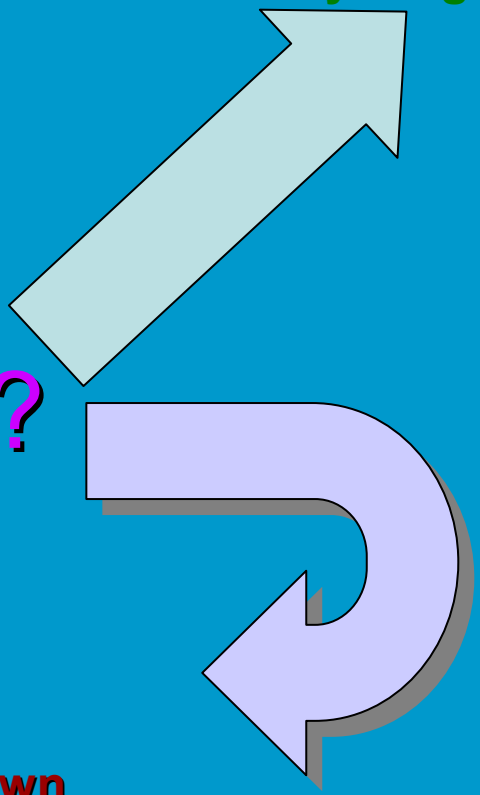
GLOBAL PROBLEMS

- Adaptation or mitigation?
- Great uncertainties
- High economic impacts
- Serious risk (high inertia)
- The facts are largely supported by the assumptions

Where goes the world? ⟷ What economy and environment insure a healthy future?

Where goes the world?



The GDP shows speed – but does not indicate the correct direction!

Content

- System approach and experts
- Mankind and the place of economy
- The Earth is full
- The energy problem
- The world of unrealities – how long?

Sustainable growth??? On a finite Earth?

Sustainable development?? Qualitative change: is it getting better or worse?

Sustainability? What? How long?

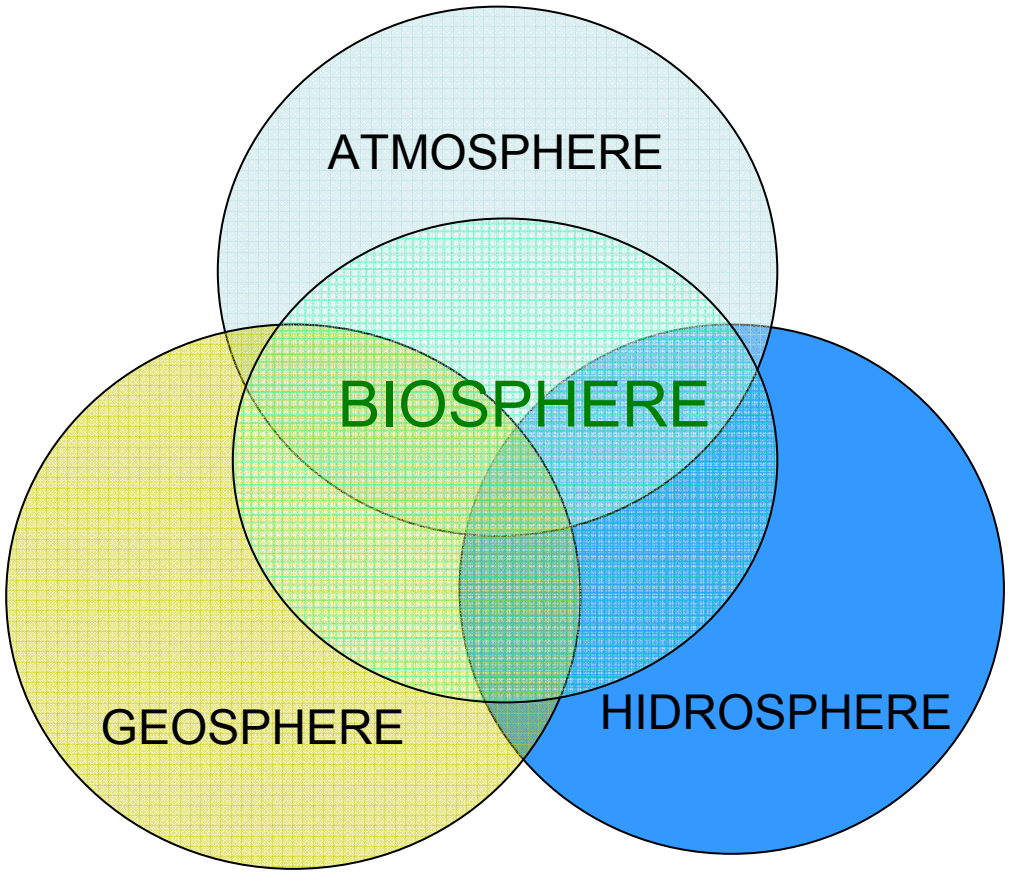
„*Such a development that meets the needs of the present generation, without compromising the chances of future generations to meet their needs.”*
(Bruntland Committee)

„Sustainable development is a continuous implementation of social well-being without compromising the carrying capacity of the environment.” (H. Daly)

To maintain the vital operation of the biosphere!

Save the ~~Earth~~ mankind!

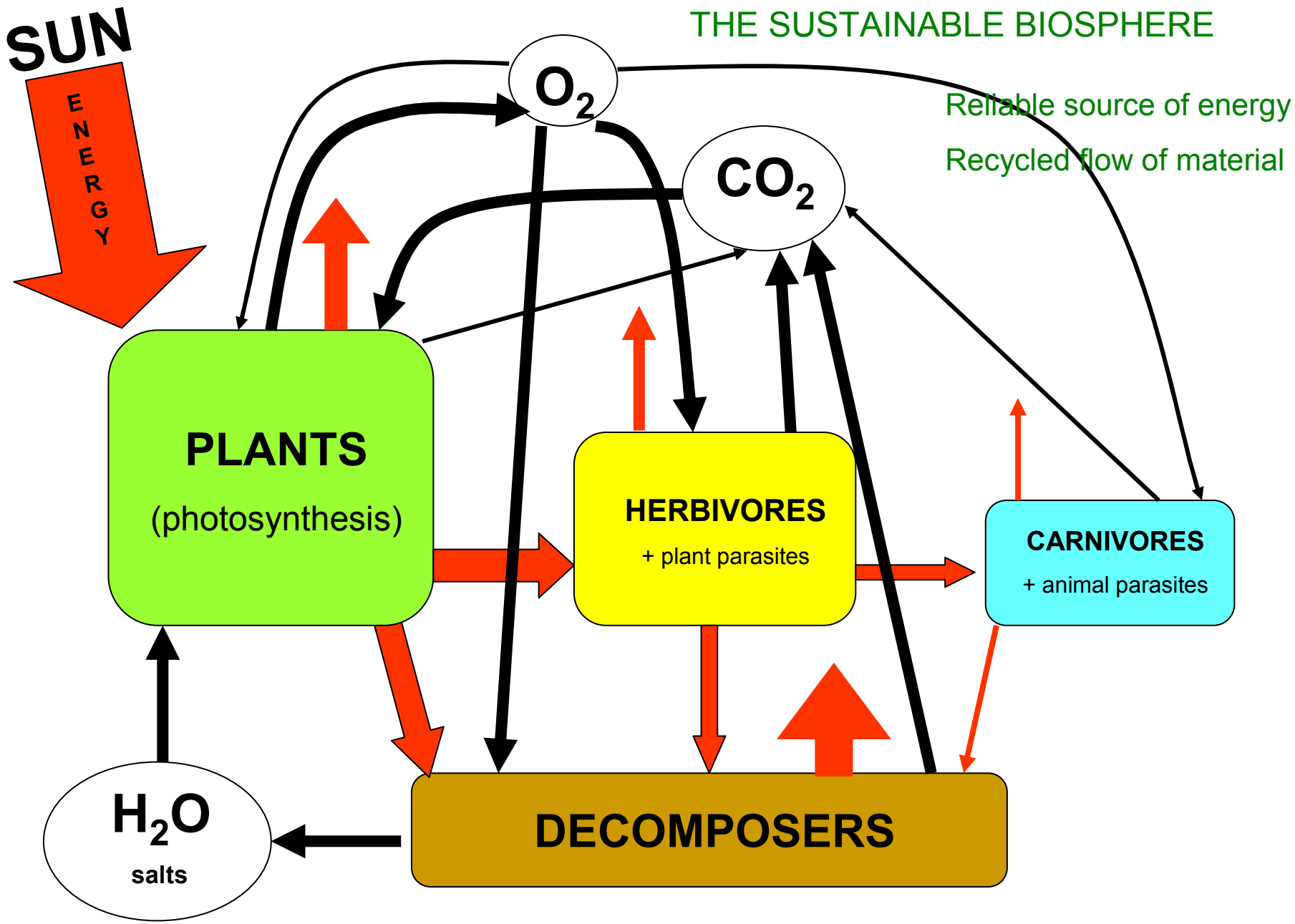
THE EARTH SYSTEM WITH THE BIOSPHERE



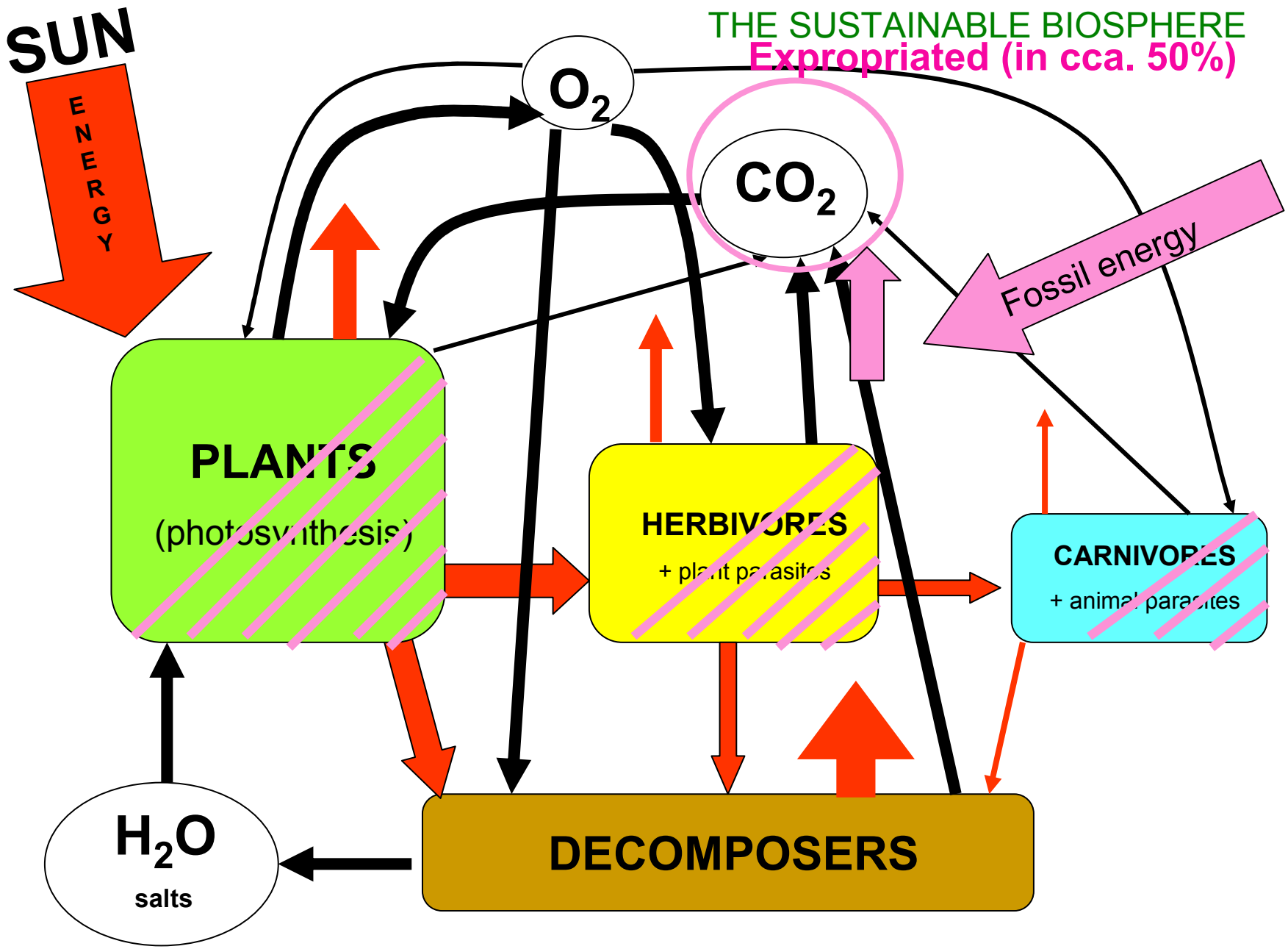
The biosphere before the mankind

- Biosphere is a growing sub-system of the great Earth system;
- 99.96% of the history of the Earth is without mankind;
- The biosphere has evolved with the diversity of life, and has been regulated with ecological organizations;
- „It has been developed sustainably…”!

… until Homo sapiens has appeared!



Complexity – diversity – flexibility - efficiency


THE SUSTAINABLE BIOSPHERE
Expropriated (in cca. 50%)
SUN
ENERGY
O_2
CO_2
Fossil energy
PLANTS
(photosynthesis)
HERBIVORES
+ plant parasites
CARNIVORES
+ animal parasites
H_2O
salts
DECOMPOSERS
Complexity – diversity – flexibility – efficiency

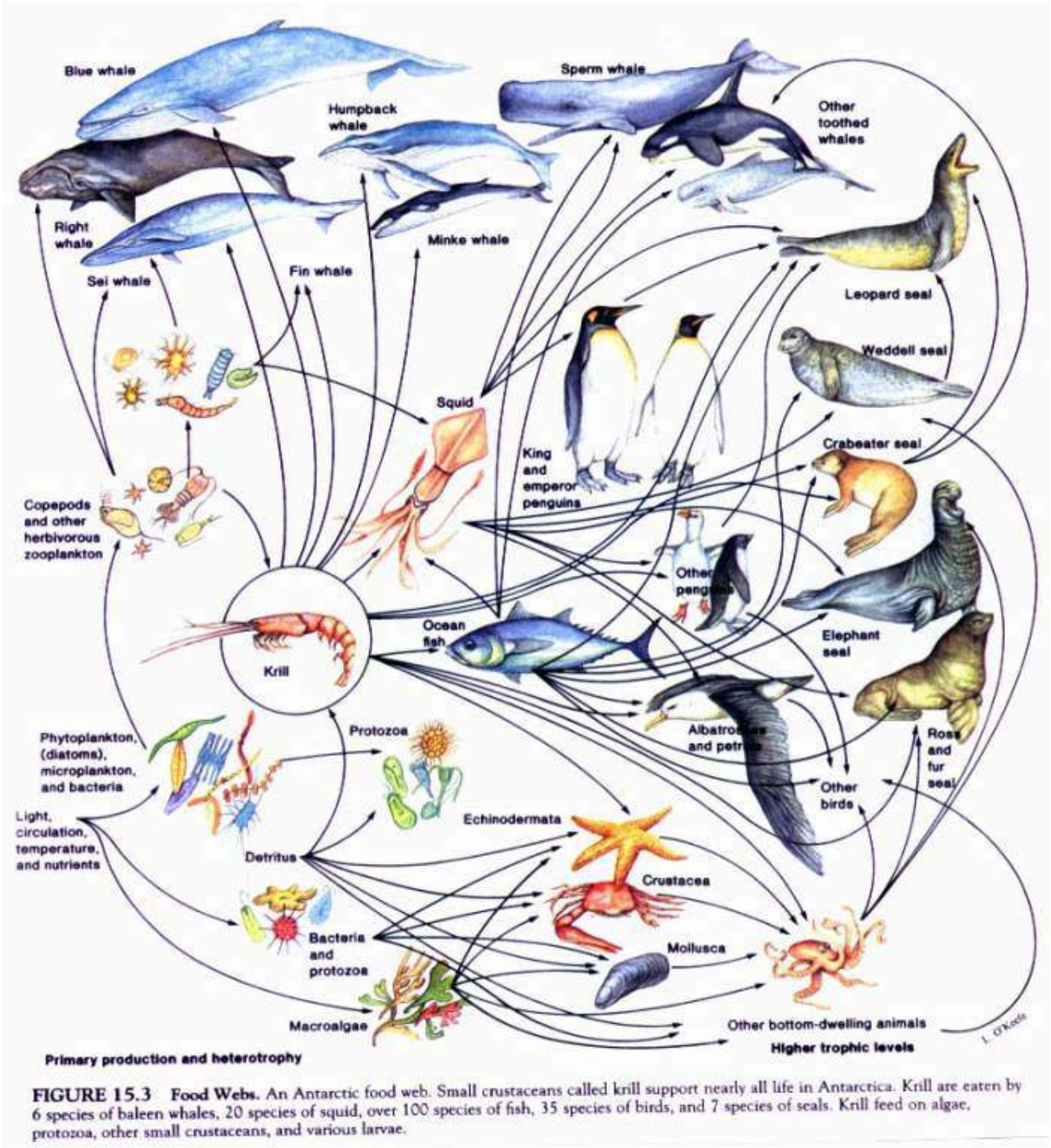


FIGURE 15.3 Food Webs. An Antarctic food web. Small crustaceans called krill support nearly all life in Antarctica. Krill are eaten by 6 species of baleen whales, 20 species of squid, over 100 species of fish, 35 species of birds, and 7 species of seals. Krill feed on algae, protozoa, other small crustaceans, and various larvae.

Antarctic food web

For what is good biodiversity?

(in all levels)

Stability

Flexibility

Efficiency

in what?

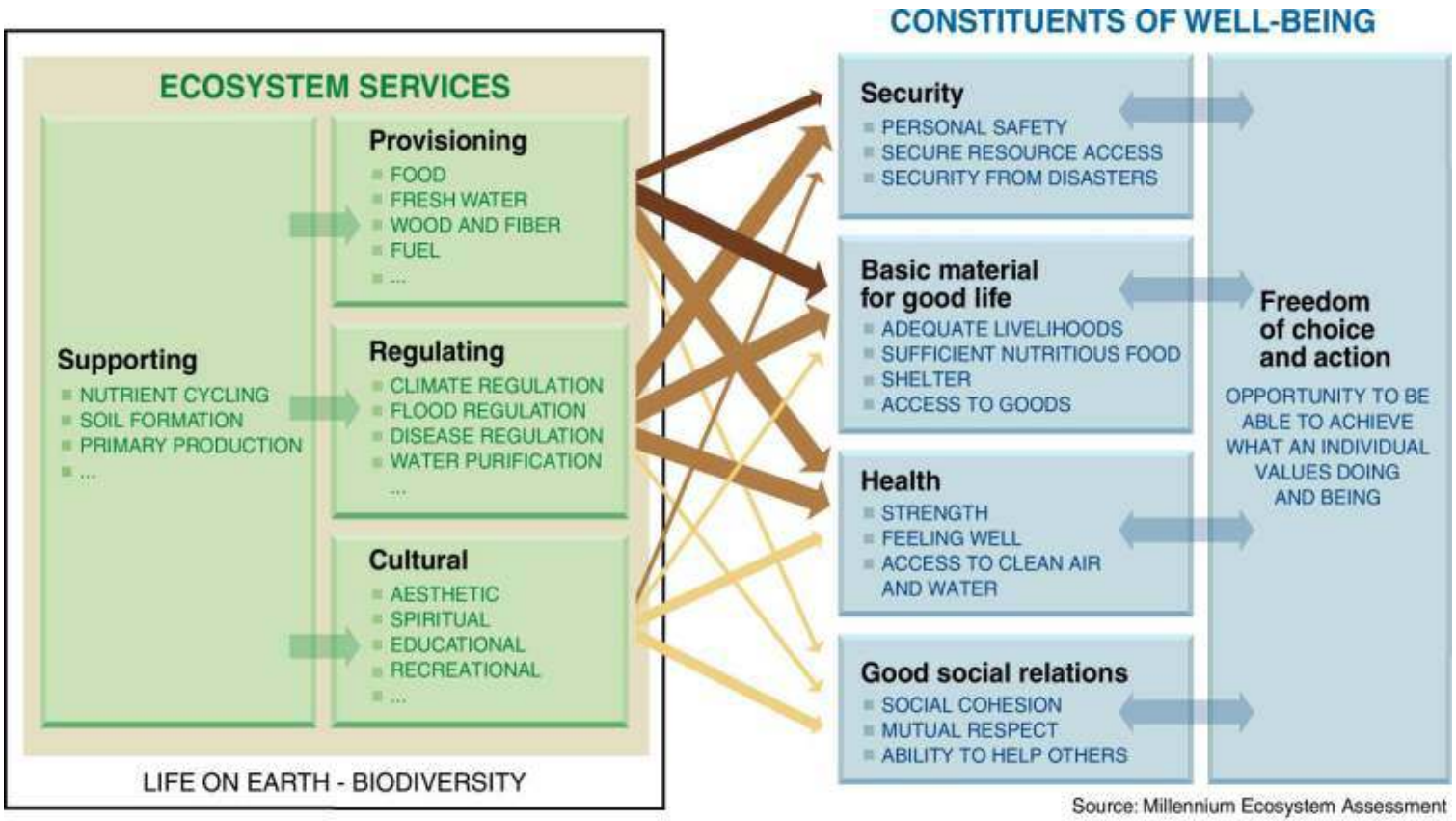
Control of the atmopshere
Climate control
Hydrological regulation
Regulation of material cycles
Pest control
Pollination
Soil formation
etc.

„ecosystem services"

Operation of the biosphere

Bet is its evolution-ability over a longer term!

Services and human well-being in the context of ecosystems



Symptoms of the „Environmental crisis”

Air

Soil

Water

Landscape

Biodiversity

Ecological services

The ozone layer

Global climate

Cycles of materials

Polluted, degraded, damaged!

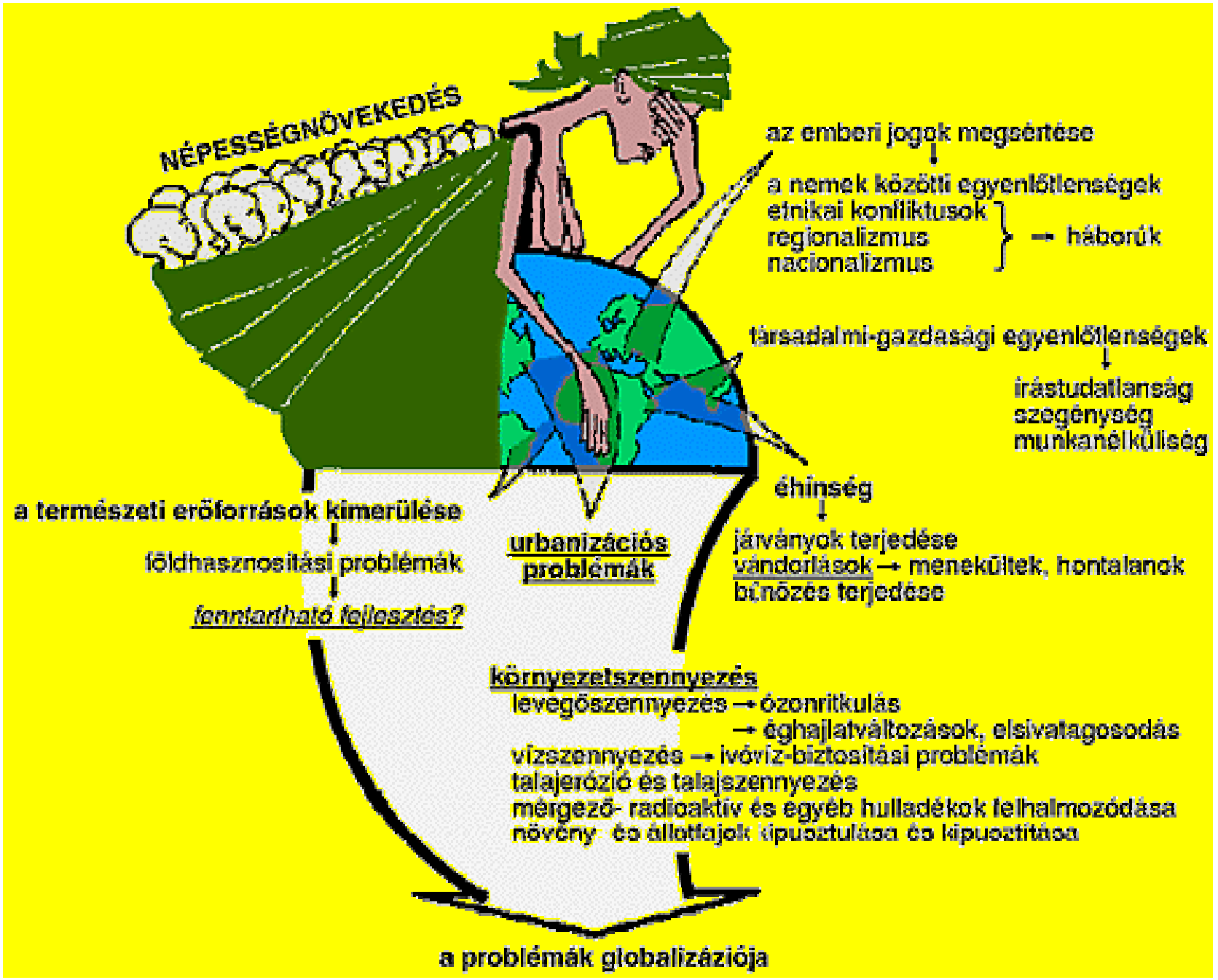
Symptomatic treatments

And the reasons?

