

Built Environment and Biodiversity

Implications for Sustainability

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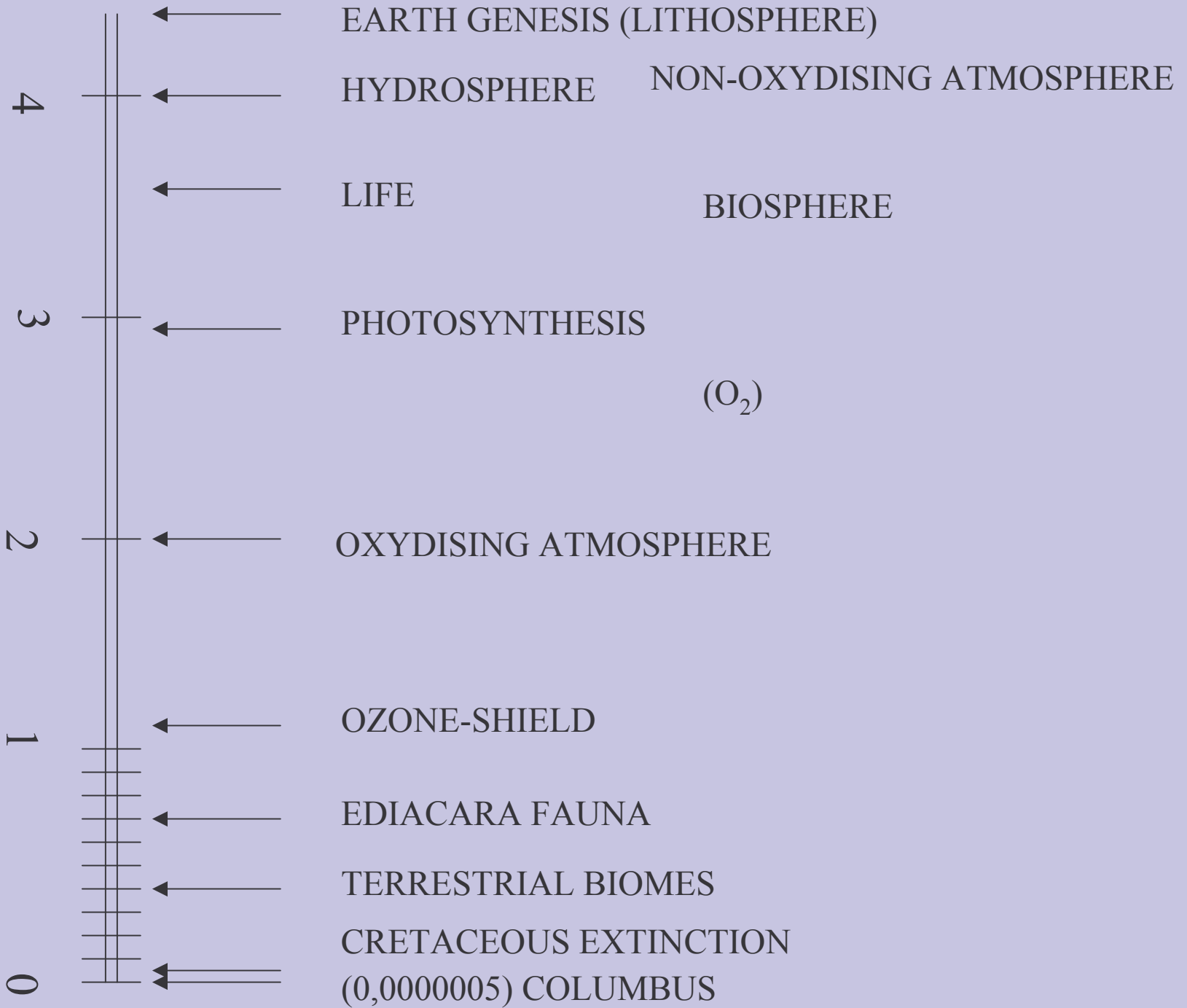
Outline

