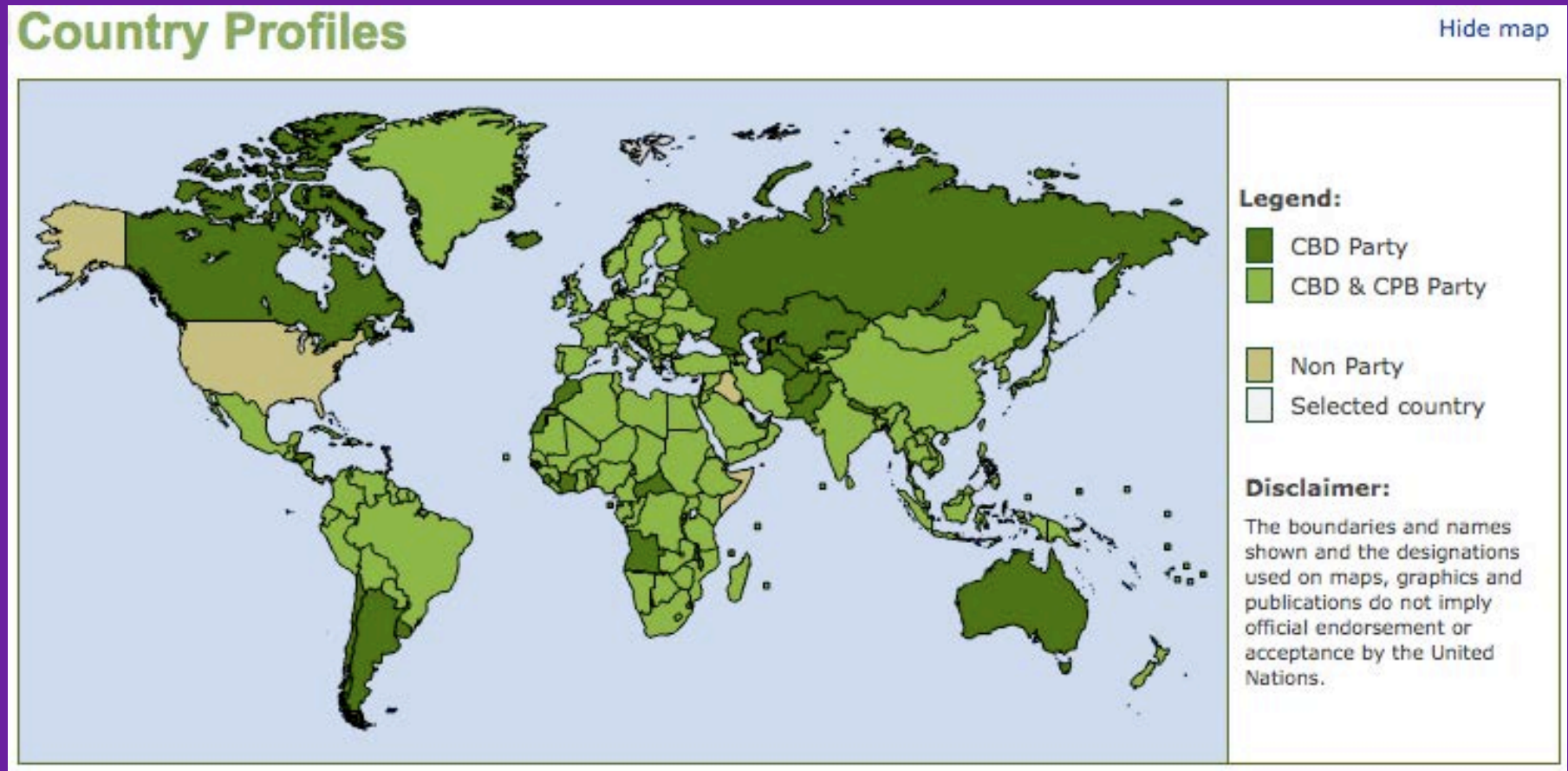
Mesoamerican bio-corridor

Question 4: How do we address biodiversity politics: What do we know?

Nat'l Biological Survey – 1994 – USGS Bio Res division

Convention on Biodiversity: the US HAS NOT signed the international Convention on Biological Diversity.

POLITICS: new species would be subject to protection under the Endangered Species Act.