Introductory question:

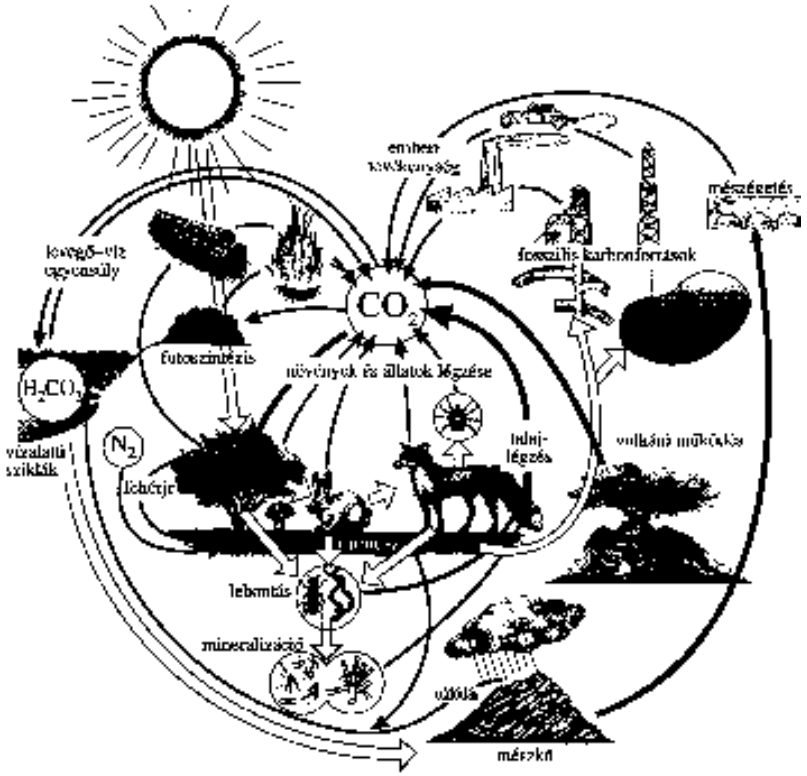
Whether we will find our place in the Biosphere?

- Delusion: *„Man is lord of the environment, and he can create it on his own mood and demand."*
- Recently mankind has become a significant factor, an element of the Earth system!
- The biosphere works great without people – not vice versa!
- The current global economic system leads to collapse, is not sustainable!
- *Survival of the humanity depends on the recognition of the above!*


NÉPESSÉGNÖVEKEDÉS
az emberi jogok megsértése
a nemek közötti egyenlőtlenségek
etnikai konfliktusok
regionalizmus
nacionalizmus
→ háborúk
társadalmi-gazdasági egyenlőtlenségek
írástudatlanság
szegénység
munkanélküliség
éhínség
járványok terjedése
vándorlások → menekültek, hontalanok
bűnözés terjedése
a természeti erőforrások kimerülése
földhasznosítási problémák
fenntartható fejlesztés?
urbanizációs problémák
környezetszennyezés
levegőszennyezés → ózonritkulás
→ éghajlatváltozások, elsivatagosodás
vízszennyezés → ivóvíz-biztosítási problémák
talajerózió és talajszennyezés
mérgező- radioaktív és egyéb hulladékok felhalmozódása
növény- és állatfajok kipusztulása és kipusztítása
a problémák globalizációja

B. Commoner (1972): “The closing circle”

1. Everything is connected wih everything.
2. Everything is moving and moving somewhere.
3. Nature is more familiar with the solutions.
4. Nature reserves ≠ Swedish table.



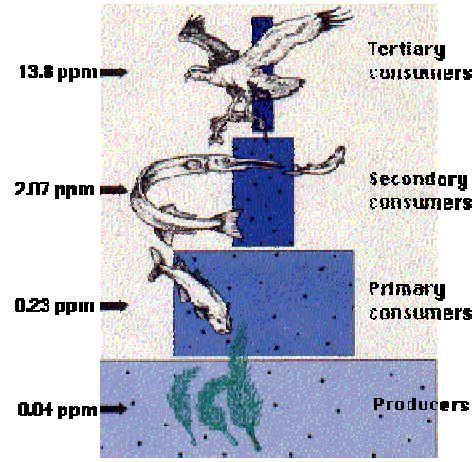
1962 Rachel Carson: Silent spring

American marine biologist

She detected harmful effects of DDT

Fiction but it has a scientific basis

Significance: draws the attention on the severity of the environmental problems



The numbers are representative values of the concentration in the tissues of DDT and its derivatives (in parts per million, ppm)

The accumulation of DDT in food chain

The stock of three species of Asian vultures reduced by 97% during 12 years (1992-2004) (American researchers, 2004);

Reason: a painkiller used in veterinary medicine (diclofenac);

$\Rightarrow$ renal failure, internal bleeding;

$\Rightarrow$ 2005: diclofenac was banned in India;

Effects of human activity:

- Accelerated material and energy flows,
- Open cycles,
- Stocks depletion and pollution,
- Environment makeover, changing environmental factors

Elimination / isolation of habitats;

Land use change;

Change of flow of moving environmental elements;

Change of heat and water balance conditions;

...

Cause:

- **Population growth,**
- **Urbanization,**
- **Industry (20th century: 50 – 100 x), ENERGY PRODUCTION,**
- **Catering**

- ❖ **Desertification, acidification, climate change,**
- ❖ **Nitrification, smog, hazardous waste,**
- ❖ **Emergency, environmental disasters, etc..**
- ❖ **Trend: local → global**
- ❖ **The economic situation determines it fundamentally (recommendation: 1% of the GDP should be devoted to environmental protection)**
- ❖ **Future?**

Overpopulation, production and environmental quality

- Before 10,000 years $\longrightarrow$ agriculture
- $\Rightarrow$ 5,000 BC.: 50 million people;
- During Jesus: 300 million people;

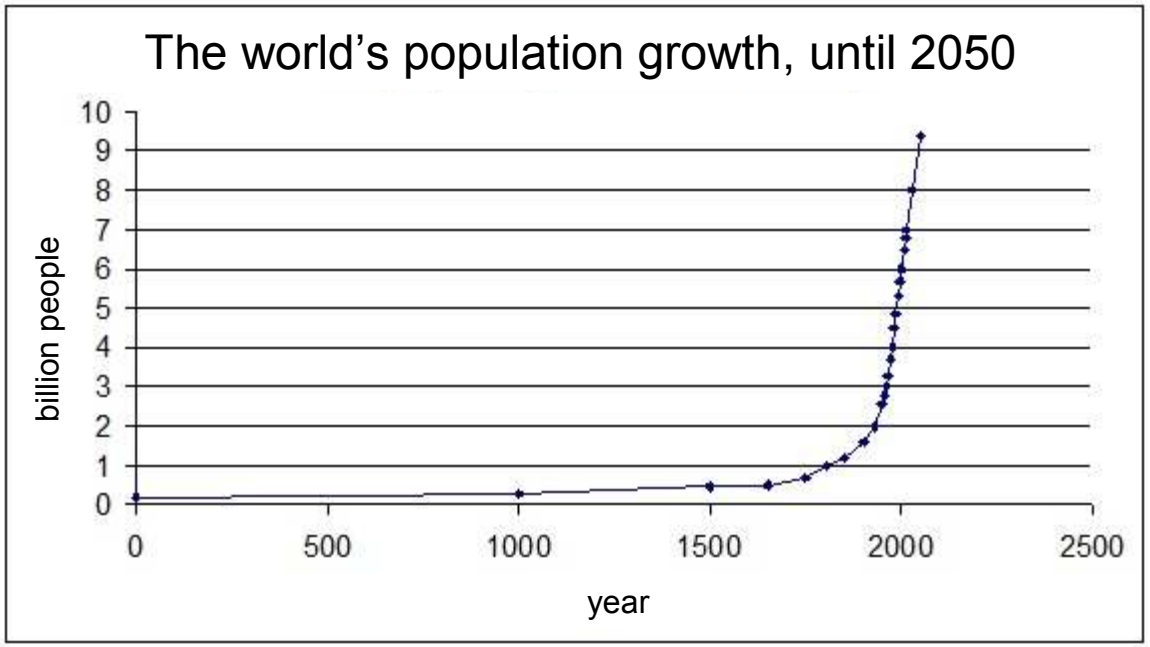
- Carrying capacity

Currently:

- **Agriculture:** 48 billion people;
- **Ecoogy:** ?

Population control

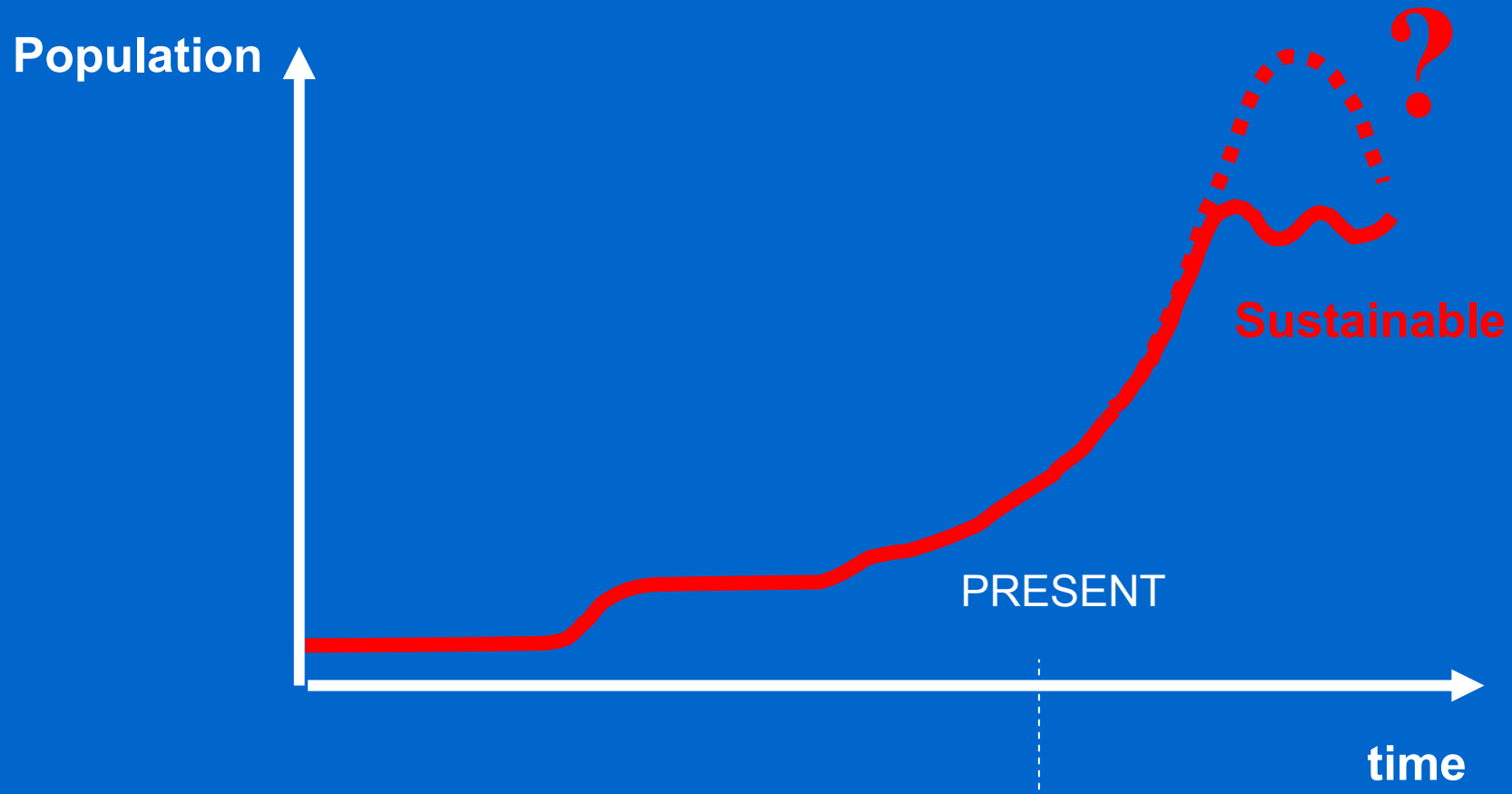
- Disease, famine, wars;
- Artificial control resulted in often cruel forms …
- Natural control: epidemics (plague, cholera)
- Since 1600- : rapid population growth
- Currently exponential growth (J-shaped curve)



Changes in the population today

- In 1996, the UN published the report of the Commette on Demography (until 2050: 8-11 billion people)
- **The main problem is inequality**

RELATIONSHIP BETWEEN HUMANS AND THE ENVIRONMENT



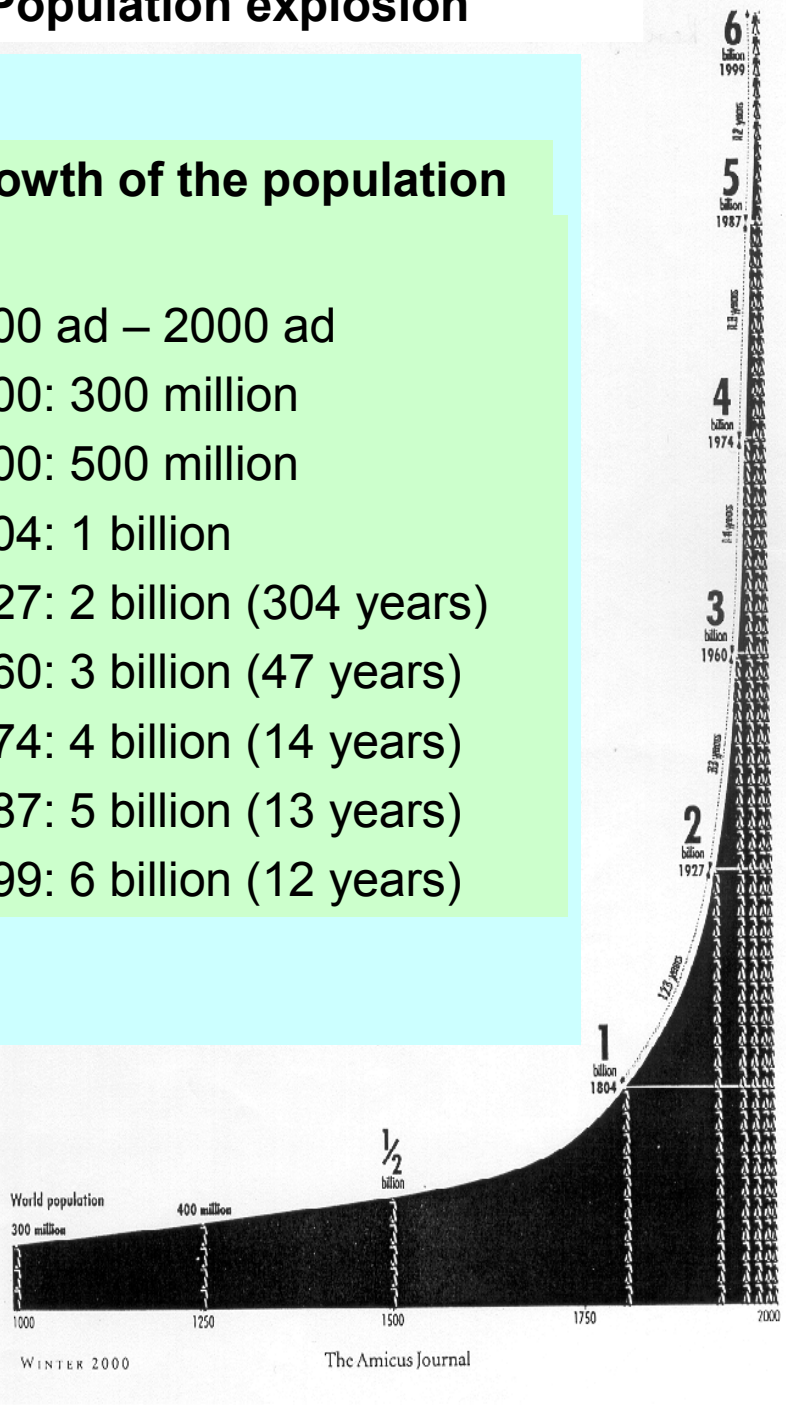
Economic activity	Hunting	Agriculture	Industrialization	Transition
Contact with the environment	Enemy	Source	Dump	Recognition of the borders
Environmental effect	Minimum	Inventury reduction	Contamination	High degree of degradation

Period	Growth (million people)	duration (years)
10000 bc - 7000 bc	5-10	3000
7000 bc - 4500 bc	10-20	2500
4500 bc - 2500 bc	20-40	2000
2500 bc - 1000 bc	40-80	1500
2500 bc - 0	80-160	1000
0 - 900 ad	160-320	900
900 ad - 1700 ad	320-600	800
1700 ad - 1850 ad	600-1200	150
1850 ad - 1950 ad	1200-2500	100
1950 ad - 1990 ad	2500-5300	40
1990 ad - 2085 ad	5300-10200	95

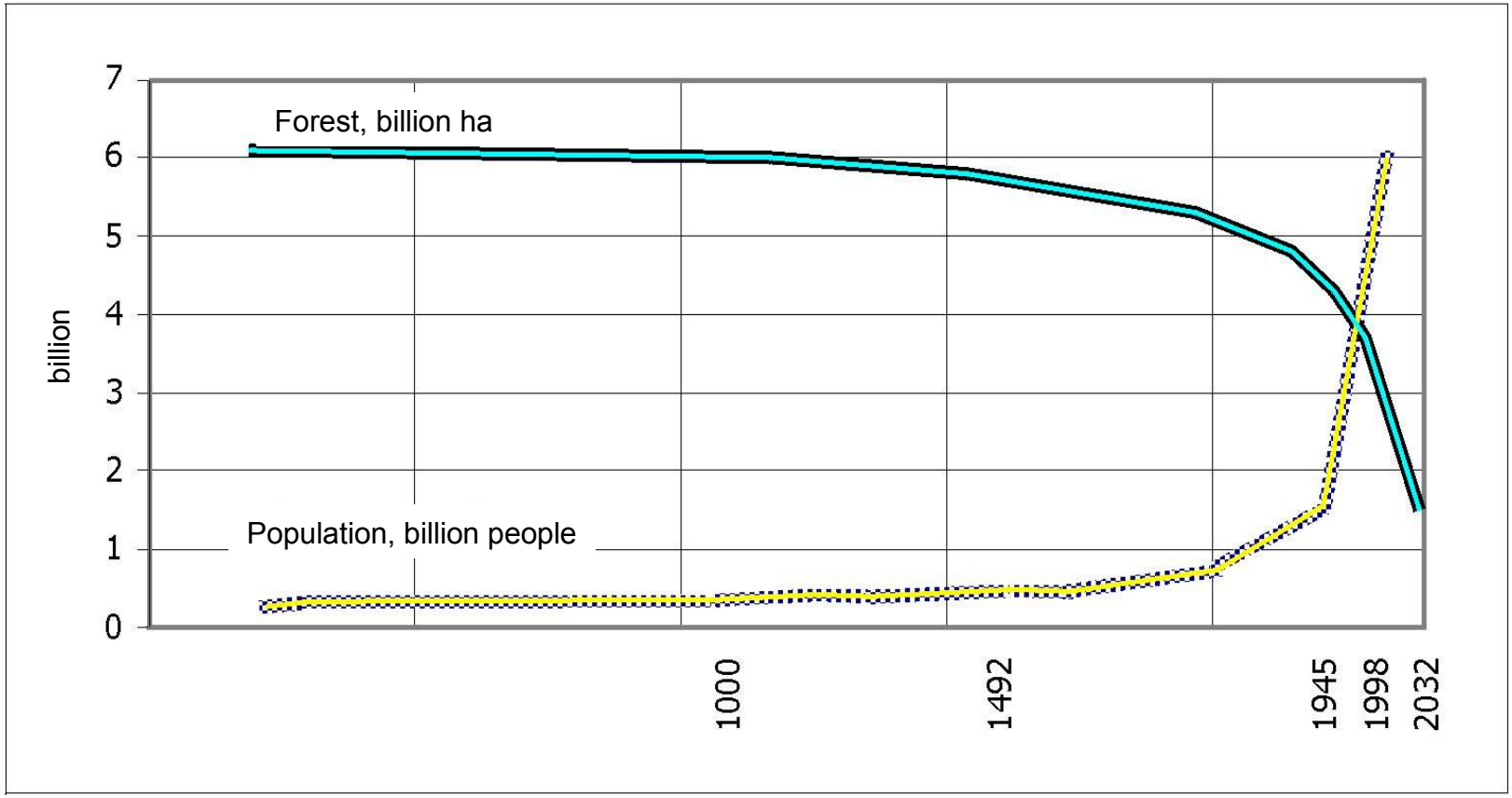
Population explosion

Growth of the population

1000 ad – 2000 ad
1000: 300 million
1500: 500 million
1804: 1 billion
1927: 2 billion (304 years)
1960: 3 billion (47 years)
1974: 4 billion (14 years)
1987: 5 billion (13 years)
1999: 6 billion (12 years)



Forest and population on Earth



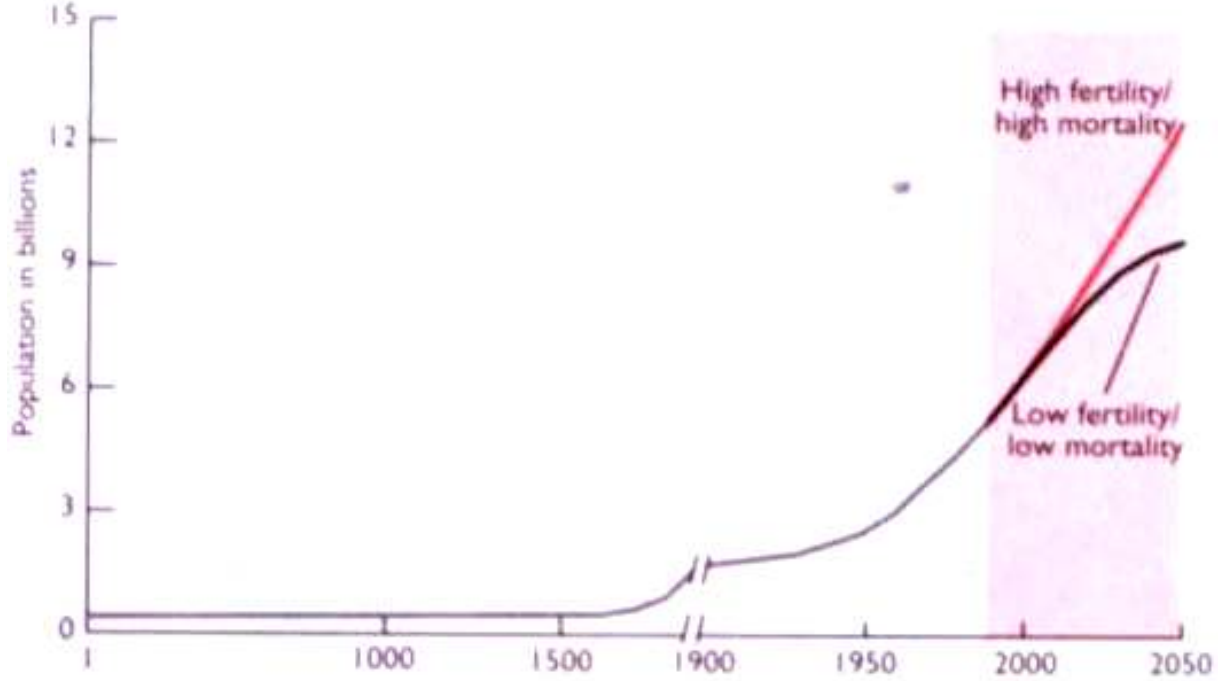
- 30 million people live in Delhi and Bombay, respectively. Their population together reach the number of residents of the United Kingdom.