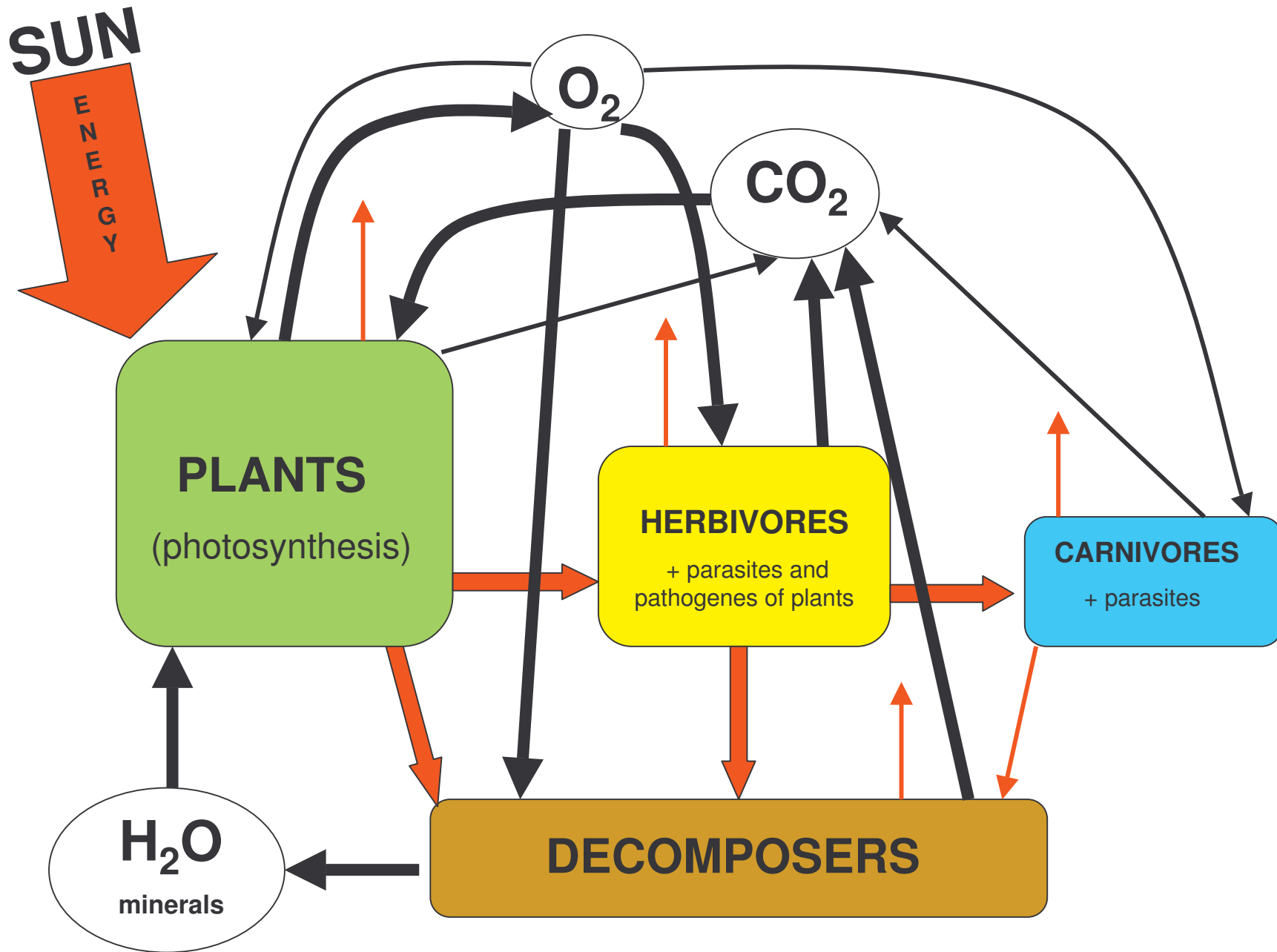
- Scale and the ecosystem thinking
- Biodiversity measures, levels and functions
(Does it really matter?)
- Biodiversity in built environment (Can it be preserved?)
- The problem at the global scale
- Is there a solution? Search for a new paradigm

The final conclusion is that we know very little, and yet it is astonishing that we know so much, and still more astonishing that so little knowledge can give us so much power.