Review: 1. Biodiversity, what is it good for?

a. Genetic Diversity Within Species: protecting from disease and permitting adaptation

vulnerable

Versus

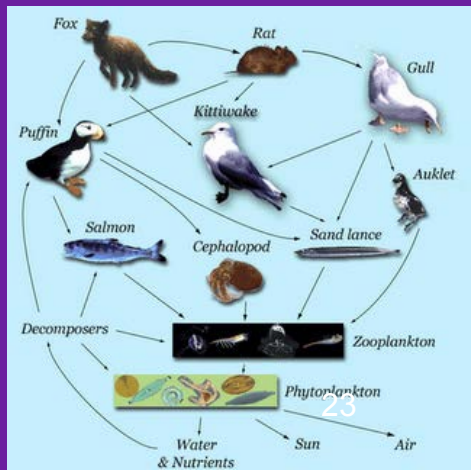
robust

b. Species Diversity: stabilizing environments

agroecological

c. Ecological Diversity

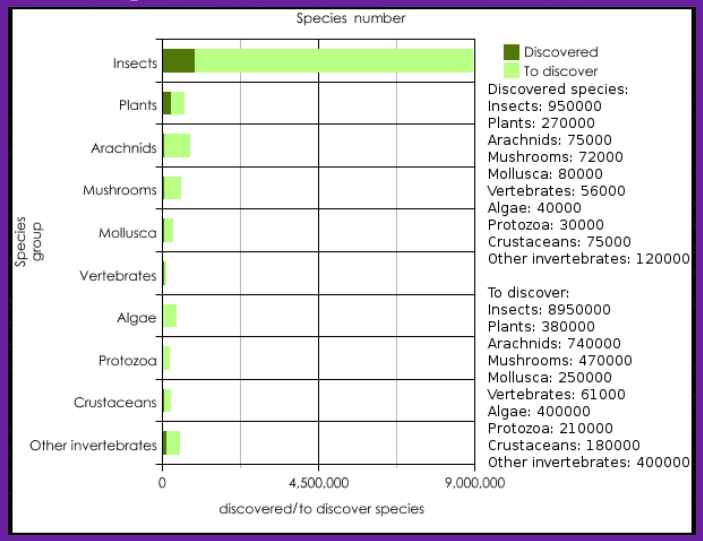
Web of Life: More connections = reduced likelihood of collapse



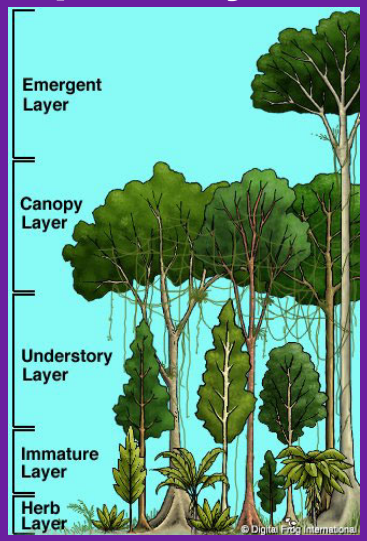
Review: 2. Biodiversity, Where is it?