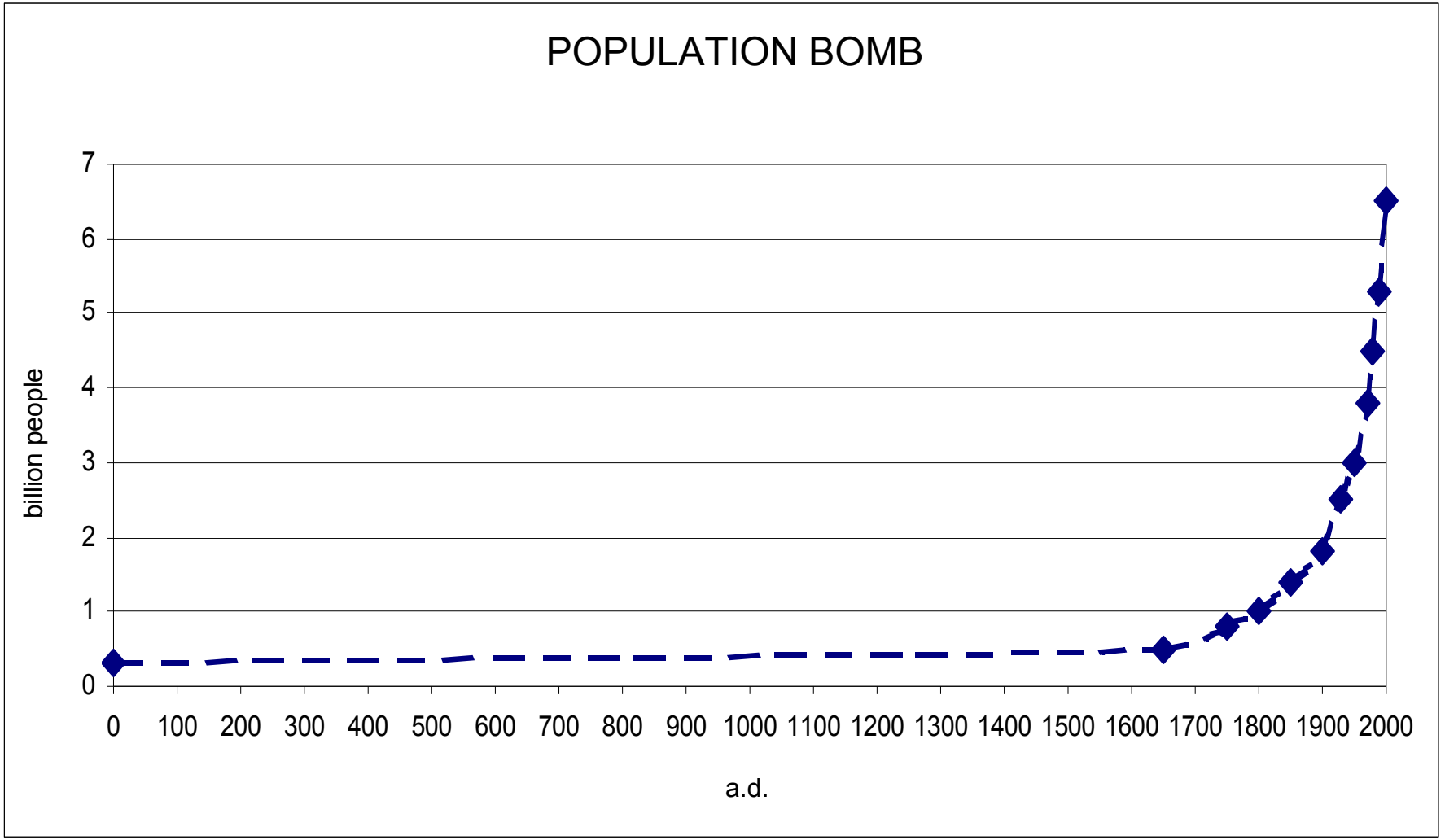
- In India, the population of 35 cities exceed 1 million people. By 2026, 70 cities will exceed this size.
- In China, the population of 45 cities exceed 1 million people.

- In 2005, China used 26% of crude steel, 32% of rice and 37% of cotton of the world total.
- By 2015, annual production of cars in China from 320 thousand (1995) may exceed those of Japan and US producing 8 million per year each.
- In 2005 China had 350 million mobile phone subscribers, while in 1996 it had only 7 million.

- 8% of the world's freswater reserves, while 22% of the world's population are located in China. The northern half of the country is drying up.
- 2004: 58% of the water samples from China's largest rivers are unfit for human consumption.
- India: 10% of the wastewaters are cleaned.
- China: 30% of arable land is acidic.
- The 20 most polluted cities in the world are in China.
- India: 4500 ha of irrigated land has become infertile due to the textile industry wastewater.

World Population, 1 A.D. to 2050 A.D.

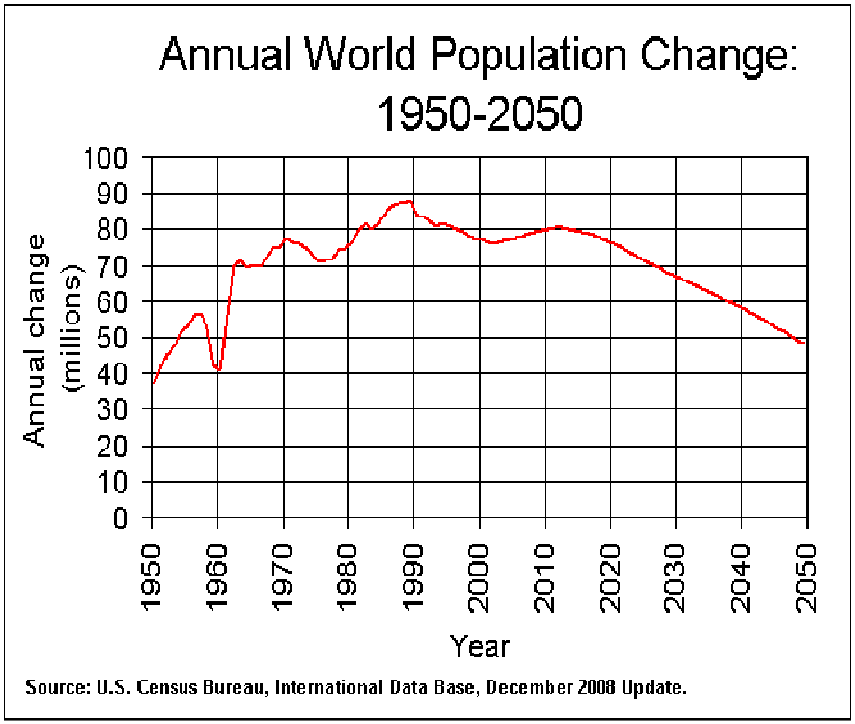



POPULATION BOMB
billion people
7
6
5
4
3
2
1
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
a.d.

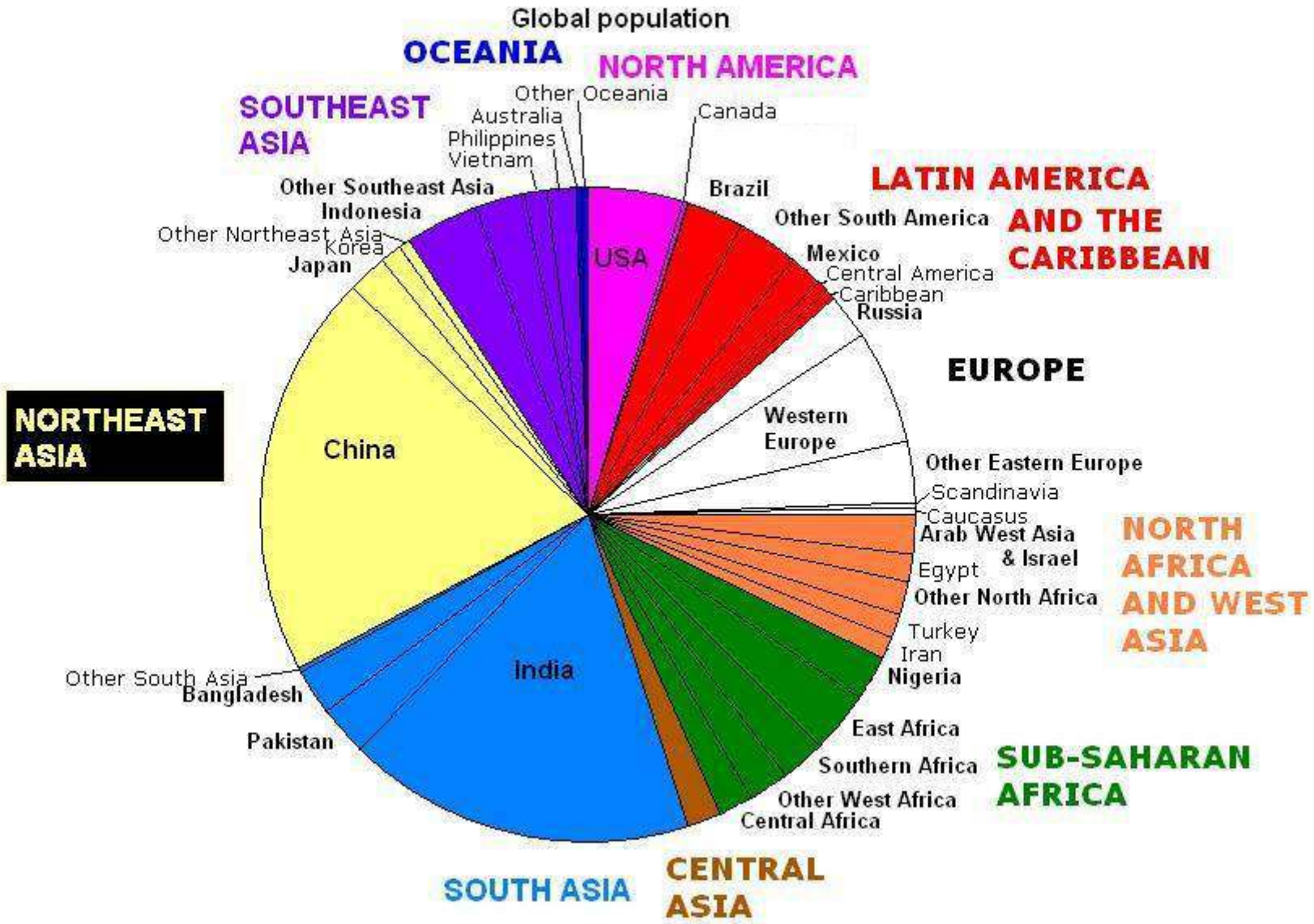
The population of the Earth

- Recently
  (June 23, 2010)
  6,829,095,560

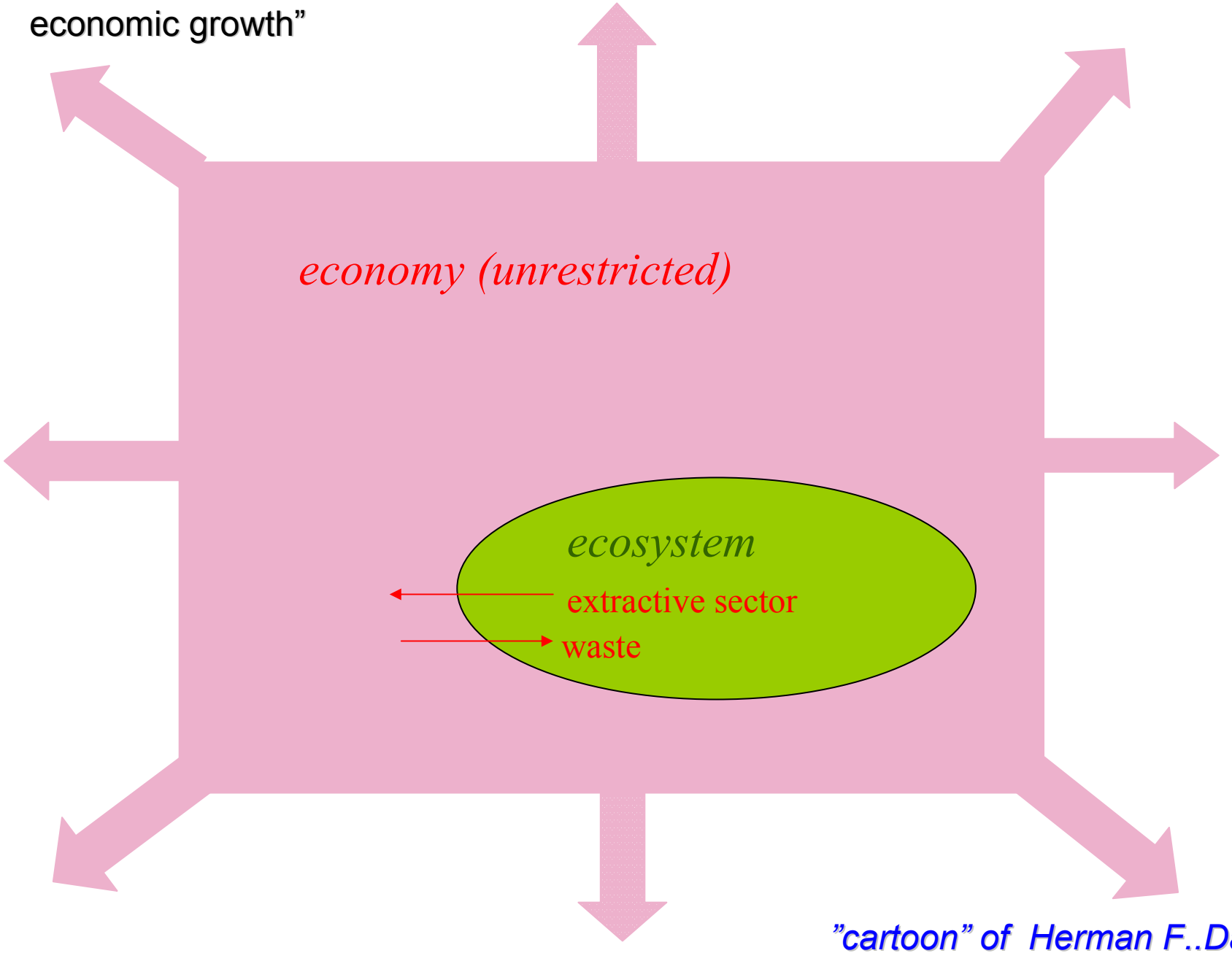
- + 1,1% per year
  75 120 050
- Daily growth:
  205 538
- Per minute
  142



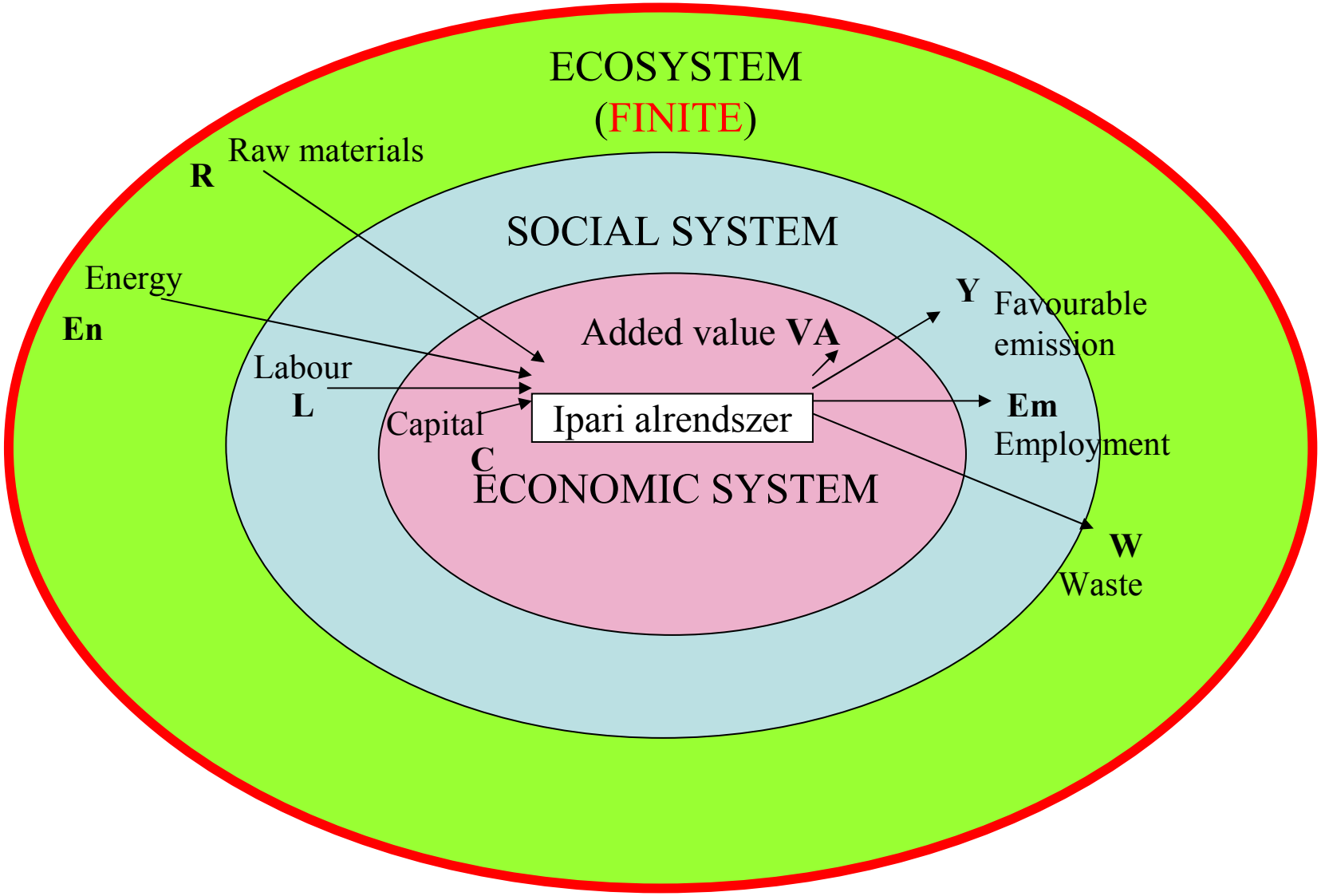
Distribution of the Earth's population (2008)



”the aim is to increase economic growth”

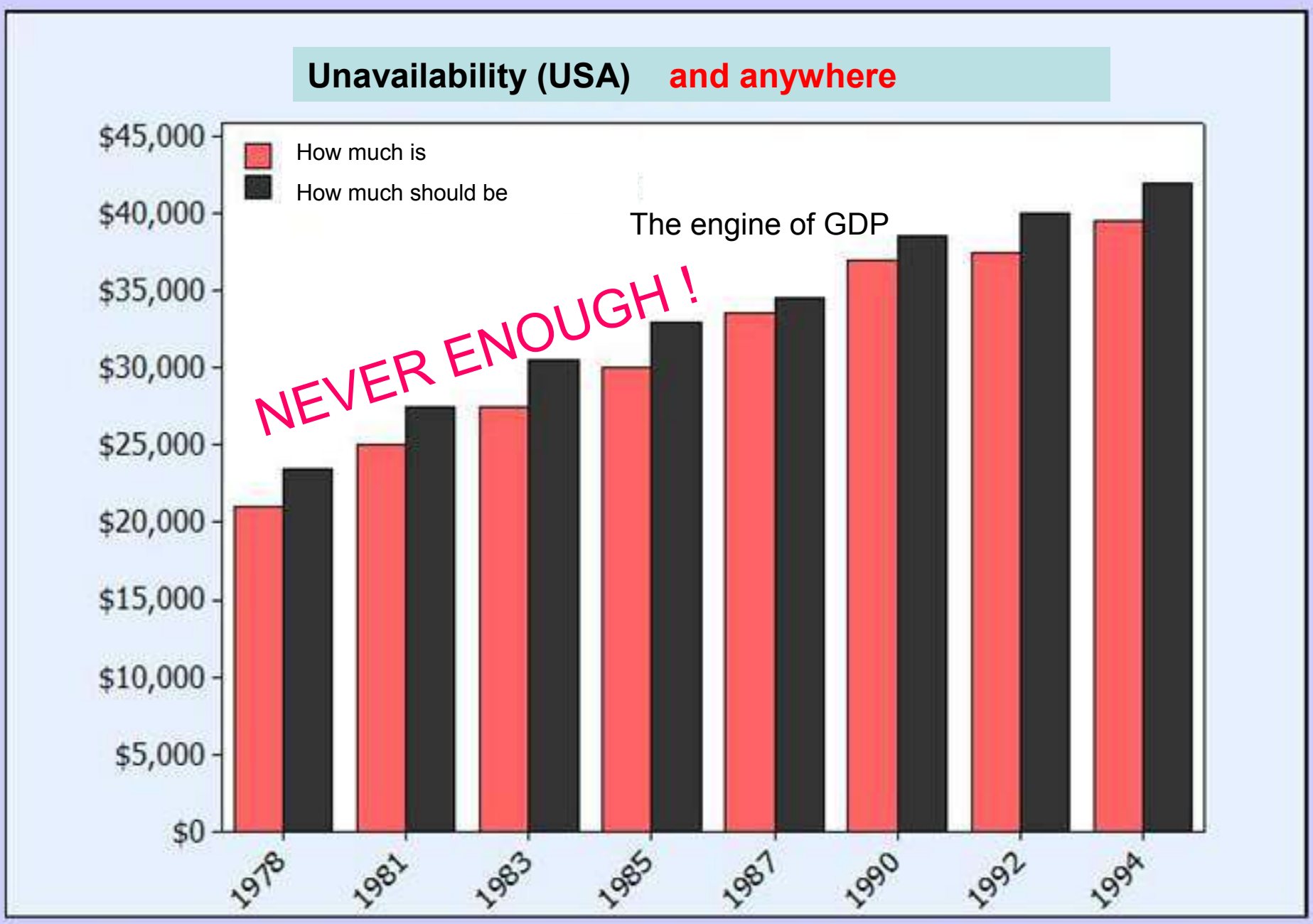


”cartoon” of Herman F..Daly


ECOSYSTEM
(FINITE)
Raw materials
R
SOCIAL SYSTEM
Energy
En
Added value VA
Y
Favourable
emission
Labour
L
Capital
C
Ipari alrendszer
Em
Employment
ECONOMIC SYSTEM
W
Waste

Kerekes, S.

Unavailability (USA) and anywhere



Source: Juliet Schor, The Overspent American: Upscaling, Downshifting, and the New Consumer

Further growth?

With an economic growth of 3% per year, the economic performance doubles every 20 years.

If this growth continues to be relized, by 2030 2x, by 2050 4x, by 2070 8x, and by 2090 16x more economic performance (and environmental impact) would be created.

Is it possible a steady growth on a finite Earth? - NO!

Increased efficiency? Dematerialisation? – Jevon paradox!

In the economics, Jevon's Paradox is as follows: if a technological process increases the efficiency of resource exploitation, this increases (rather than decreases) the rate of consumption of that resource, as well.

"What if the 2008 crisis is much more than a deep recession? What if the constant economic growth model that we have created over the last 50 years, neither economically nor ecologically sustainable, and bumped into a wall in 2008, which both Mother Earth and the market has sent a message: There is no more!"

„Sustainable crisis" (V.G.)

The Inflection Is Near?