B. Russell

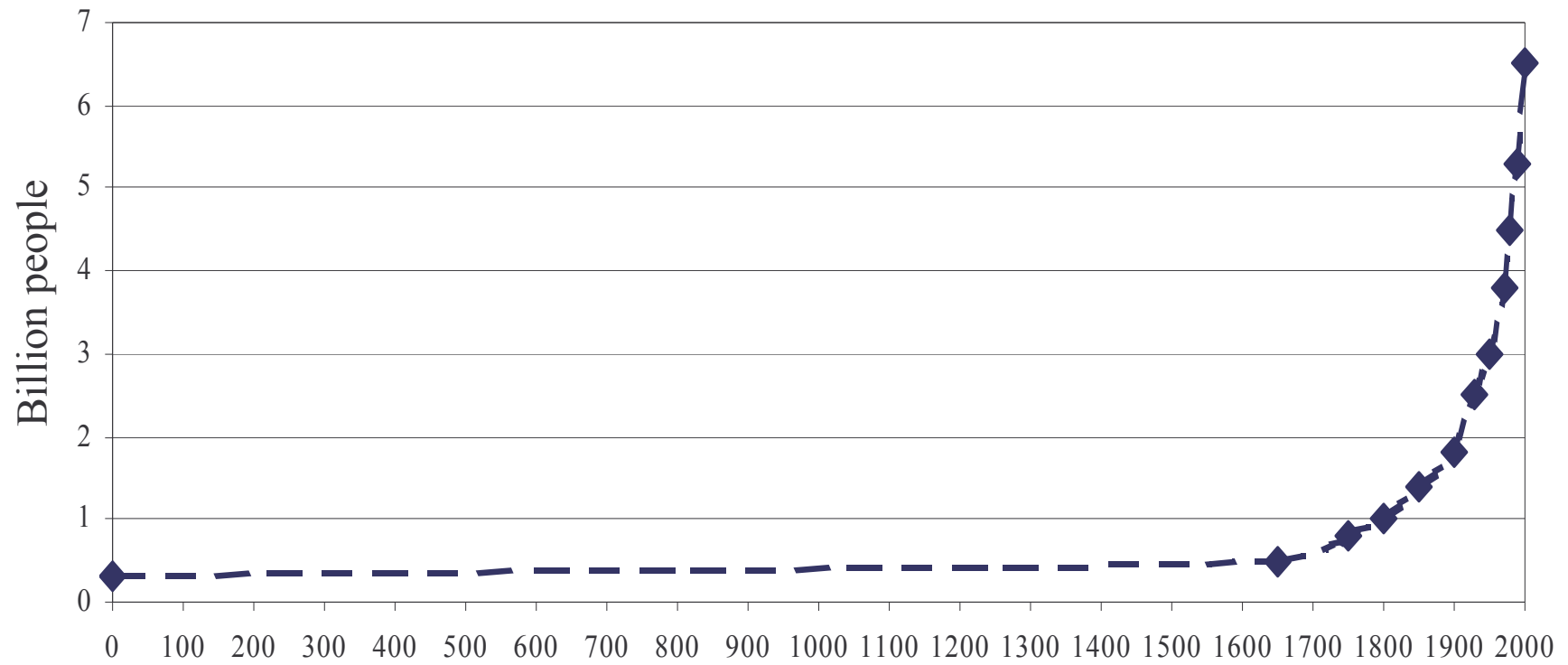
billion years

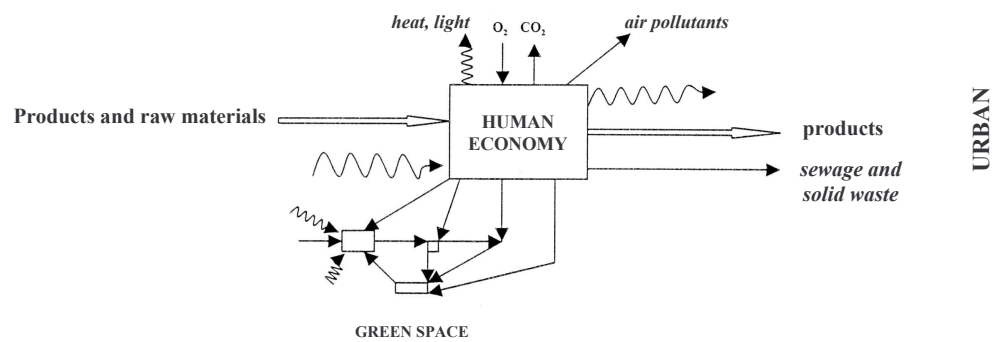
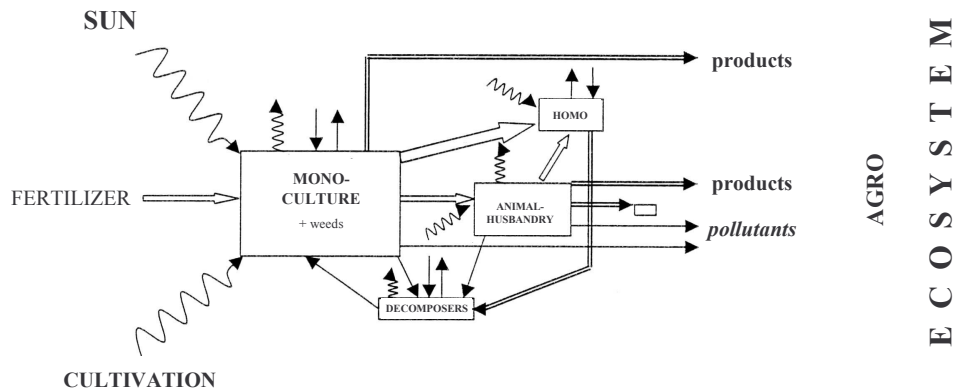
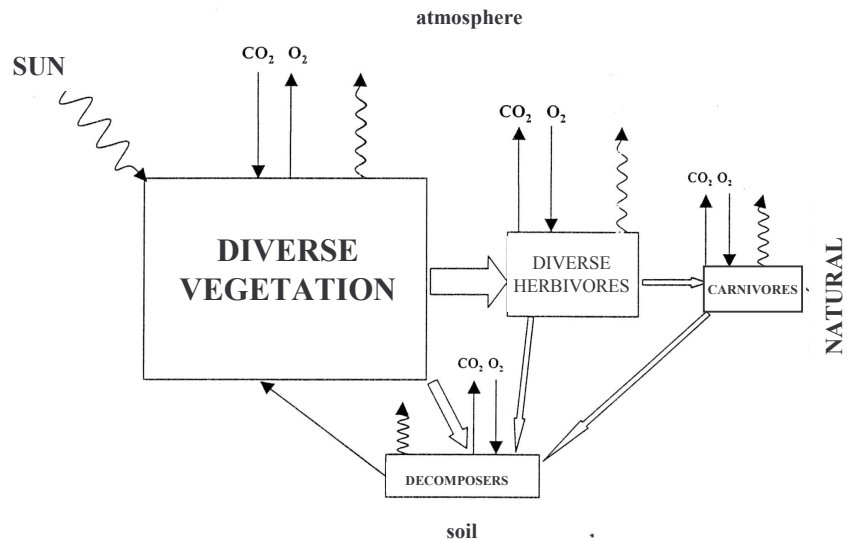