a. Problem of knowledge: measuring and surveying

Species numbers



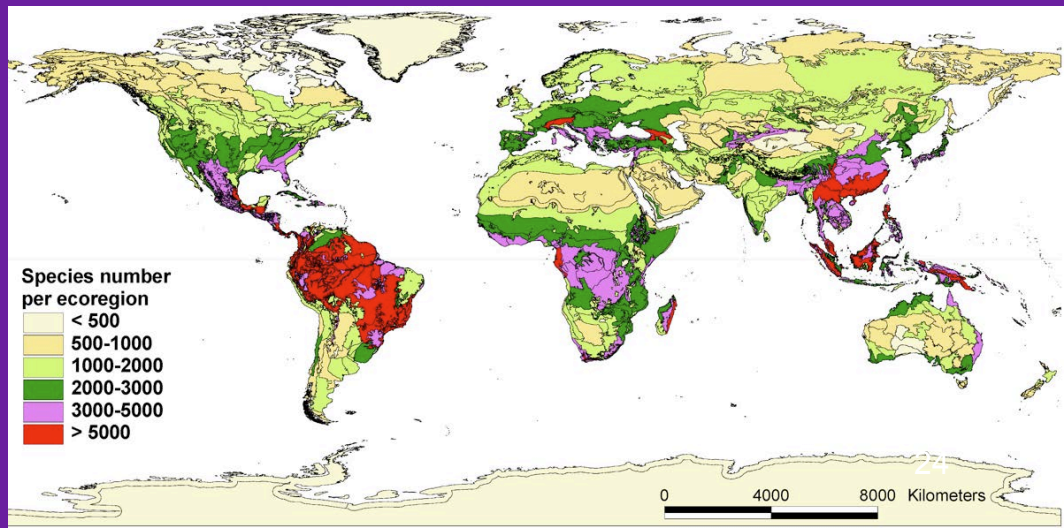
spatiality



temporality

b. Global Distribution