By THOMAS L. FRIEDMAN

New York Times

Published: March 7, 2009

Two simple growth equations

exponential

$$dN/dt = rN$$

Unlimited growth

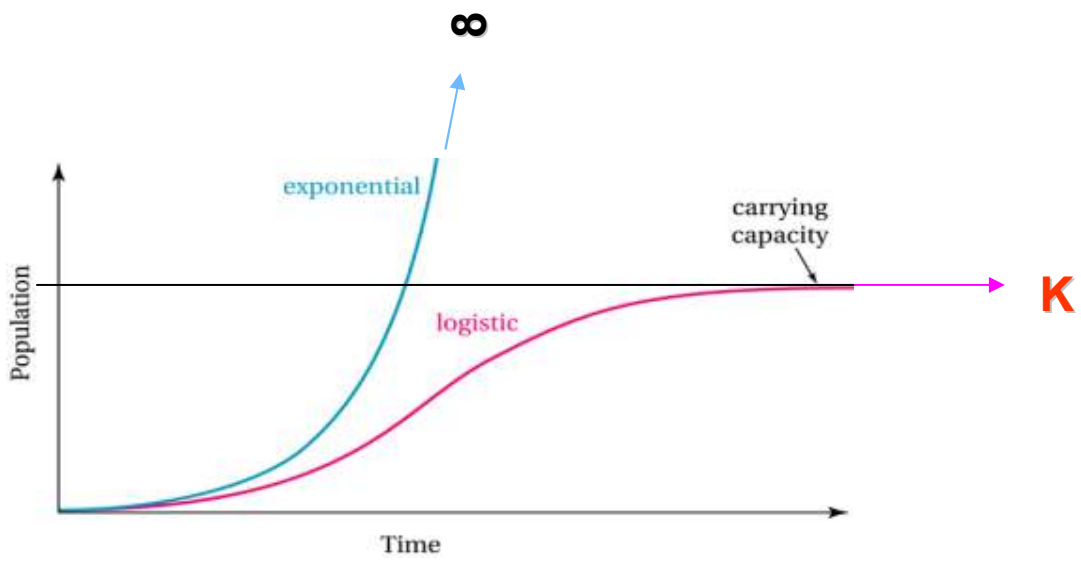
IRREAL **(only temporarily)**

logistic

$$dN/dt = rN[1-(N/K)]$$

limited by K saturation level

REAL



- http://444.hu/2013/10/31/szimulalt-terkepen-figyelheto-hogy-valtozik-a-fold-nepessege/

Ecological footprint

Wackernagel

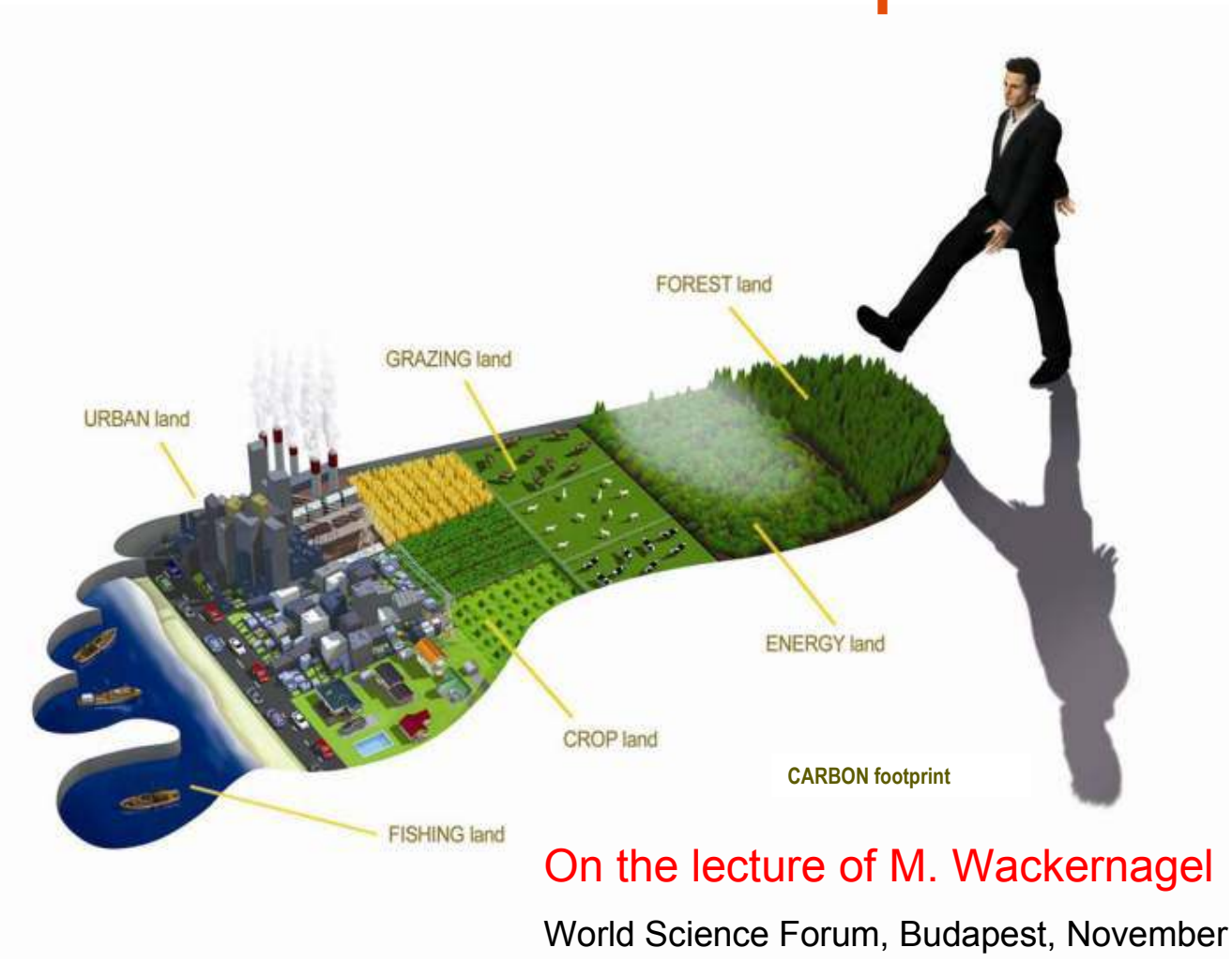
The area that is able to continue to produce consumer goods, + the area, that is able to continuously process waste.

All this is calculated according to current scientific knowledge on current production levels.

It can be specified to a man, a village, a country, or even the whole Earth.

The area means a biologically productive area.

Components of our footprint need



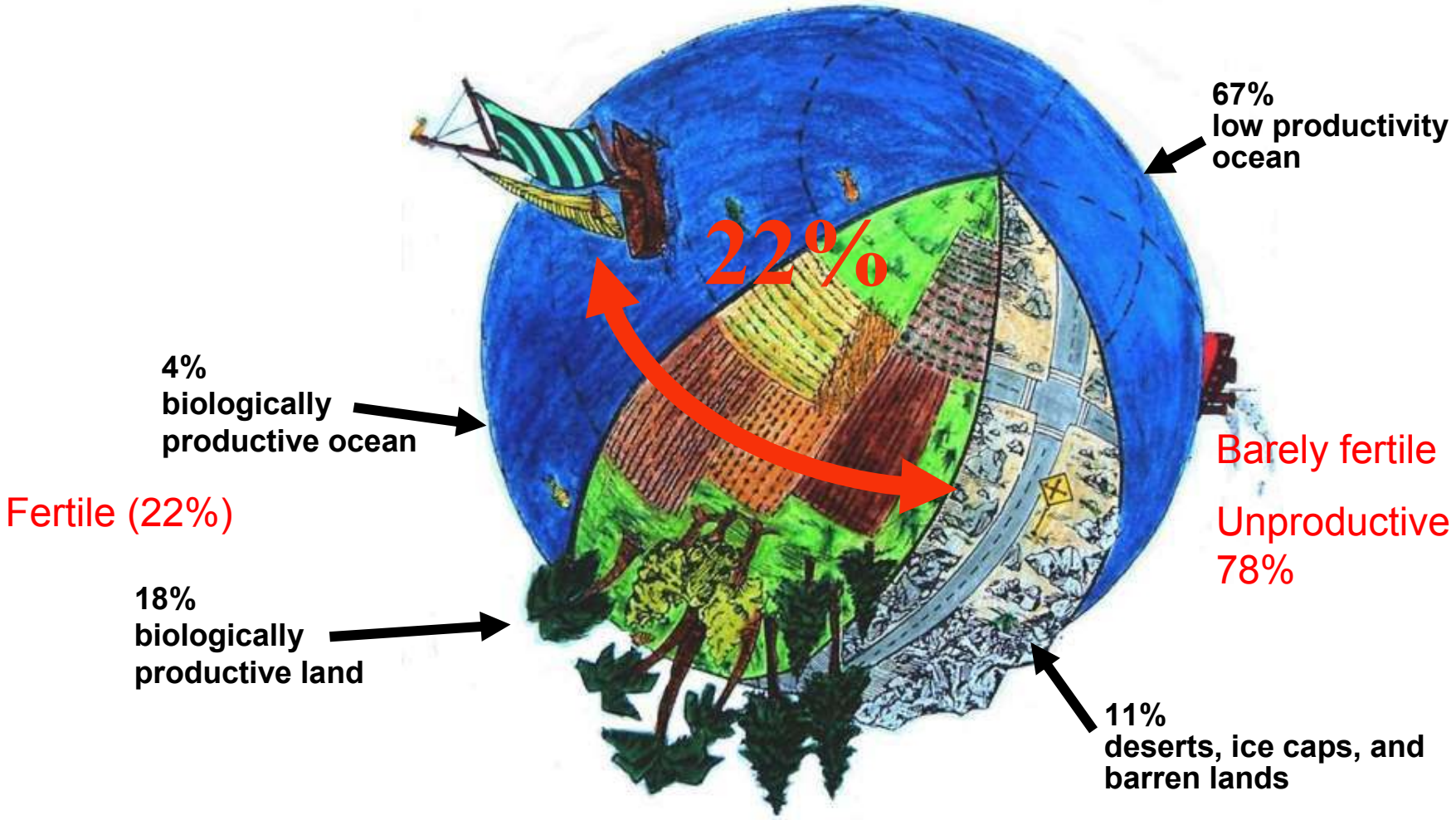
On the lecture of M. Wackernagel

World Science Forum, Budapest, November 6, 2009

Calculate your ecological footprint!

tavoktatas.kovet.hu/okolabnyom.html

Biocapacity (Possibility)



Ecological unsustainability

Footprint of mankind:	2,7 ha/fő	- 0,6
Footprint of a US citizen:	9,4 ha/fő	- 4,4
Footprint of an Arab Emirates citizen:	9,5 ha/fő	- 8,4
Footprint of an Afghan citizen	0.5 ha/fő	+ 0,3
Footprint of a citizen of the Congo	0,5 ha/fő	+13,3
Footprint of a Hungarian citizen:	3,5 ha/fő	- 0,7

Globally 17.6 billion hectares biologically productive area would be needed. In contrast, 13.4 billion hectares are available!

This has already been an exceedance of 31% (2005).

Global Footprint Network, 2008

The message of the ecological footprint

„Put it plainly, we have to devise ways of getting as much, and more, from less.”

Leape, JP, Director General, WWF International

Living Planet Report, 2010. október 13.

Environmental distruction top 10

(Bradshaw et al., 2010)

Compared to the country's possibility

1. Singapore
2. South-Korea
3. Qatar
4. Kuwait
5. Japan
6. Thailand
7. Bahrain
8. Malaysia
9. Philippines
10. Netherlands

63. Hungary

…

179. Cape Verde

23. Poland
47. Czech
98. Romania
115. Slovakia
122. Austria

On the Earth, as a whole

1. Brazil
2. USA
3. China
4. Indonesia
5. Japan
6. Mexico
7. India
8. Russia
9. Australia
10. Peru

41. Hungary

….

171. Antigua & Barbuda

34. Romania
44. Poland
48. Czech
97. Austria
100. Slovakia

Based on deforestation, habitat destruction, marine fisheries, fertilization, water pollution, CO_2 emissions, and the proportion of threatened species;

Environmental load

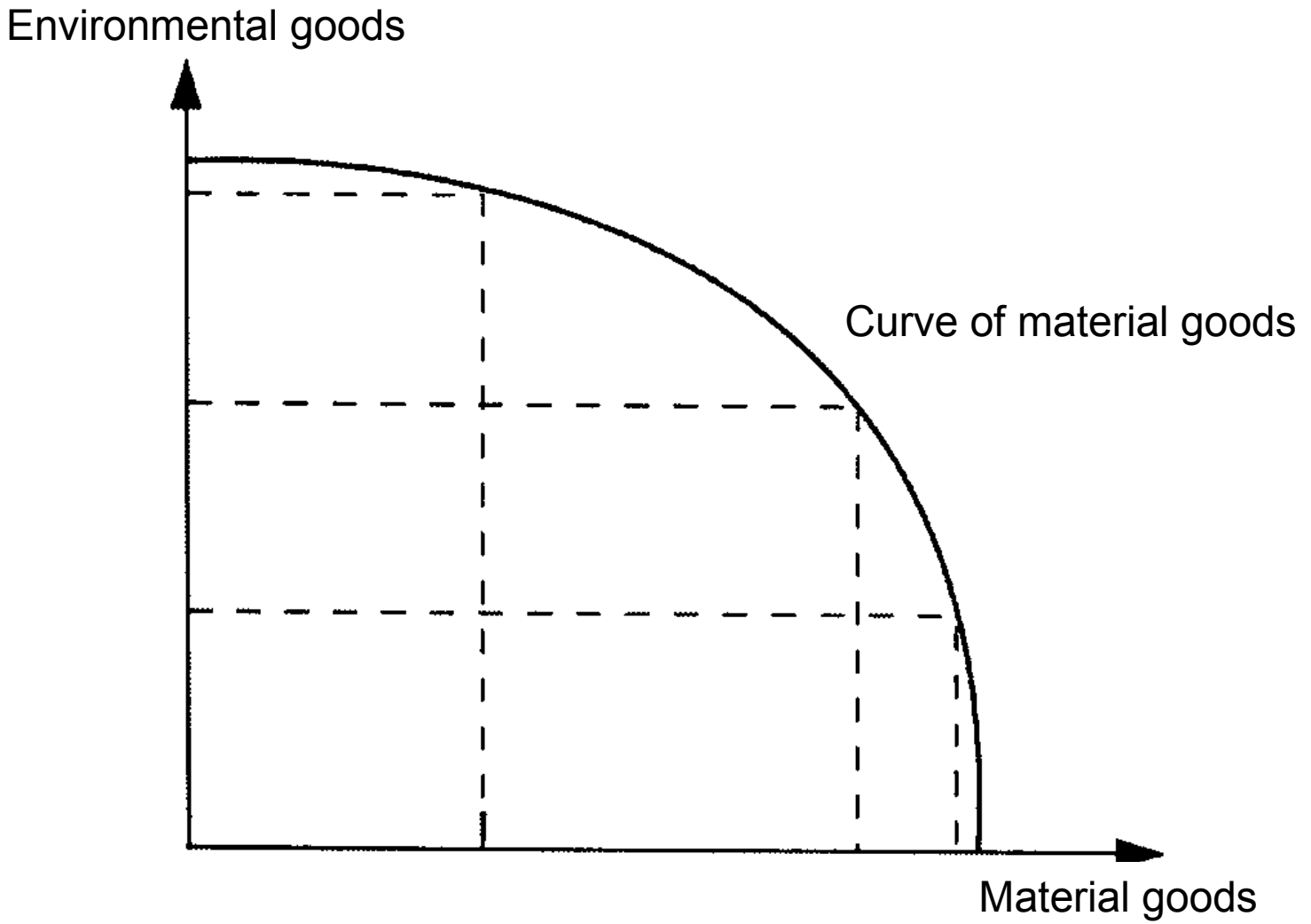
„It's quite striking really –

the richer you are,

the more damage you do."

The University of Adelaide press release, 5.5.2010

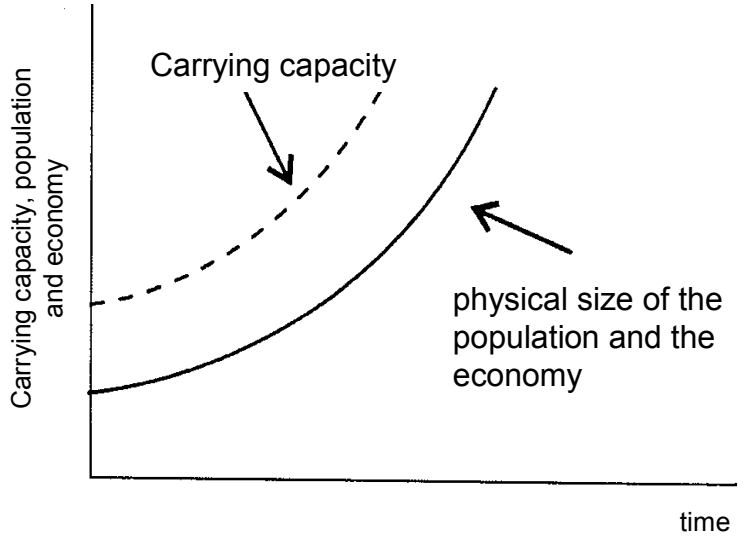
The curve of the production possibilities



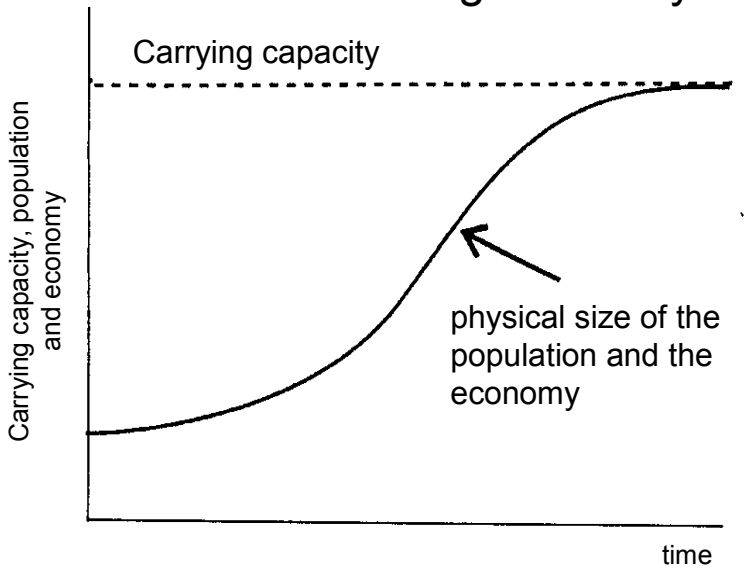
Frontier of the environmental goods and production possibilities

Potential combinations of carrrying capacity of the nature and growth potential

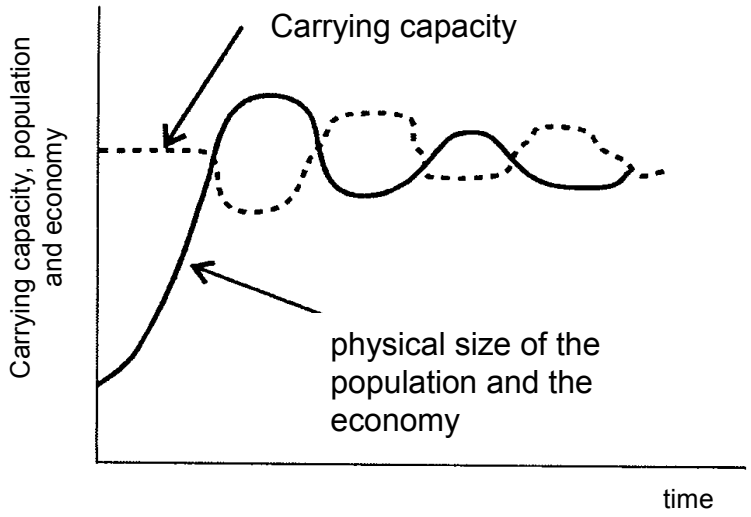
1. Carrying capacity and economy grow together



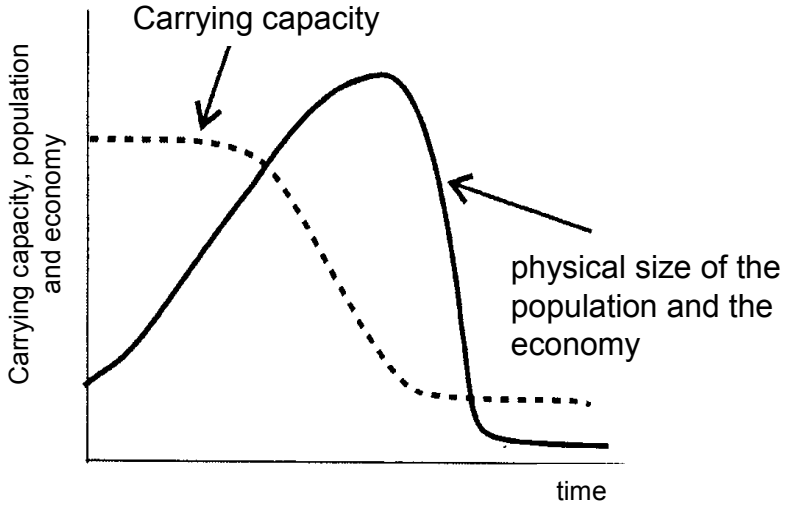
2. Self-limiting economy



3. Carrying capacity and economy are iterating



4. Collapse version

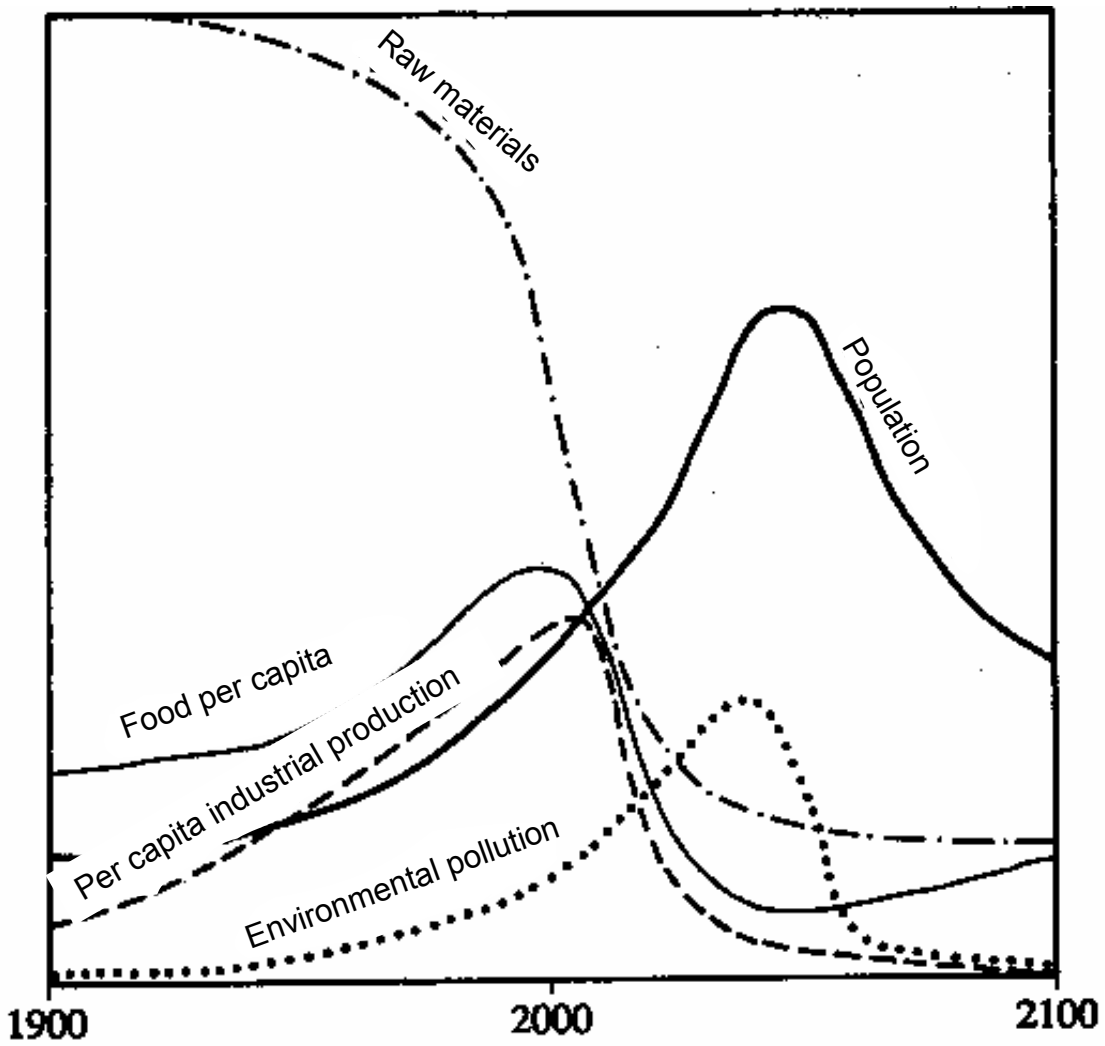


WORLD MODELS OF MEADOWS 1.

Normal world model (tendencies of the 1970s are to be continued);

Industrial production and food production increase until 2010;

Then rapid decline follows;



WORLD MODELS OF MEADOWS 2.