Complexity – diversity – stability - efficiency

POPULATION BOMB





BIODIVERSITY INDICES

(the simplest)

N (the number of gene forms, species, communities, etc.)

(Shannonian)

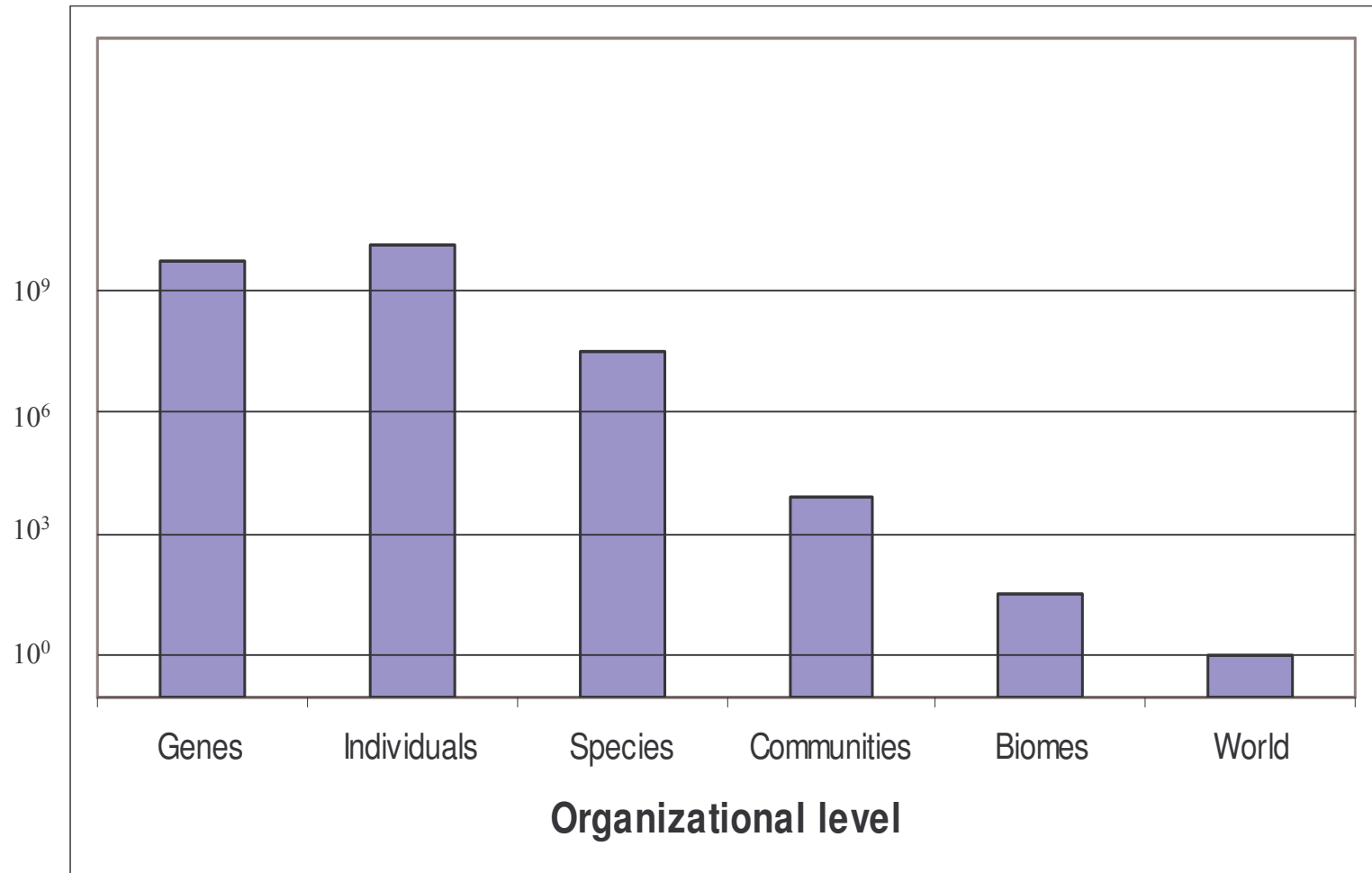
H = $-\sum p_i \log p_i$ (where p_i is the relative frequency of the i^{th} kind)

(Simpsonian)

H = $1 - \sum p_i^2$

• • •

NUMBER OF KINDS



GENETIC DIVERSITY

- Final source of higher-level biodiversity
- Necessary to adaptation and evolution
- Contributes to the survival of the population and the higher-level biodiversity
- Usually limited by the size of population (N_e)

Functional aspects of biodiversity (at all levels)

Stability

Resilience

Efficiency

in processes of

atmospheric regulation
climatic regulation
hydrological regulation
nutrient cycling
pest control
pollination
soil formation
etc.