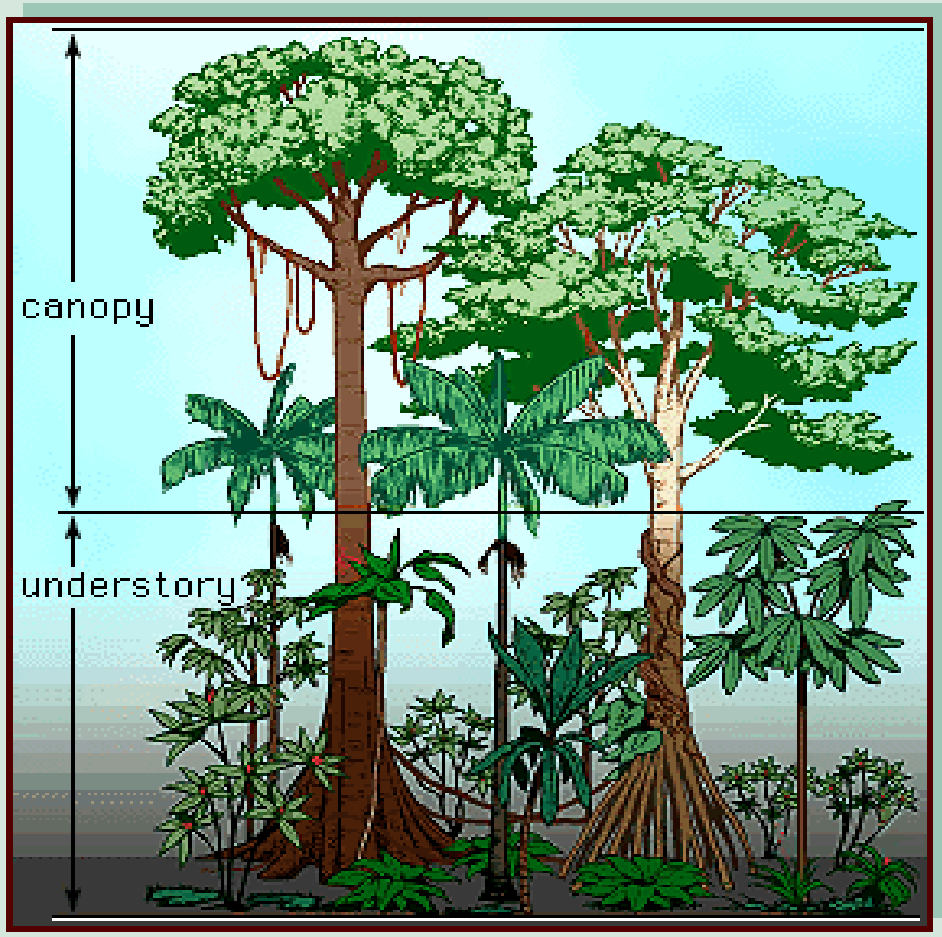
Biodiversity hot spots



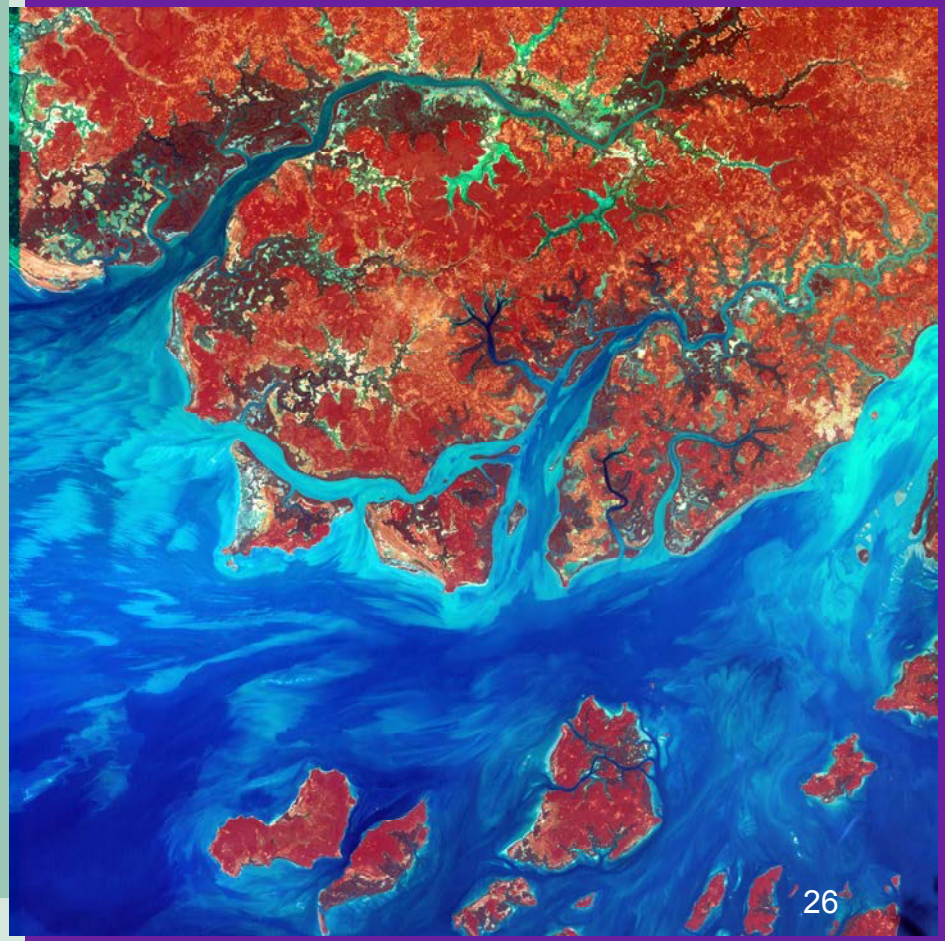
“All that is solid, Melts into air”