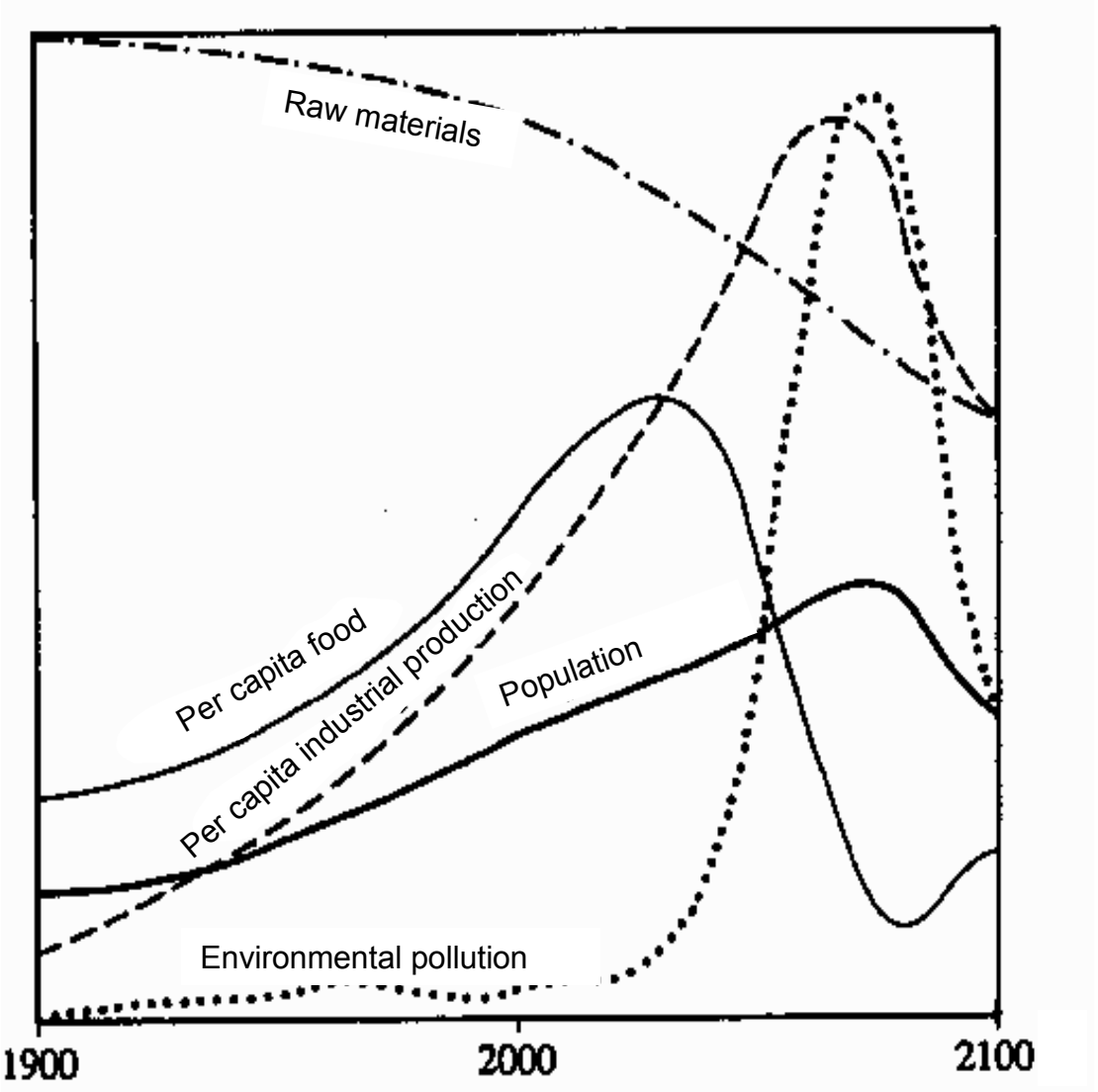
Model of limited economic growth

Regulated birth rate,

New energy sources,

Unlimited sources of raw materials:

Decline will be only after 2050, and escalating environmental pollution



WORLD MODELS OF MEADOWS 3.

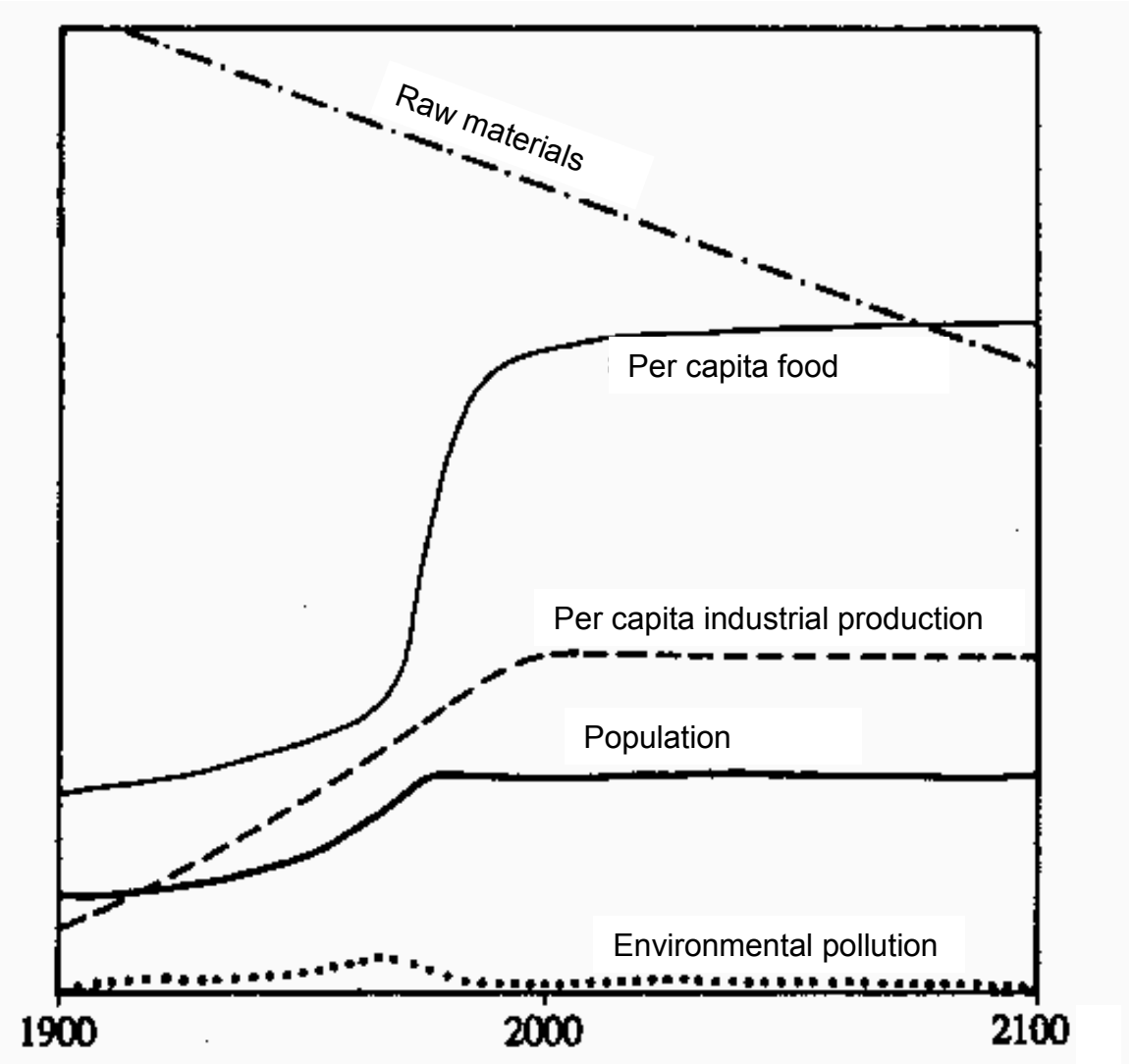
Stabilized world model

Population growth can be stopped immediately;

Increase in industrial production will be stopped after 1990;

Environmental pollution will be stopped;

Staeyd-state until 2100-ig;



Big mistake of Malthus:

underestimation of the rate

economic growth

with solar energy hidden and stored by the Earth:

Coal

Crude oil

Natural gas

Millennium Ecosystem Assessment

2007

„Human actions are depleting Earth's natural capital, putting such strain on the environment that the ability of the planet's ecosystem to sustain future generations can no longer taken for granted."

(Overwiew: Main findings of the Millennium Assessment)

1360 researchers from all over the world

Global crisis

Anthropogenic climate change, growing social inequalities, oil summit, rising food prices, declining biodiversity, epidemics, injury of the ozone layer, pollution and destruction of the Earth's ecological systems are a serious threat to our civilization. All of this can be traced back to a single (albeit very complex) reason: No strategy switched to the new "full Earth" situation but continues to hope for the possibility of unlimited growth.

(a paper of 13 researchers, PNAS, February 24, 2009)

Carrying capacity of the Earth 1.

For how many people the carrying capacity of the Earth provides acceptable or favourable conditions?

- Uncertainties:
  - what kinds of raw materials will be used in the future?
  - what kinds of development paths will the countries of the third world follow?

- **Optimistic scenario:**
  - ❑ Mankind will solve this problem (Julian Simon);
  - ❑ The recent generation may have less natural resources leave offspring, but the next generations will receive a higher level of technology and capital to get bigger.

- **BUT: until now the economy was dwarfed compared to the biosphere, however now it is becoming dominant to prevail in the biosphere.**

Carrying capacity of the Earth 2.

- **Pessimistic scenario:**
- **1st law of the thermodynamics, the so callad conservation law: all production growth has two effects** (quantity limit).
  - ❑ energy and material is needed from the environment and
  - ❑ it increases the load of the waste assimilation capacity of the environment.

  ⇒ recycling only relieves but does not solve either the problem of the raw materials scarcity or the environmental pollution caused by waste.
- **2nd law of the thermodynamics, the law of the energy flow (law of entropy):** entropy measures energy quality (either it can be used or not). Entropy is a negative measure of usefulness. In spontaneous processes, entropy of the system and the environment is increasing. Environmental degradation is characterized by an increase of entropy (quality limit).

  ⇒ The Earth is moving towards a high-entropy, unfavourable final state for human life, if it is considered a closed system. We can only influence the speed, and this speed is what today is too much concern.

GLOBAL

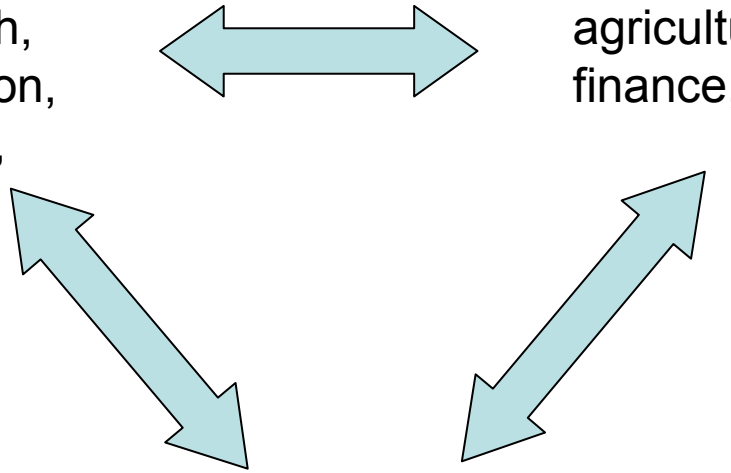
SUSTAINABILITY CRISIS

SOCIAL CRISIS

Morality, faith, values, family, culture, education, health, science, trust, cooperation, employment, population, falling behind

ECONOMIC CRISIS

energy, raw materials, agriculture, food, finance, credit, growth



ENVIRONMENTAL CRISIS

climate change, loss of biodiversity and soil, pollution, landscape degradation, deforestation, water shortages, injury of the ozone layer

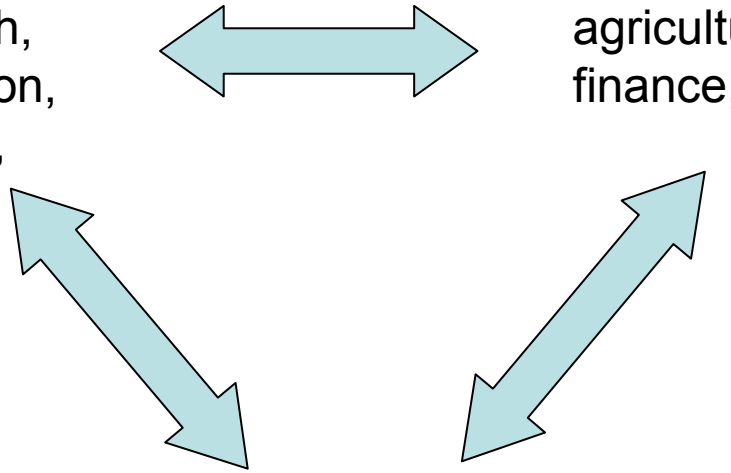
GLOBAL SUSTAINABLE / SUSTAINABILITY CRISIS

SOCIAL CRISIS

Morality, faith, values, family, culture, education, health, science, trust, cooperation, employment, population, falling behind

ECONOMIC CRISIS

energy, raw materials, agriculture, food, finance, credit, growth



ENVIRONMENTAL CRISIS

climate change, loss of biodiversity and soil, pollution, landscape degradation, deforestation, water shortages, injury of the ozone layer

Doubling years of the world's economic output

A.D. 1	how many years?		Estimated growth rate (%)
1100	1100		<0,1
1550	450		0,1
1760	210	COLE_____	0,24
1840	80		0,9
1880	40	CRUDE OIL_____	1,8
1905	25		2,5
1932	27		2,4
1952	20	NATURAL GAS____	3,5
1963	11		6,0
1983	20		3,5
1998	15		5,0

After J. Bradford DeLong (Dept. of Economics, Berkley, USA)

The secret of the mankind's success for the last two centuries is the use of the finite resources of fossil energy!

ENERGY CONSUMPTION OF THE EARTH, %, 2008

- **Crude oil** **37.3**
- **Cole** **25.3**
- **Natural gas** **23.3**
- **Nukleáris** **5.7**

86% fossil energy

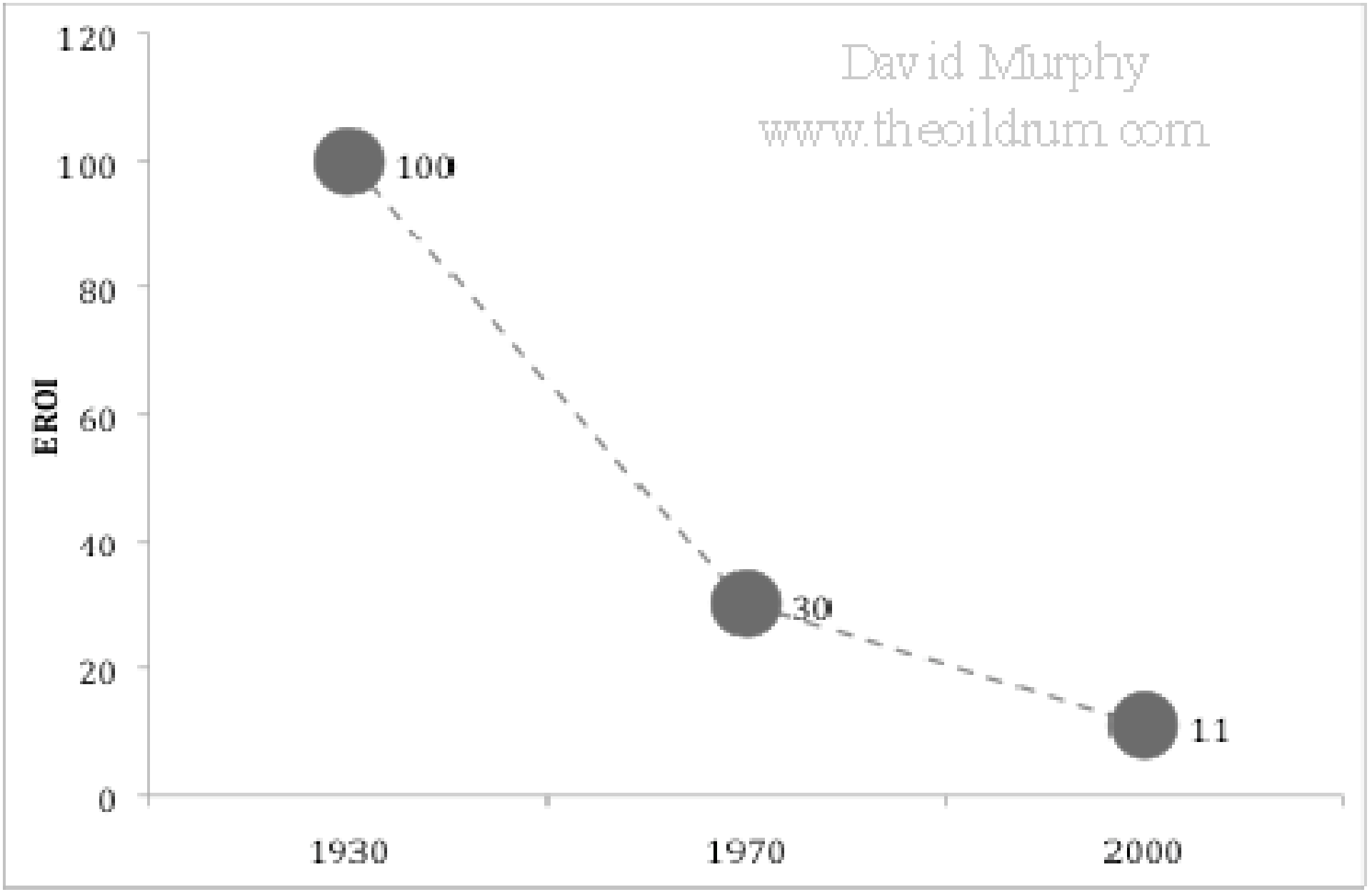
non-renewable: 91.6 %

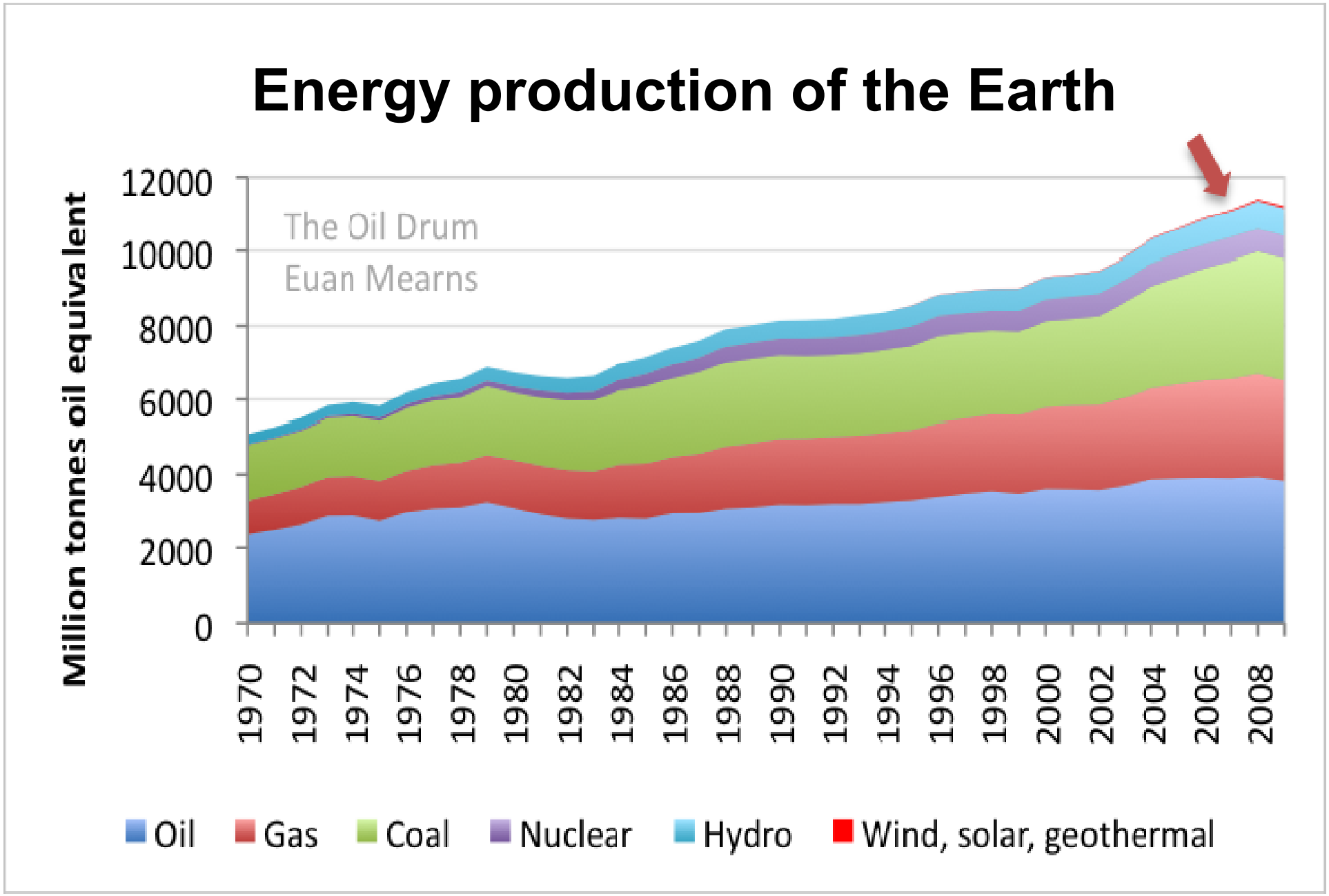
- Biomass (wood) 3.8
- Water power 3.2
- Solar collector 0.5
- Wind turbine 0.3
- Geothermal 0.2
- Bio-fuel 0.2
- Solar power 0.04

renewable: 8.4%

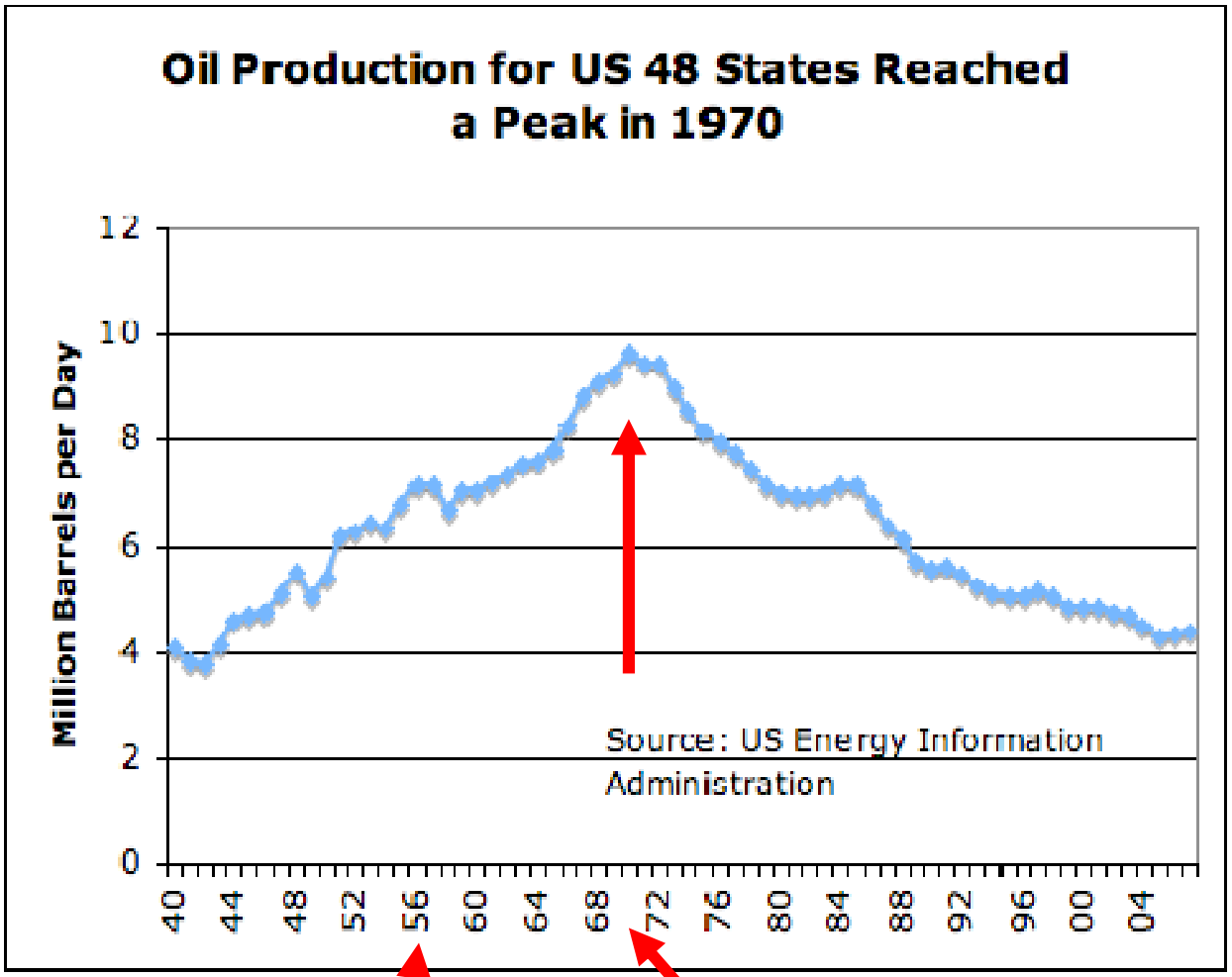
(0.2% lost in the rounding)