CONTRASTING TERRESTRIAL ECOSYSTEMS

	NATURAL	ARTIFICIAL
Species diversity	high	low (mostly monoculture)
Genetic diversity	high	low (mostly homogeneous genetically)
Biomass	high	low
Material cycling	± balanced	unbalanced
Adaptation in changing environment	natural selection	crop change, breeding
Experience	400 000 000 years	cca. 400 years
Global trend	declining	expanding
Consequences	Sustainability (GAIA)	Global change Global human responsibility

THE NEUTRAL GENETIC DIVERSITY MODEL

$$H_t = H_0(1-1/2N)^t \quad \rightarrow \quad H_\infty = 0$$

with mutation (μ)

$$\hat{H} = \frac{4N\mu}{4N\mu + 1}$$

Migration increases, selection decreases or increases the neutral diversity

Message to preservation programmes:

Large interconnected populations ($N > 1000$) are viable!

Ecological unsustainability

World average footprint:	2.2 ha/cap	
US average footprint:	9.5 ha/cap	
Pakistani average footprint:	0.7 ha/cap	(2001 data)

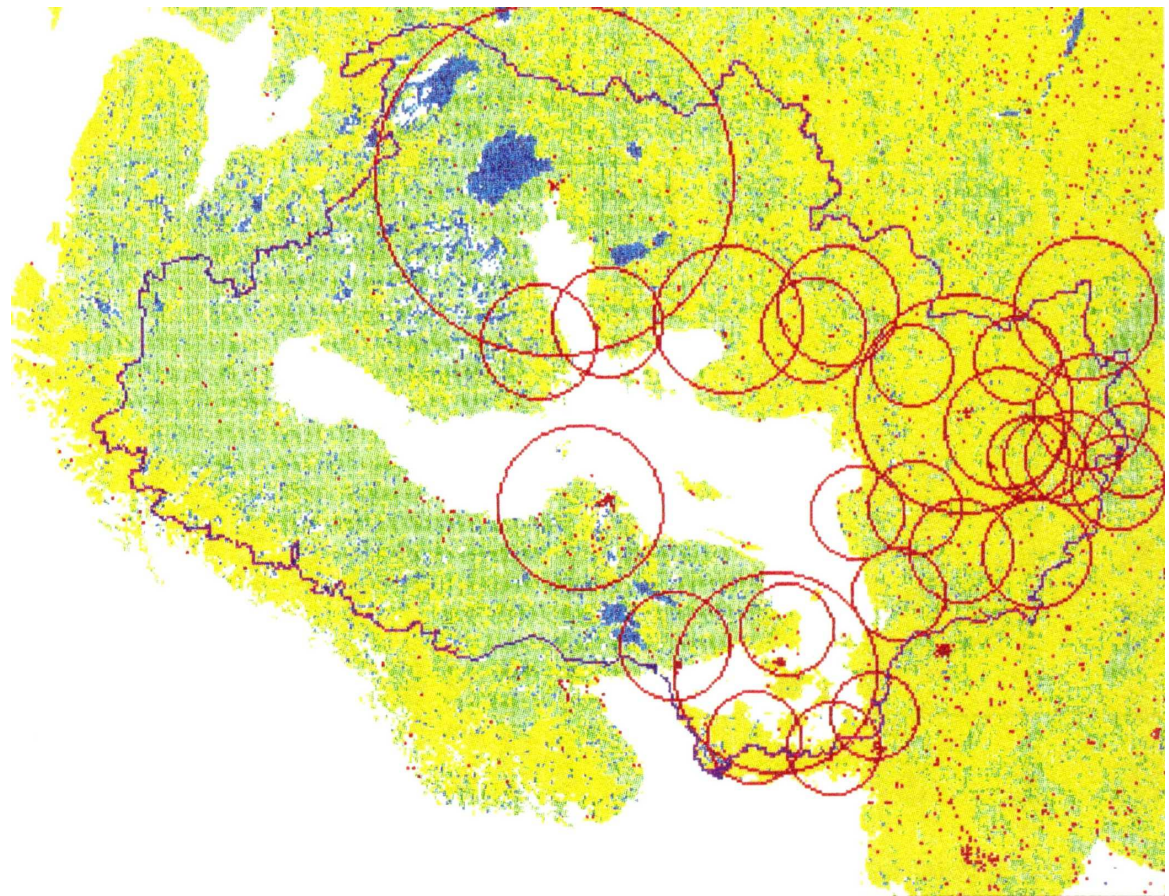
World average deficit: 0.4 ha/cap

Wackernagel (2006)