Biodiversity across landscapes: The importance of landscape organization

Rainforest canopy



Biodiversity in spatial heterogeneity: Guinea-Bissau coastline

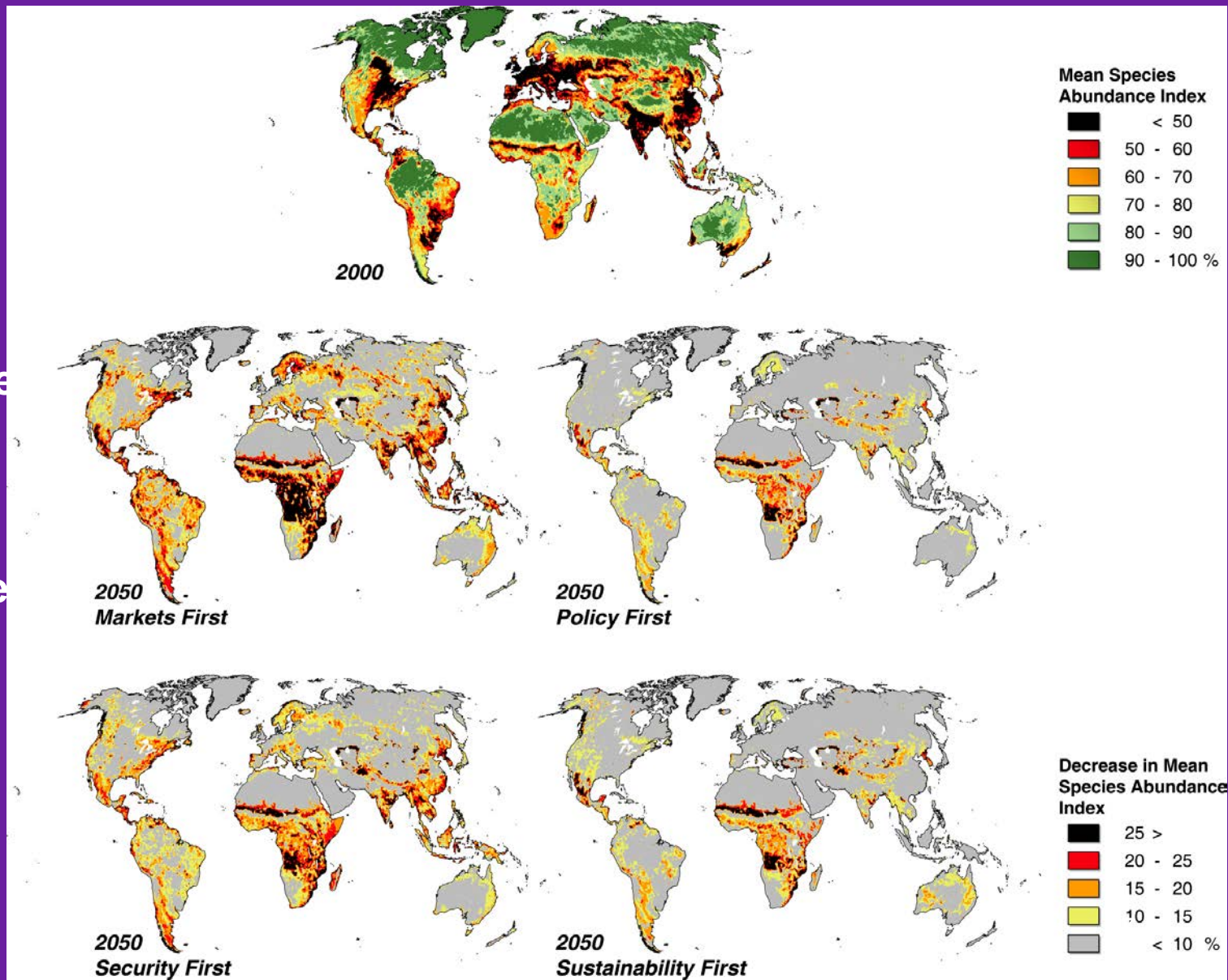


Global Background Economic Drivers, what about the future?

MAP: Biodiversity loss:
4 Scenarios for 2050.

i. **Markets unfettered**
ii. **(growth) Policy-drive**
iii. **(military) security driven**
iv. **Sustainable economies**

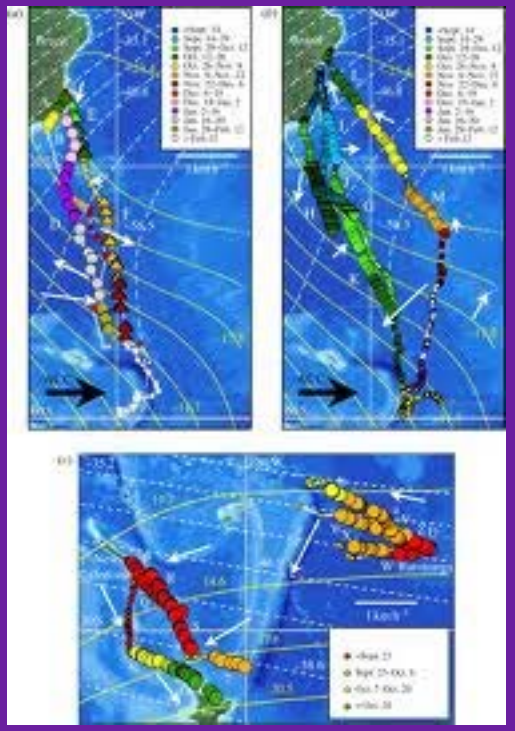
United Nations environmental program Study



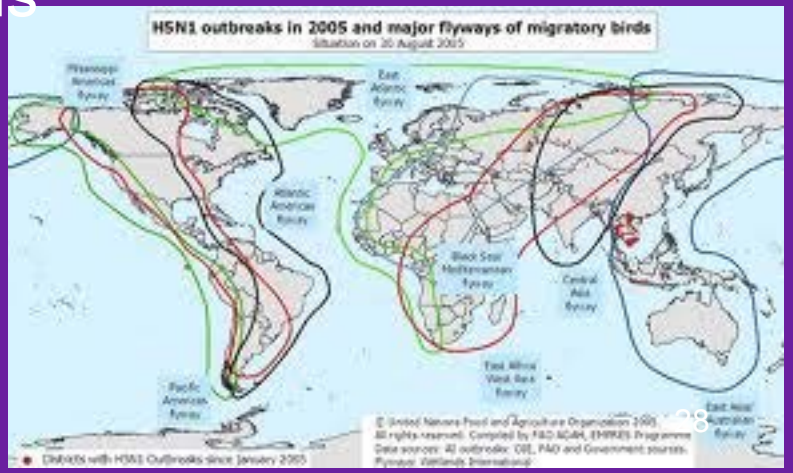
Design: biological corridors, species migrations, conservation

butterflies

whales



birds



Which group has the greatest percentage of endangered members?

A. amphibians
B. birds
C. reptiles
D. mammals