Decrease of energy profit of oil wells (US)

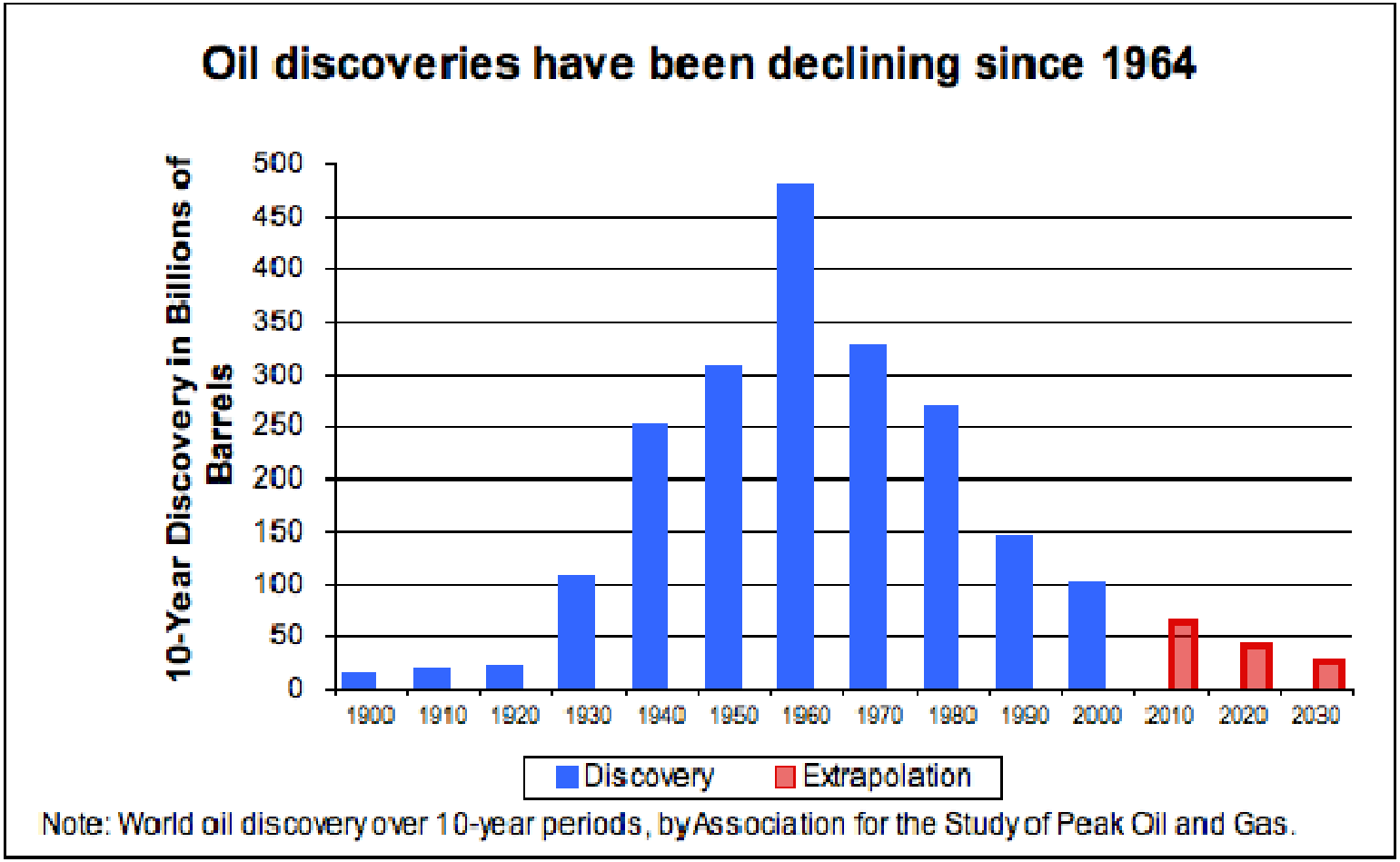



Energy production of the Earth
Million tonnes oil equivalent
12000
10000
8000
6000
4000
2000
0
The Oil Drum
Euan Mearns
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Oil
Gas
Coal
Nuclear
Hydro
Wind, solar, geothermal

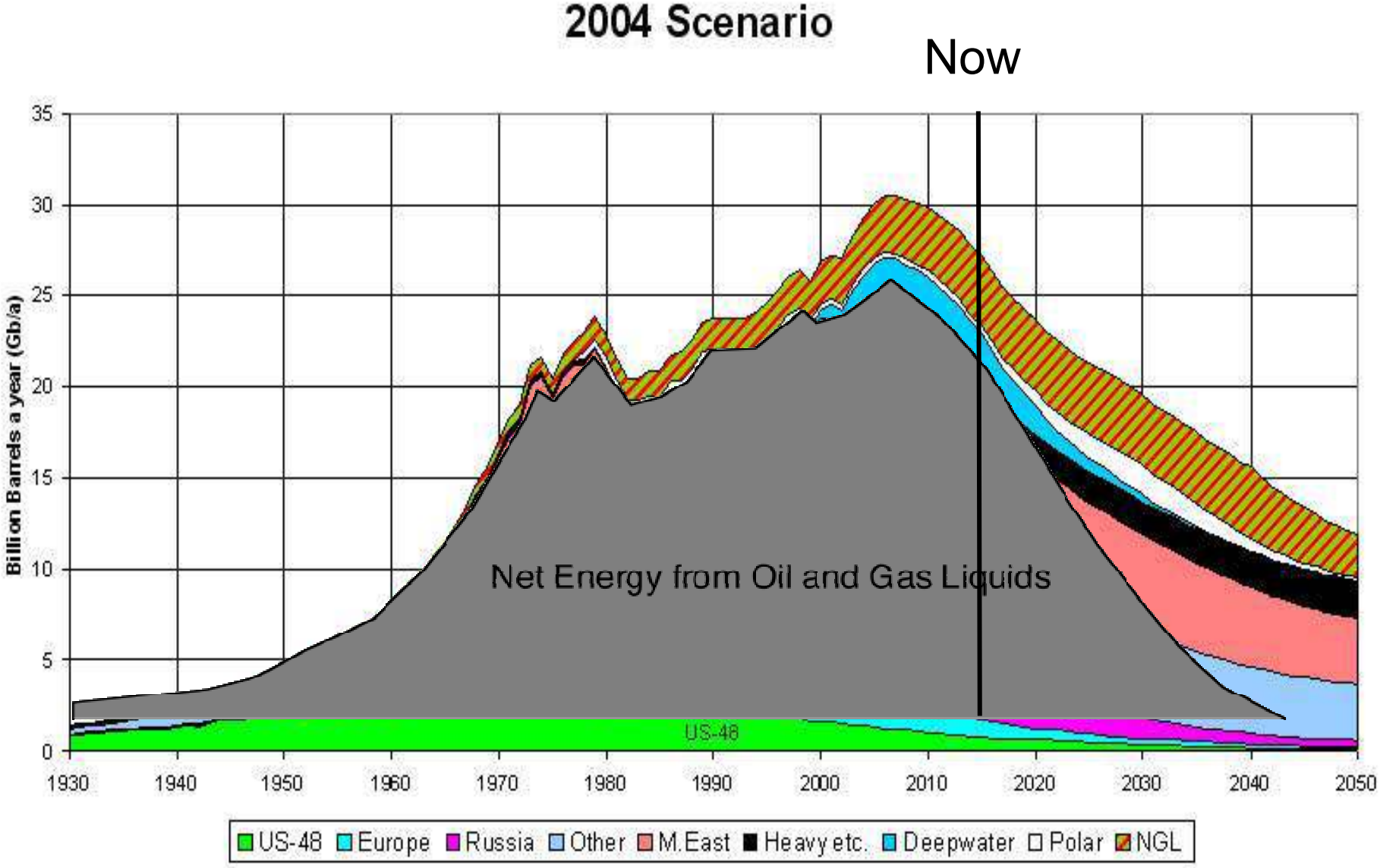
The US Oil Story

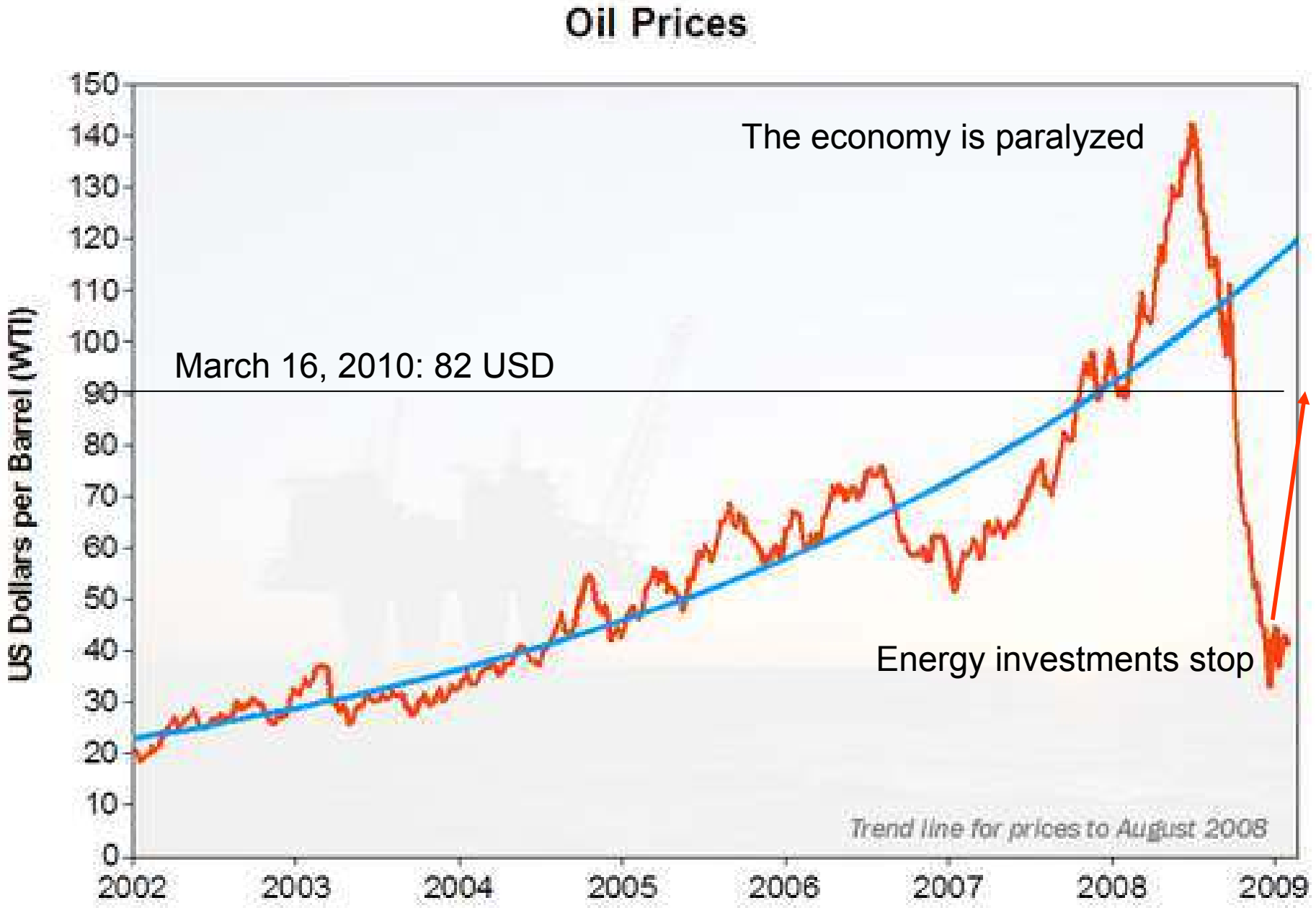


Discovery of the oil quarries of the Earth – similar distribution



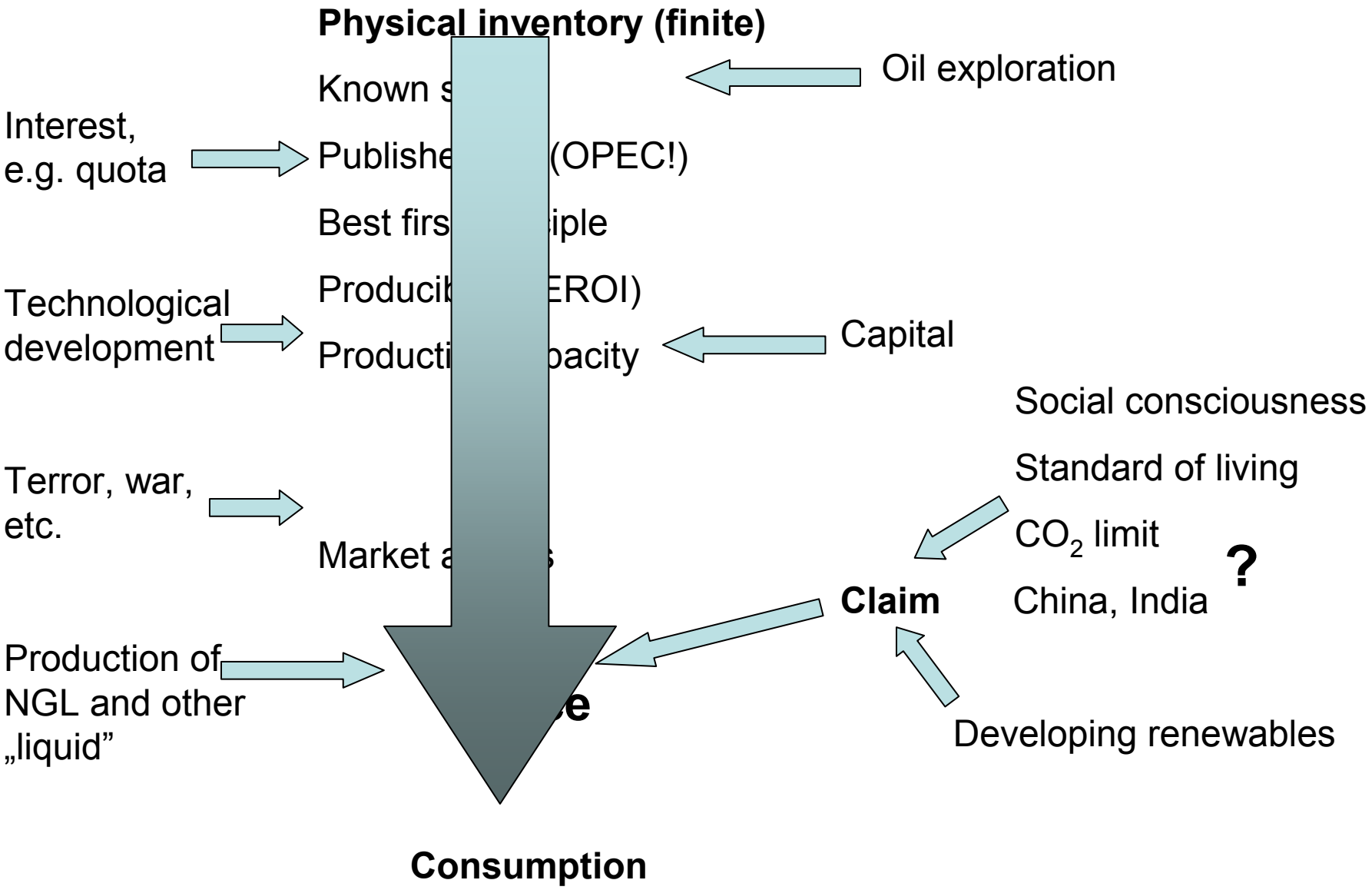
CRUDE OIL AND NATURAL GAS PRODUCTION OF THE EARTH




Oil Prices
US Dollars per Barrel (WTI)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
2002
2003
2004
2005
2006
2007
2008
2009
The economy is paralyzed
March 16, 2010: 82 USD
Energy investments stop
Trend line for prices to August 2008

How long oil socks are anough?

For a few years or a few centuries?



Climate crisis or energy crisis?!

Oil summit

CO_2 !

Natural gas summit

Coal summit

Uranium summit

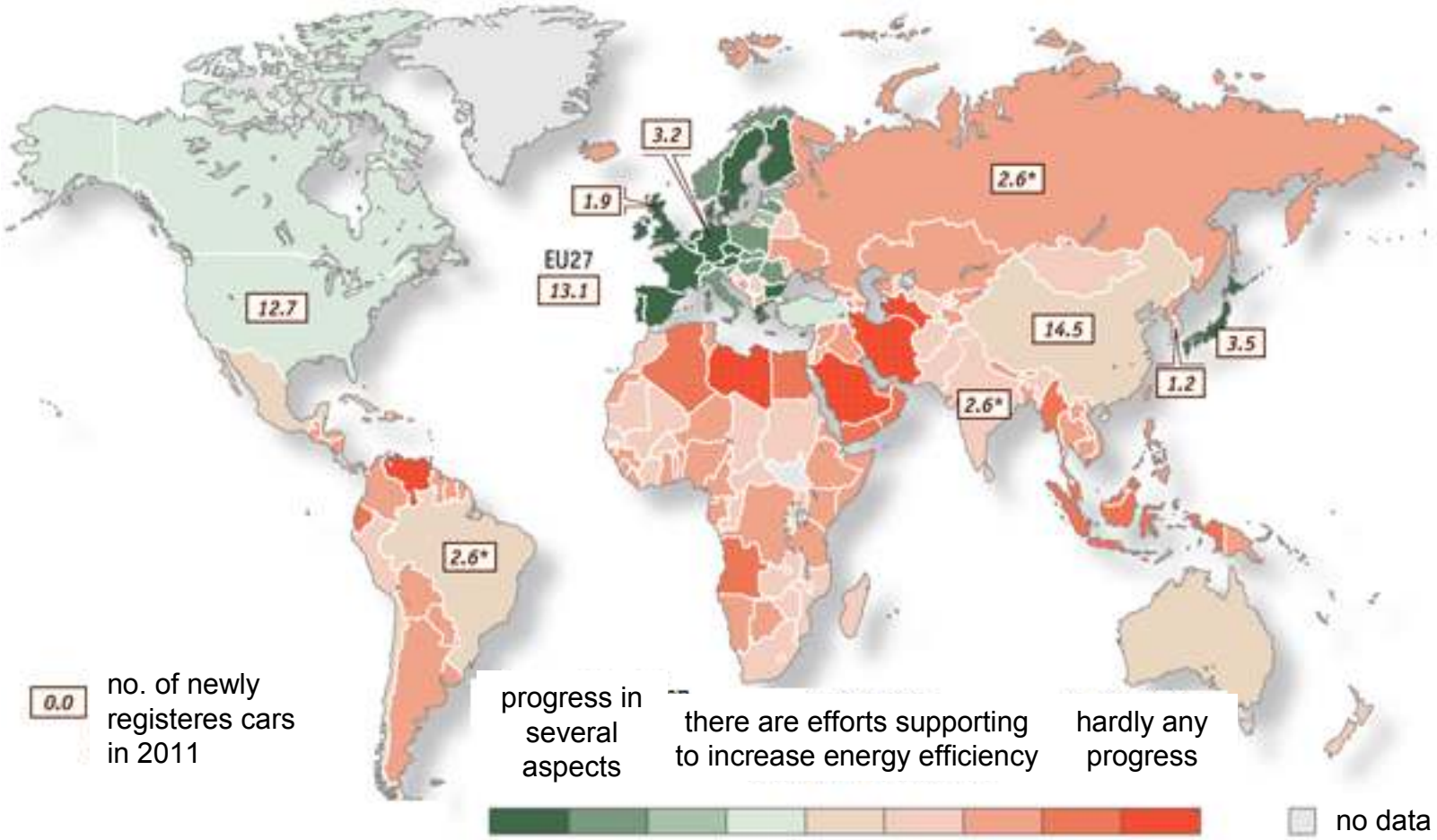
„All summit”

The Oil Drum (TOD)

The economy of abundance past ⇨ The economy of scarcity future

Energy Bulletin, Sep 3 2009

Fuel economy readyness index, 2010



Source: *IEA, Economist Inteligence Unit, Haver Analytics*

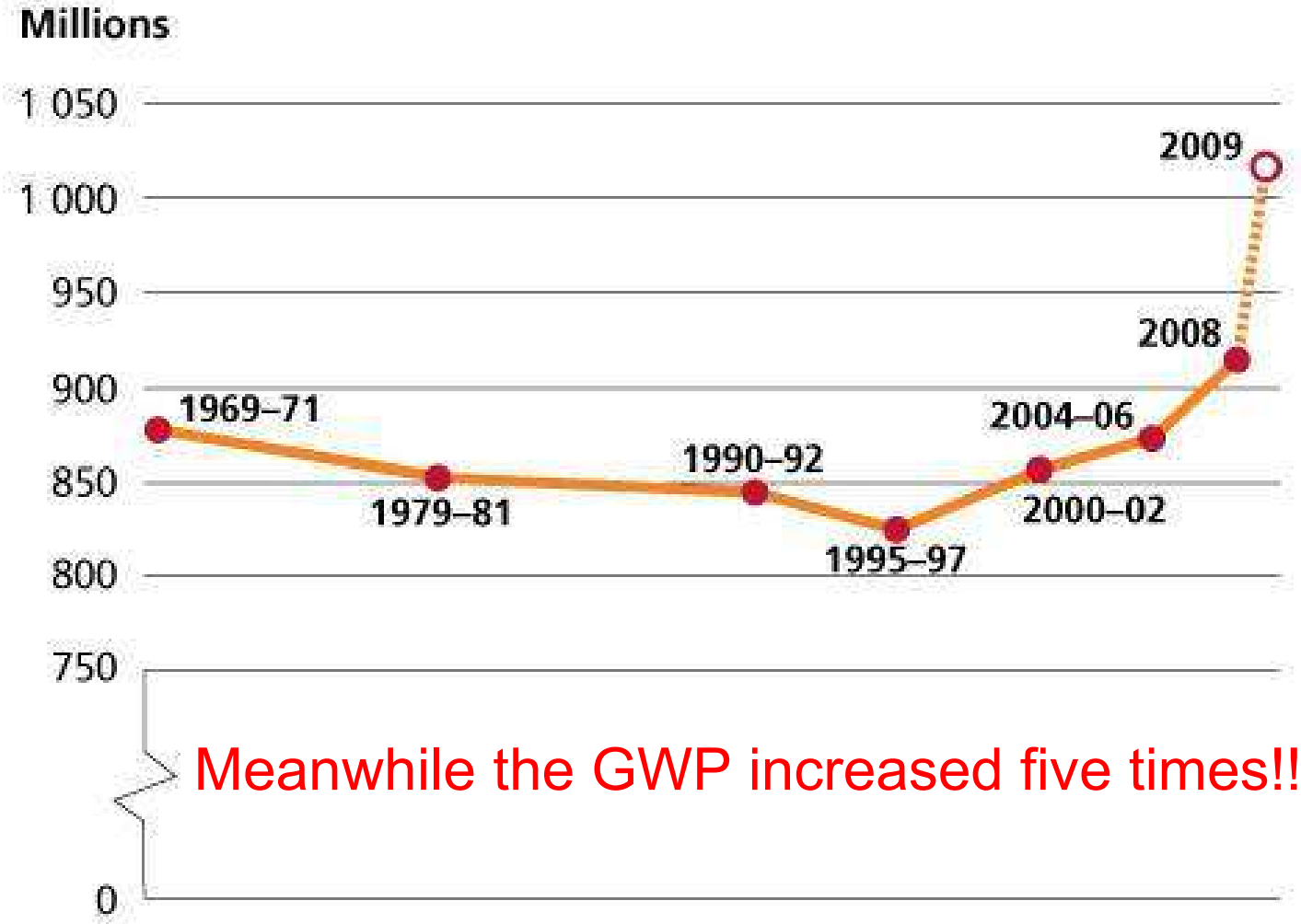
Why should the economy grow?