Average person's ecological rucksack (North): **40-80 tons /year**

*„I cannot see any plausible strategy of protecting what remains of our planet's biodiversity without **drastically** reducing the material flow traveling through the human technosphere.”*

von Weizsäcker (2006)



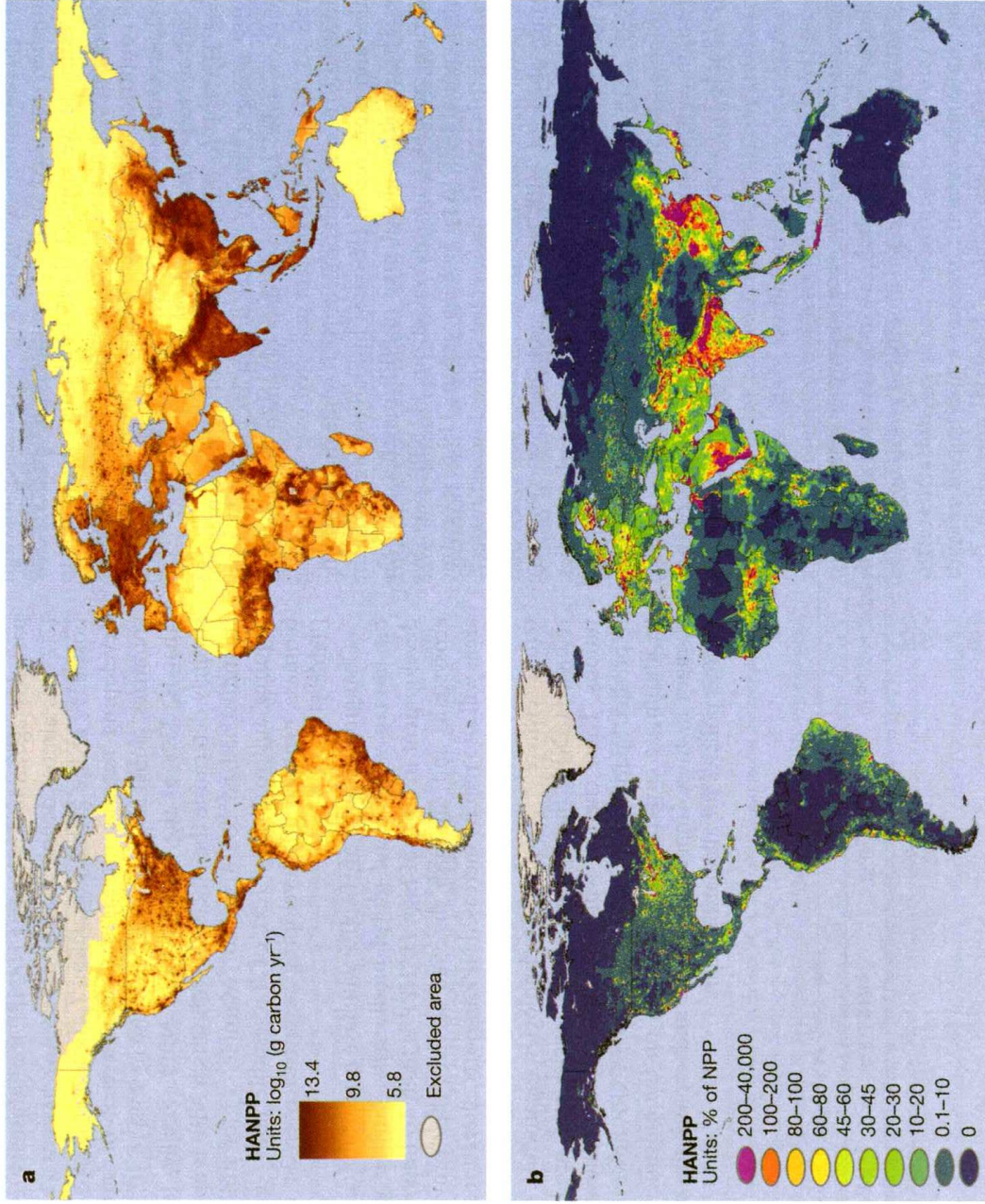


Figure 1 Spatial distribution of the annual NPP resources required by the human population. As measured by **a**, HANPP and **b**, HANPP as a percentage of local NPP. Both maps use the intermediate estimate for HANPP and are in units of carbon.