- Without growing there is no point of living.
  .
  (X.Y., renowned Hungarian economist)

- It is immoral to question economic growth, while millions are starving on Earth.
  (W.Z., renowned Hungarian economist)

Reminder: The number of undernourished people on Earth, 1969-71 - 2009

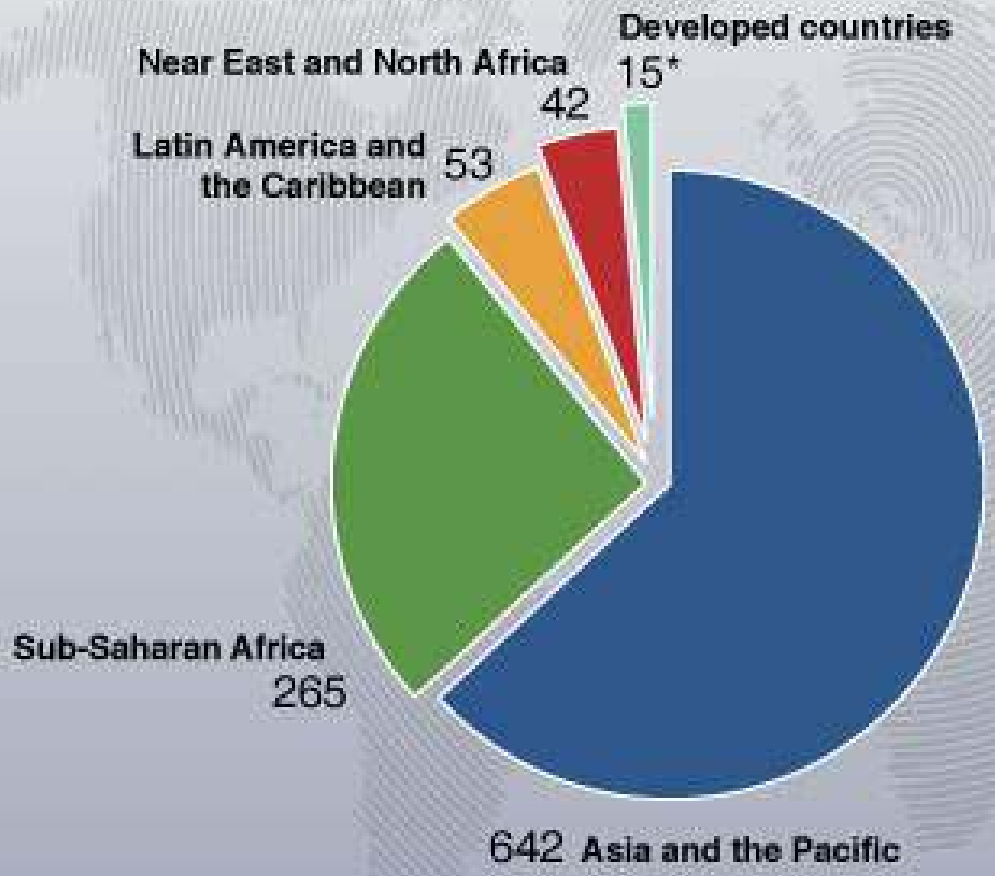
The number of hungry people



Meanwhile the GWP increased five times!!!

Source: FAO

More than 1.02 billion hungry people



*Millions of people

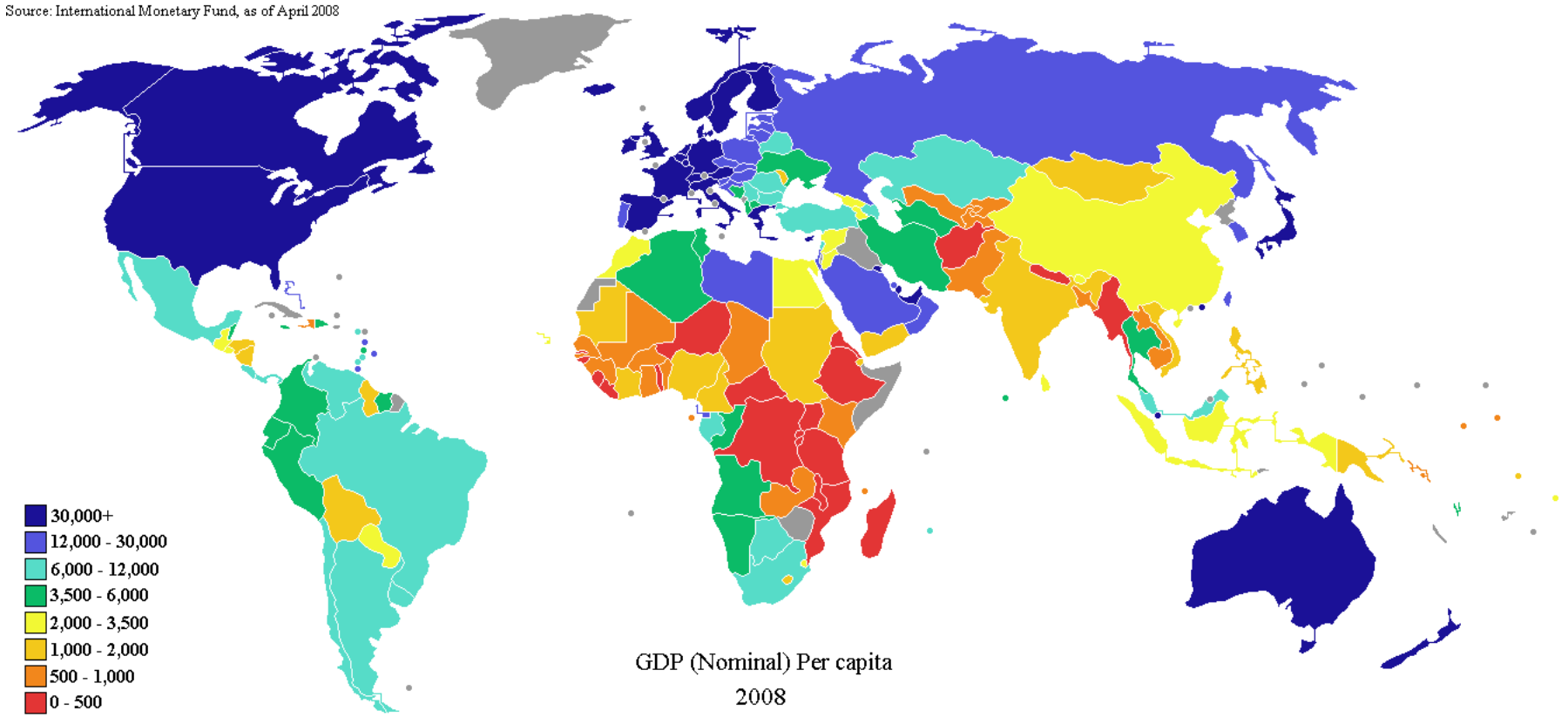
FAO estimates that 1.02 billion people are undernourished worldwide in 2009. These are more hungry people than at any time since 1970, the earliest year for which comparable statistics are available.

Hunger has increased not as a result of poor harvests but because of high domestic food prices, lower incomes and increasing unemployment due to the global economic crisis. Many poor people cannot afford to buy the food they need.

The chart on the left shows where the world's hungry people live.

- Hunger at a glance
- Policy brief
- More graphs

Per capita GDP in the Earth's countries, 2008



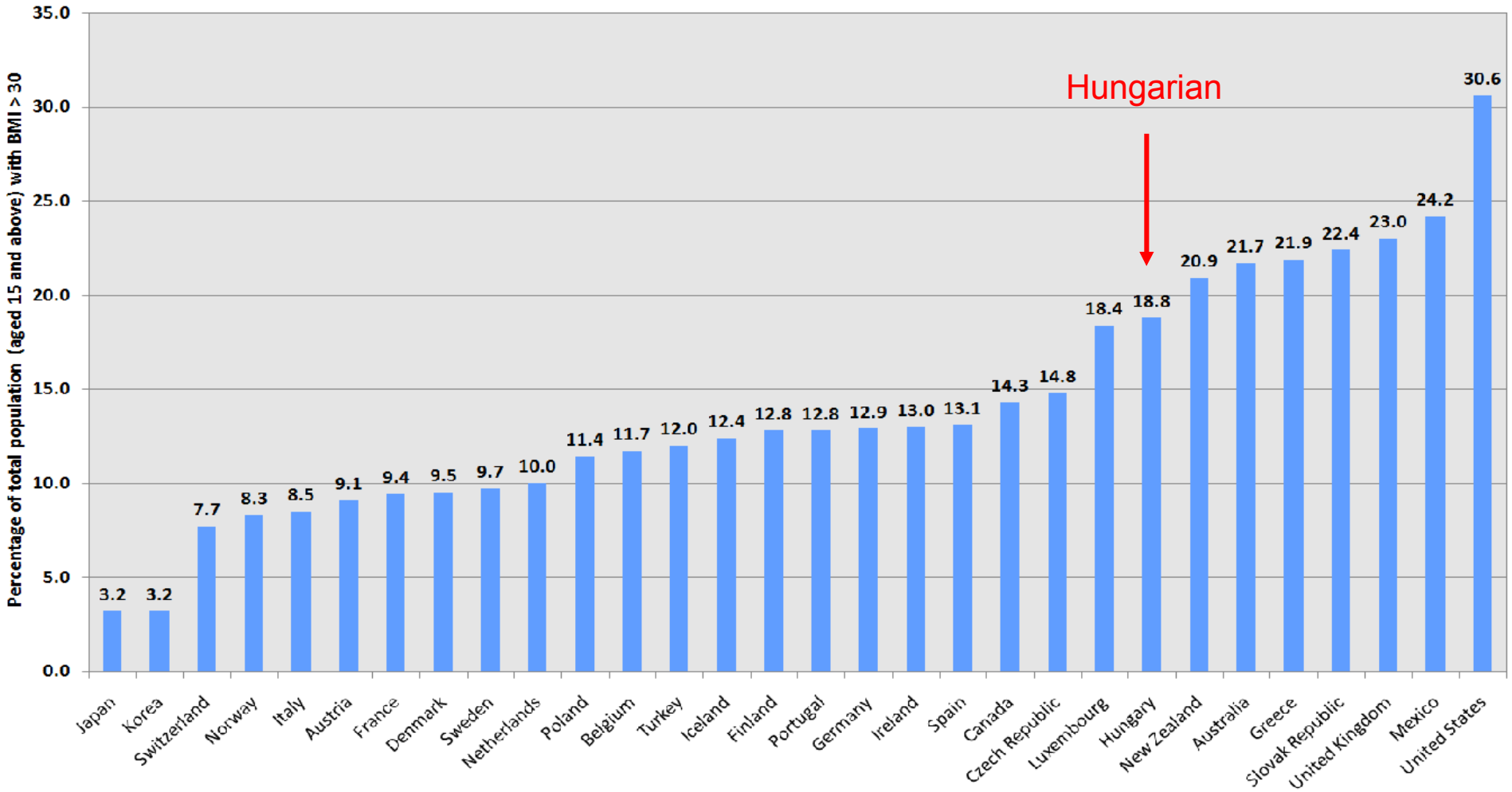
There is a hundred-fold difference between rich and poor countries!

Consumer society, 1.

Consumer society, 2.

Consumer society, 3.

The proportion of obese people in the population over 15 years



Screening for Atherosclerosis

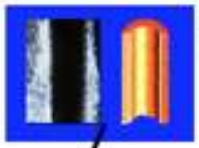
Risk Factors vs Disease

Numerous Risk Factors

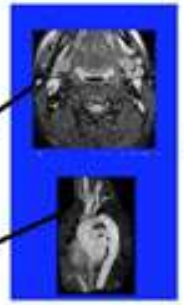
- High LDL
- Low HDL
- High BP
- Diabetes
- Smoking
- CRP
- Metabolic Syn
- Lp(a)
- Homocysteine
- Dense LDL
- Lp-PLA2
- ApoB/ApoA
- Family History
- Sedentary Life
- Obesity
- Stress
- ...
- ?

Over 200 risk factors have been reported.

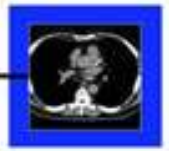
Examples of Arterial Structure Tests



Carotid IMT and Plaque Measured by Ultrasound

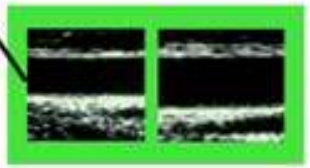


Aortic and Carotid Plaque Detected by MRI



Coronary Calcium Score Measured by CT

Ankle Brachial Index



Brachial Vasoreactivity Measured by Ultrasound

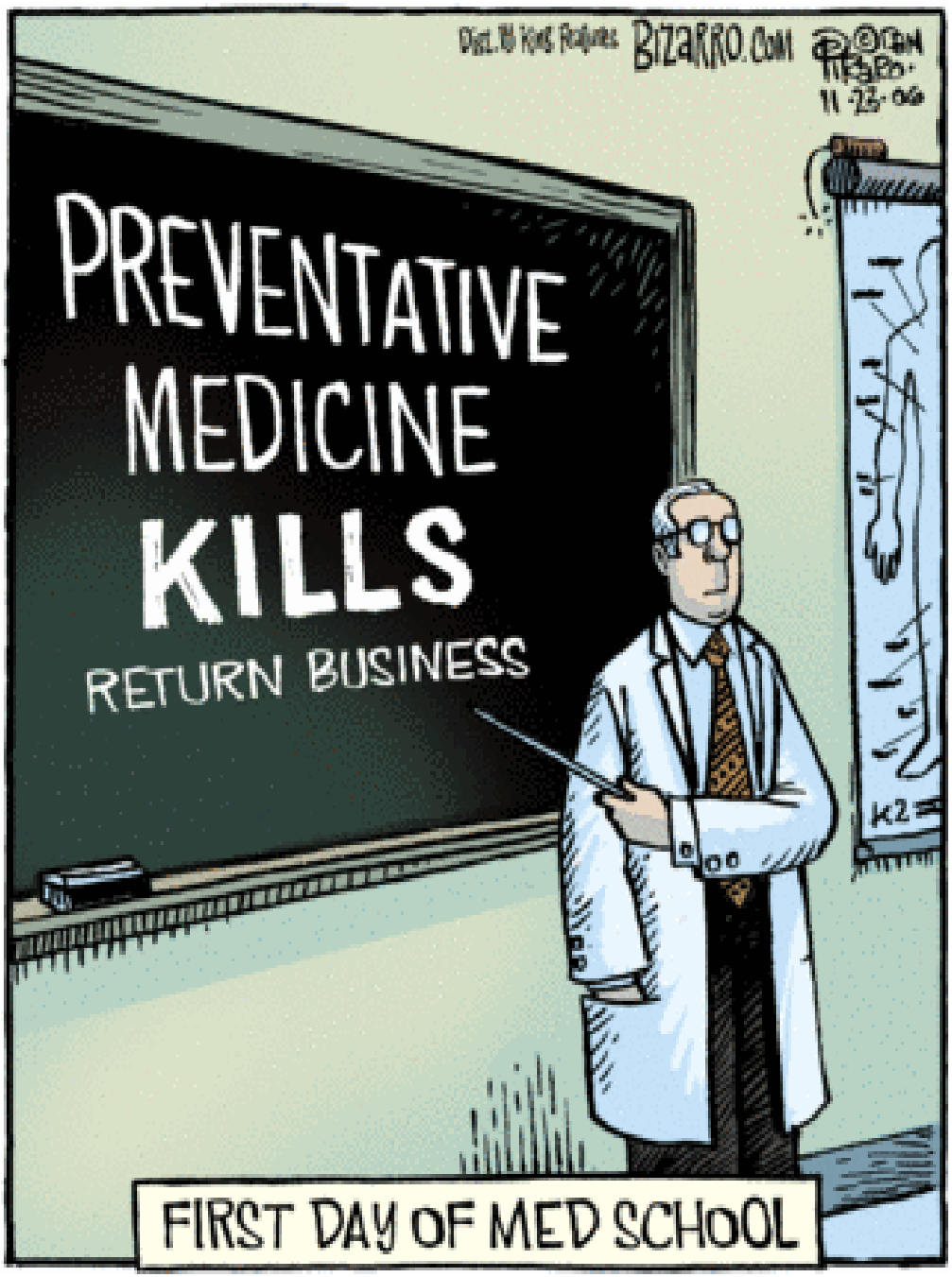
Vascular Compliance Measured by Radial Tonometry

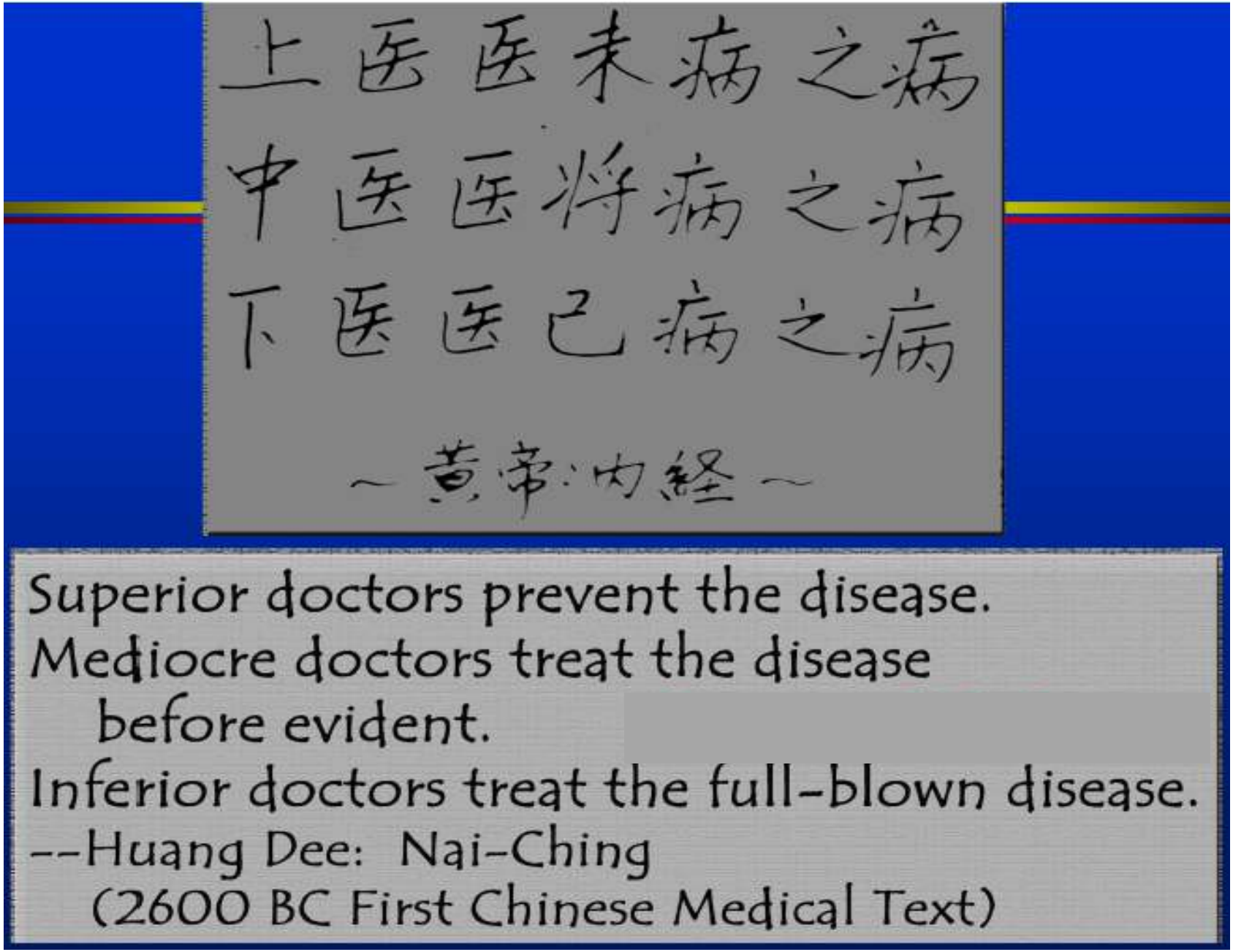
Examples of Arterial Function Tests

Microvascular Reactivity Measured by Fingertip Tonometry

Illness definitions

- **Metabolic syndrome:** ”A civilization diseases, according to a genetic (hereditary) predisposition; due to incorrect lifestyle and diet causes latent, progressive metabolic disorder with few symptoms (glucose intolerance, abnormal lipid metabolism, accelerated coagulation), hypertension, apple-shaped obesity that induces atherosclerotic lesions and leads to early deaths because of insulin resistance (IR) and hyperinsulinemia (HI) developing on this basis." (International Diabetes Federation)”. (International Diabetes Federation)
- **Homocisztein:** sulfur-toxic acid, also called H-factor. **It is a greater threat to the functioning of the heart, such as cholesterol.** Dual effect: high levels of H-cholesterol is greater synergies. The high H-level is an independent risk factor in terms of formation of cerebral and cardiac diseases. **The H endangers the cells of veins, arteries,** it will accelerate the development of resulting scars and injury sites on hazardous areas.
- **Lp-PLA$_2$ (lipoprotein associated phospholipase-A$_2$) enzyme:** specifically characterized by vascular inflammation, and **upon its detection the risk of coronary heart disease or ischemic stroke (a blood clot blocks a vein in the brain - thrombotic / embolic stroke) is moderate or high.**
- **ischemia:** oxygen deficiency;
- **lipid transport proteins, the so-called apolipoproteins (apoA, apoB, … indicated from A to E): better indicate the risk of cardiovascular disease, such as cholesterol** (d'AstraZeneca, Lancet). apoB and apoA-I are much more indicative of the risk of myocardial infarction than cholesterol. The levels of apoB and the apoB / apoA-I ratio increases spectacularly before the fatal infarctions. ApoB already indicates the appearance of the risk factors in both sexes, when cholesterol still shows no appreciable changes.


Dist. by King Features
BIZARRO.COM
11-25-06
PREVENTATIVE
MEDICINE
KILLS
RETURN BUSINESS
K2
FIRST DAY OF MED SCHOOL



Superior doctors prevent the disease.
Mediocre doctors treat the disease
before evident.
Inferior doctors treat the full-blown disease.
--Huang Dee: Nai-Ching
(2600 BC First Chinese Medical Text)

Consumer society, 4.

A severely malnourished boy's hand holding by a Catholic monk; Karamoja, Uganda. (In 1980, 20% of the population and 50% of the infants died of hunger in Uganda.) Photo of the Year Award, 1981; Mike Wells, World Press Photo

Well-being and GNP

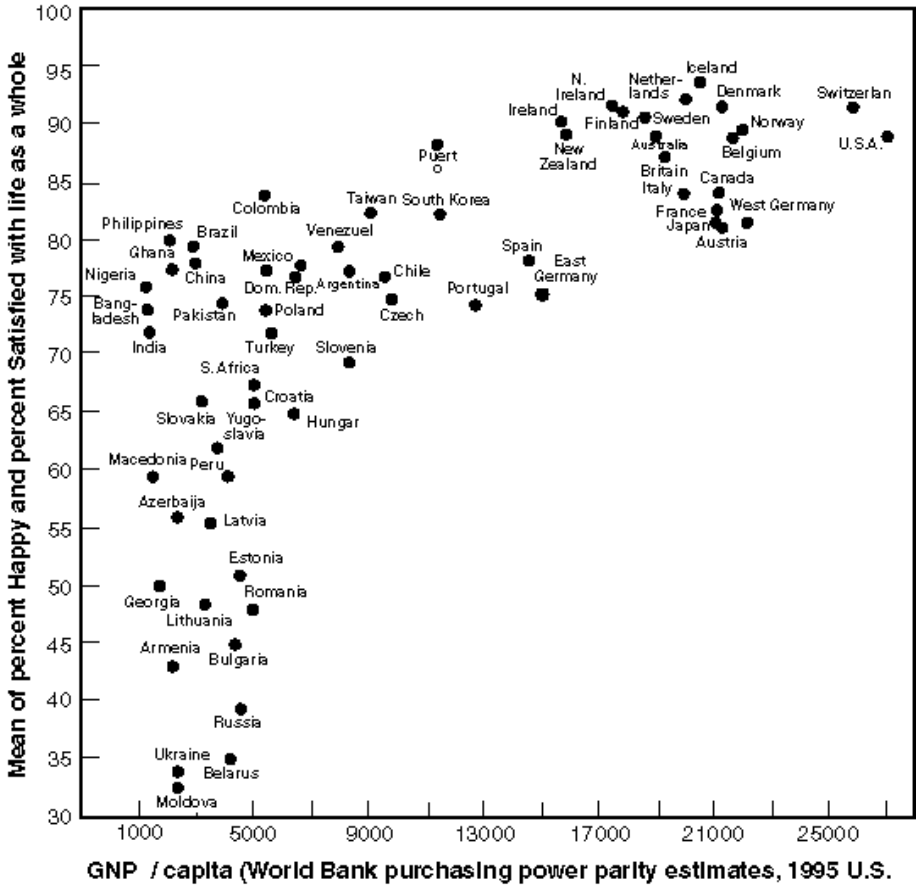
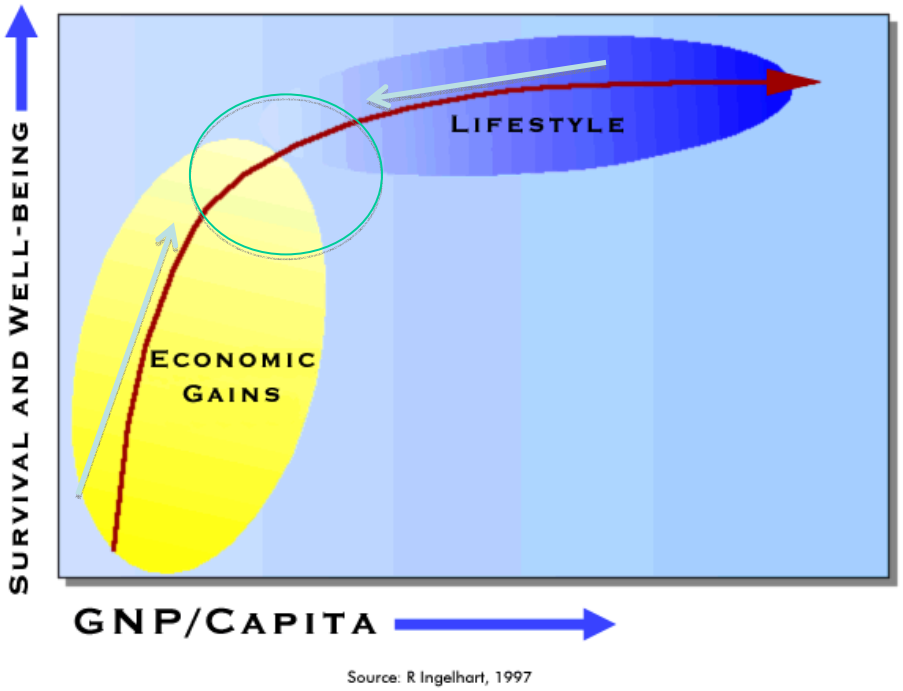


Figure 2. Subjective well-being by level of economic development.
Source: World Values Surveys; GNP/capita purchasing power estimates from World Bank, World Development Report, 1997.
R = .70 N = 65 p < .0000



Source: R Ingelhart, 1997

Catching up or back to isolation?