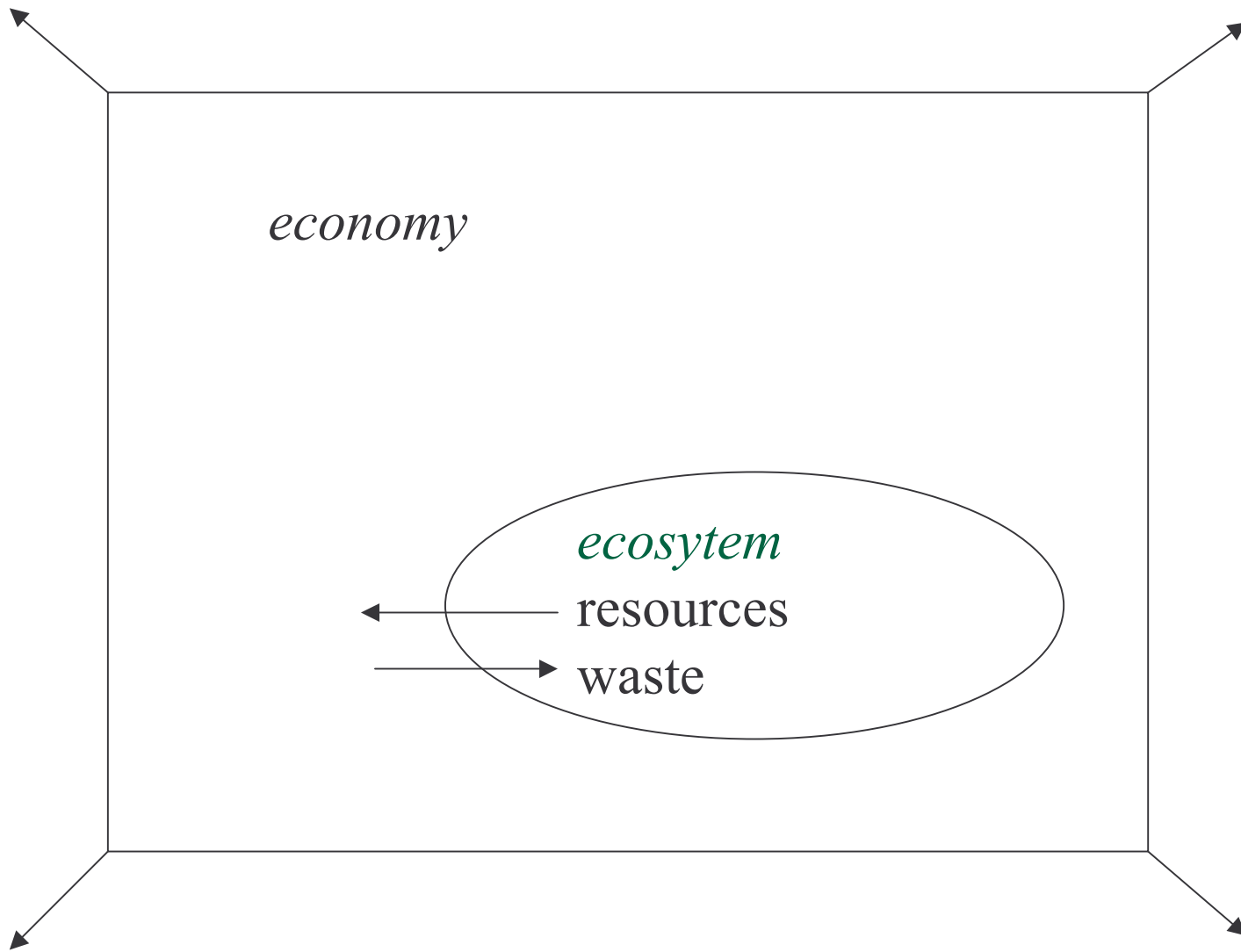
Trends in social unsustainability

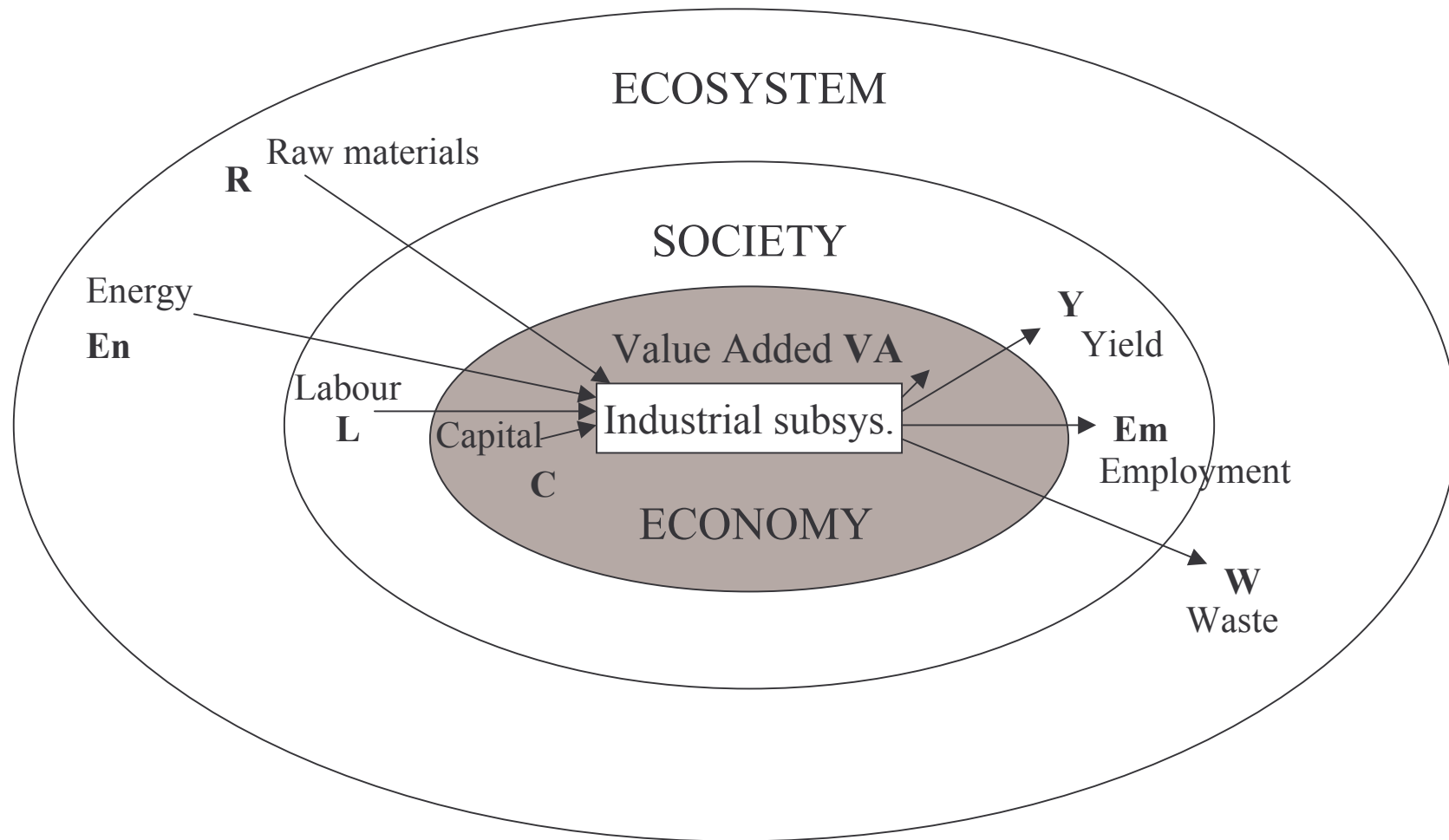
WORLD POPULATION INCOME

$$1970: \quad \frac{\text{richest 20\%}}{\text{poorest 20\%}} = 30$$

$$2005: \quad \frac{\text{richest 20\%}}{\text{poorest 20\%}} = 75$$

von Weizsäcker (2006)





How to halt the loss of biodiversity?

General problem: issues are interrelated

warning!

ROAD TO HELL IS PAVED WITH GOOD INTENTIONS

Economic growth

Developments

Environmental protections

Biodiversity actions



Biodiversity loss

Degraded ecosystems

Declining ecosystem services

Mounds of documents
declarations
agreements
initiatives
research papers
etc.



satisfaction

cf. Millennium Ecosystem Assessment

How to halt the loss of biodiversity?

Answers:

- No, we cannot
- Pseudo-yes
 - a) by selecting appropriate indicators
 - b) by losing next to everything by 2010

„If we can't laugh at ourselves and our pretensions, we just haven't taken ourselves seriously enough.”

D.Orr Conserv. Biol. 16. p.297 (2004)

- Real (eu-)yes
 - by paradigm change

„[we need] major initiatives, which will mean profound changes in the way global society operates.”

H. Mooney et al. Nature 434.p.562 (2005)

Simplest illustration of the problem (P. & A. Ehrlich)

$$I = PCT$$

How much is enough?

I = Impact (incl. biodiv. loss)

P = Population

C = Consumption

T = Technology

Trend: increasing gap between poor and rich!

(NB. welfare is relative)

„The core problem is that we have forgotten that economic growth is a means to an end, not an end itself.”

„[The] goal is (or should be) a sustainable and desirable present and future for all of humanity.”

„... this implies that maintaining our ecological life-support system and the biodiversity that allows it to function is a key sub-goal.”

R. Costanza Nature 439.p.789 (2006)

Ecological footprint!
(desperate developing world)

What are we to do?

*„We have utterly changed our world;
now we'll have to see if we can change our ways.”*

Paul & Anne Ehrlich: One with Niniveh (2004)

? Millennium Assessment of Human Behaviour

Global Climate Change $\xrightarrow[\text{adaptation}]{\text{mitigation}}$ **by changing ourselves**

Suggested changes:

Present

Growth

Competition

Material wealth

Soft sustainability

Business spirit dominance

Profit orientation

Selfish consideration (excuse: invisible hand)

Consumer society (disposables)

Progress indicator: GDP growth

Neoliberal economics

Life is struggle

Never enough

...

Alternatives

Equilibrium

Cooperation, mutualism

Mental health

Hard sustainability

Ethical, intellectual, aesthetic prevalence

Public welfare orientation

Altruistic consideration

Sustainable society

Evaluation: ISEW, GPI, etc.

Ecological economics

Life is good

„Logic of Sufficiency” (T.Princeton)

...

end note:

*„You may say I'm a dreamer
But I'm not the only one...”*

John Lennon: Imagine