- Mankind catching up to the current standard of living of the US would need 6 „Earth”!
- Any further increase of the footprint in the developed world (~ per capita GDP) takes the possibility of the development away from 5 billion people!
- Is there a solution? What is the response of the researchers?

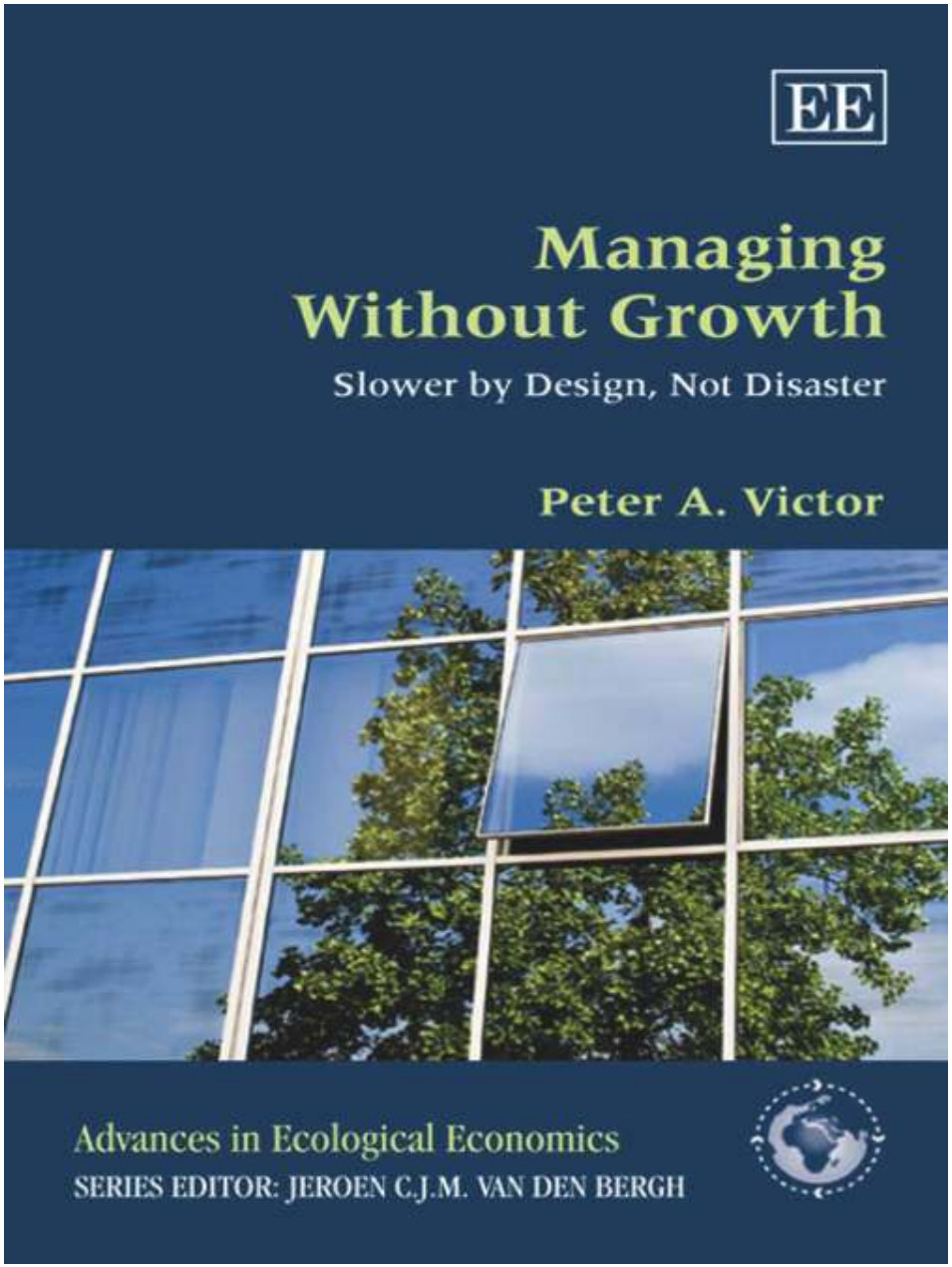
Limits to Growth (Stockholm, Rio, Johannesburg, etc.)

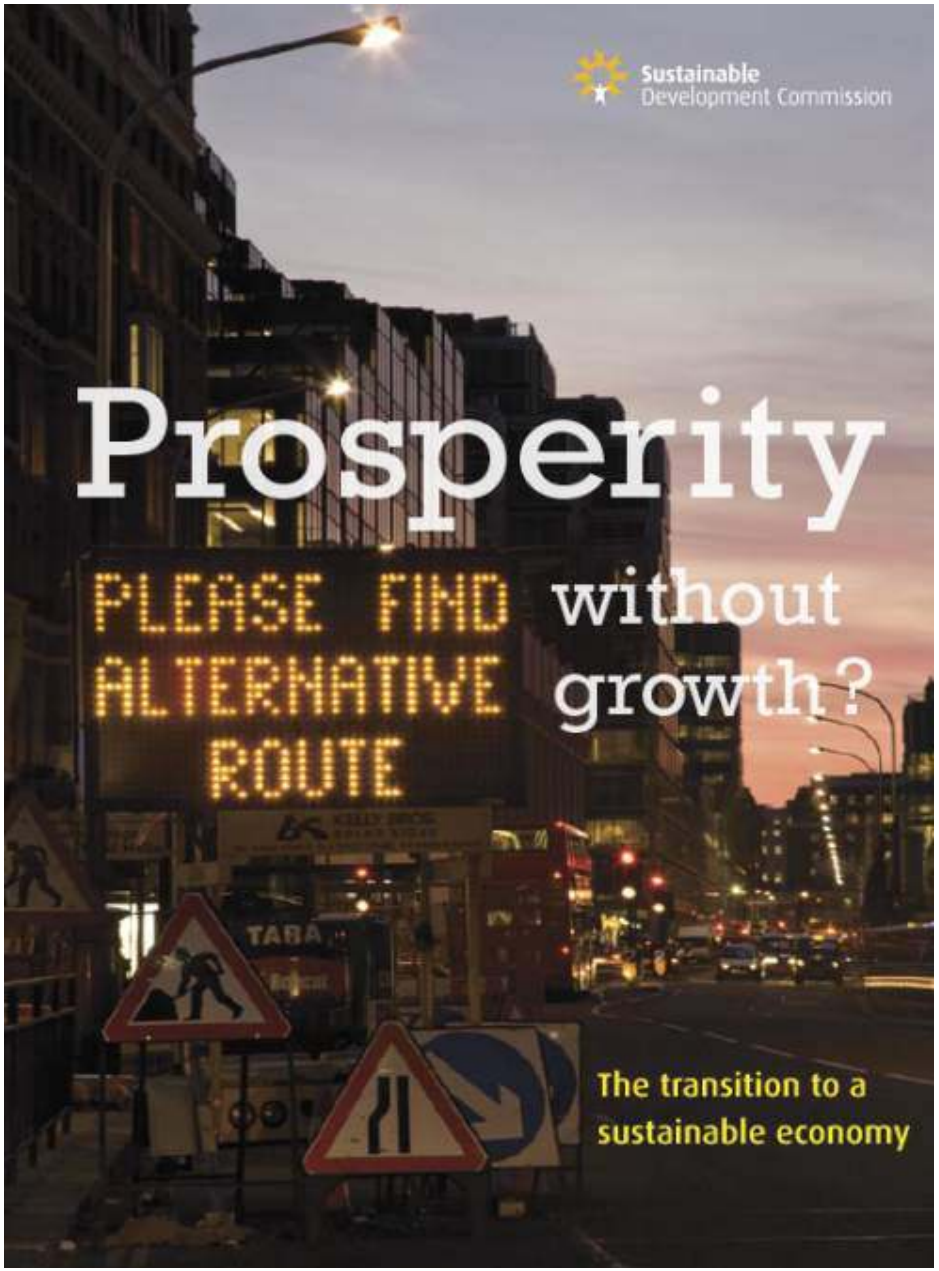
World Scientists’ Warning to Humanity (1992)

Millennium Ecosystem Assessment (2005),
Living Planet Report, Global Footprint Network, etc

Millennium Assessment of Human Behaviour

Global economy without growth constraints





The interest-bearing money

„According to investigating alternative approaches (Gesell, Creutz) on the sustainability point of view, **driving force, behind the steady growth constraints causing environmental and social conflicts, is the financial institution system**. Because of the interest, income earned with work steadily move towards the capital owners. Poor people – in the lack of capital – are unable to offset their interest burden and inflation with interest rate gains. That is why **the rich get richer, and poorer of the poor**. Because of the compensation of the interest both the indebted state and the working income earners are forced to increase, while the capital owner is interested in growth due to capital enhancement. Compound interest calls to life an exponential increase of the financial wealth that can not cover natural resources in a finite world."

NFFT Jövőkereső (future searcher), pp. 23-24.

Absurdities of the financial world

- By the summer 2009, the sum of so called "Derivatives" on the world market has exceeded the amount of 10^{15} US dollars.

  There are far not so much value on the Earth that can be purchased (except for bonds and promissory notes!)

  If this amount was distributed to all the inhabitants of the Earth equally, everybody received about 140 thousand US dollars, each. This is around 30 million HUF. Whether mankind is such wealth?

- In May 2010, the US debt was 13.1×10^{12} US dollars.

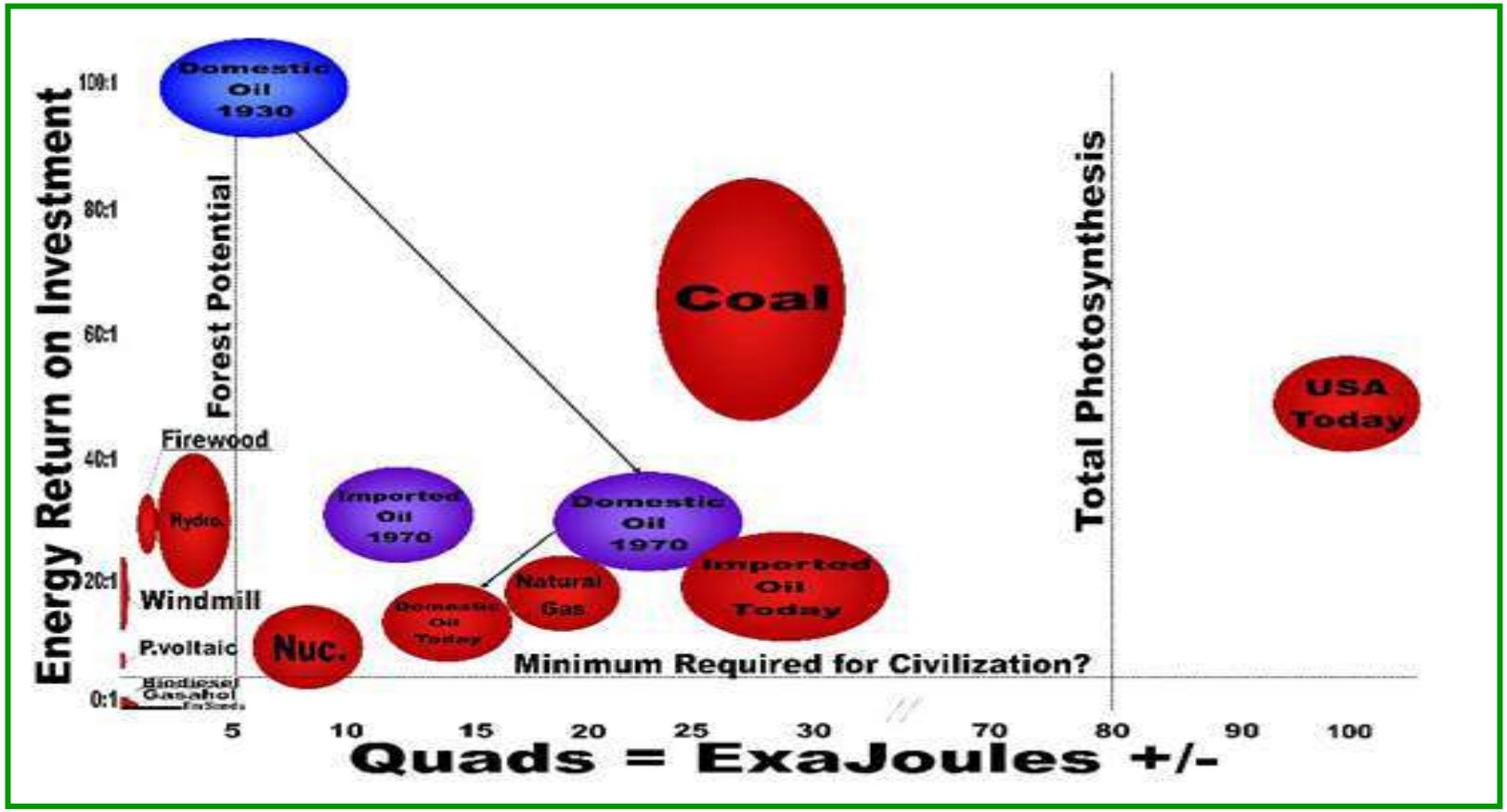
  If US citizens should pay back this amount now, it were 44 thousand dollars per capita (nearly 10 million HUF).

  A **derivative** indicates such market transactions that represent a fraction of real businesses, however not directly as share, but indirectly, mostly through groups of investors.

This is…

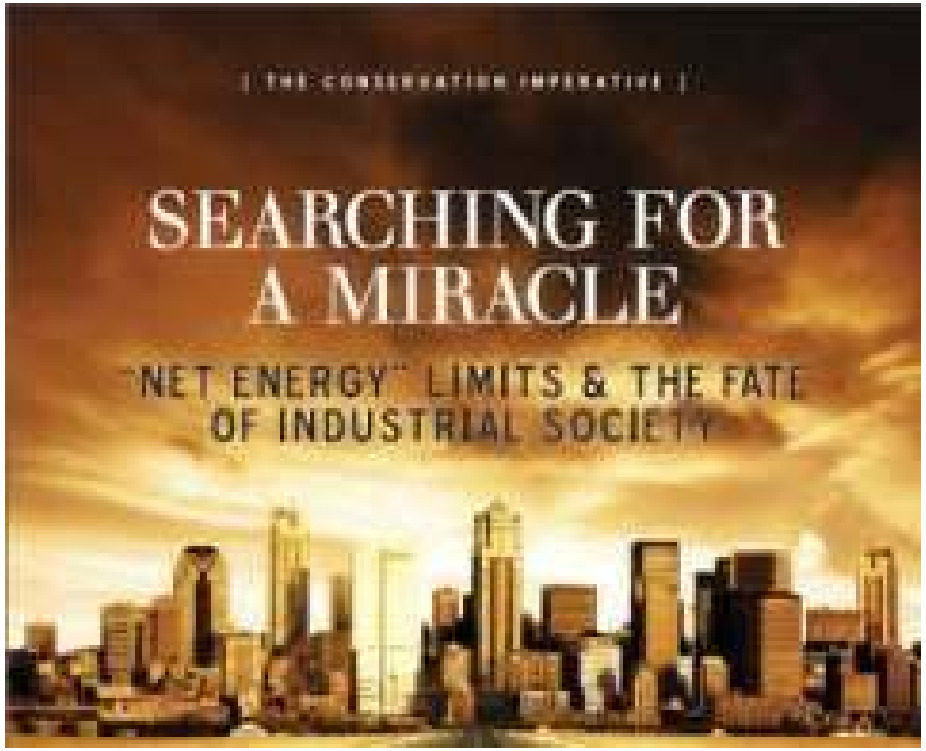
Most competitive

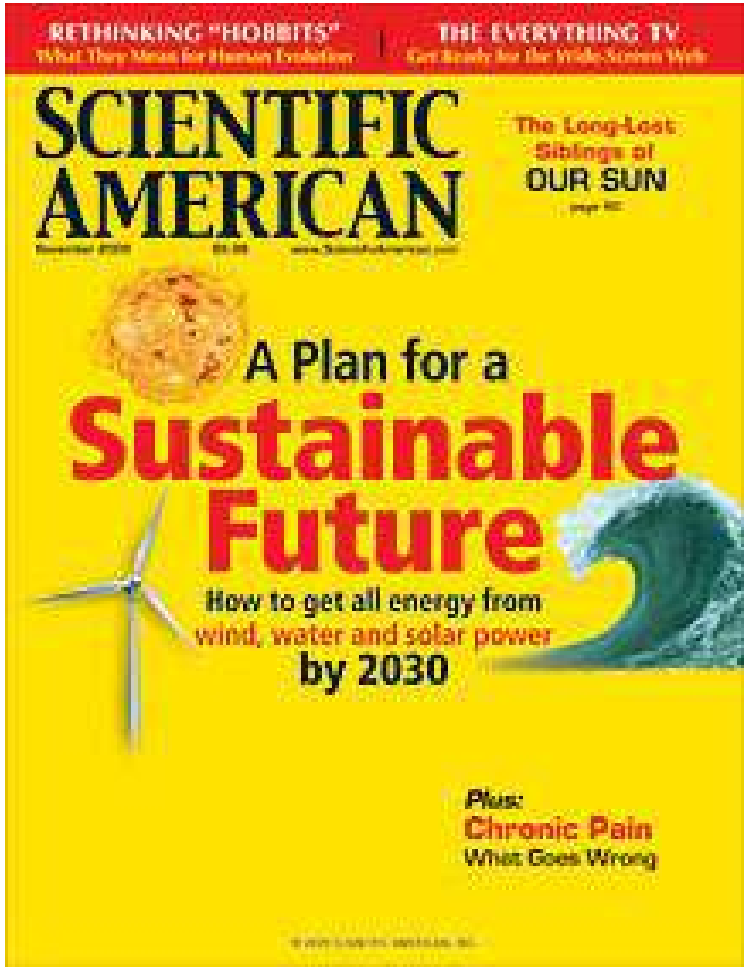
- Materiality
- Individualism, selfishness
- Competition
- Worship of money
- Greed
- Envy



The ellipses indicate the quality (y-axis) and quantity (x-axis) of the US economy for different fuels and periods. The arrows relate to different periods of fuels (e.g. domestic oil: 1930, 1970, 2005), furthermore the size of the ellipse represents the uncertainty of EROI-estimates.

(Source: US EIA, Cutler Cleveland and C. Hall's own EROI work in preparation)

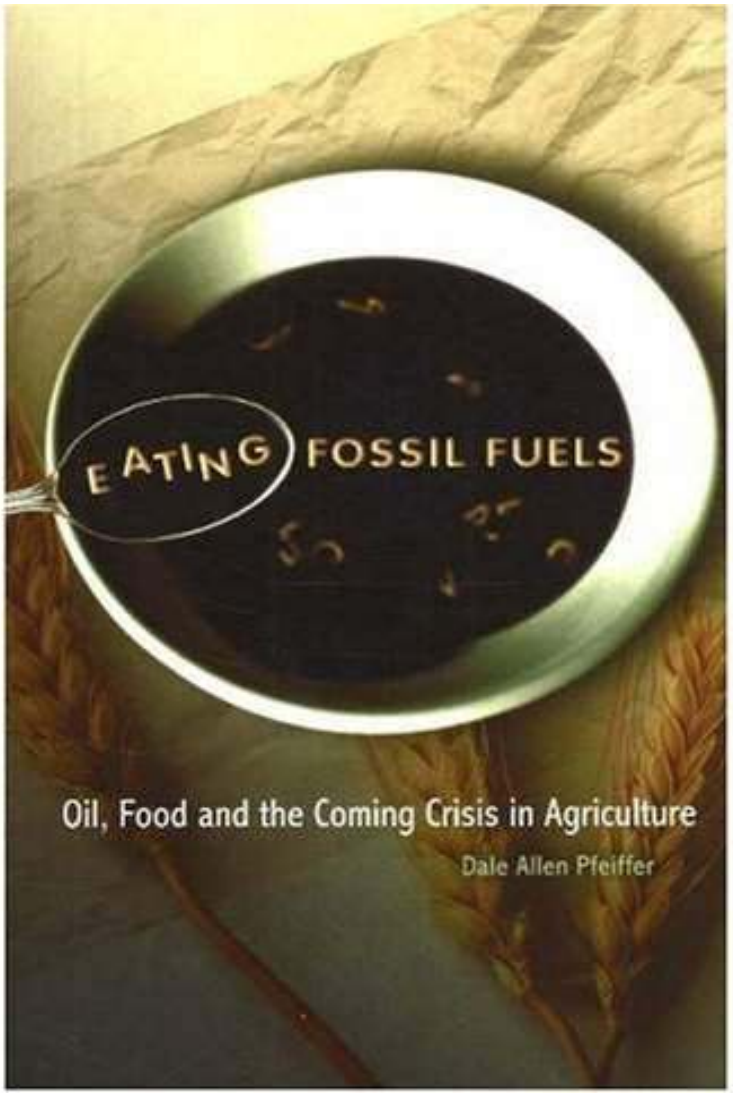




Searching for a Miracle
Richard Heinberg
Published Nov 12, 2009

Perhaps the most important limitation of the future energy supply is the "clean energy" factor - the demand that energy systems provide more energy than were put into their construction and operation.

THE „CARRION-EATER" HUMAN



An average American citizen "eats" 400 US gallons (512 liters) of crude oil per year!

- 31% for production of fertilizers
- 19% for the consumption of farm machinery
- 16% for shipping
- 13% for irrigation
- 8% for raising naimals
- 5% for drying
- 5% for pesticide production
- 3% for others

Agriculture produces 1 calory with 10 calories investments (excludng solar energy)!

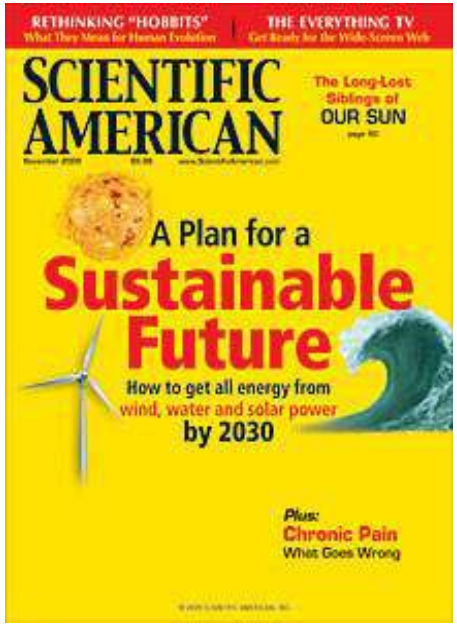
Visions

Techno-optimism

BAU (Busines as usual)

as before, only

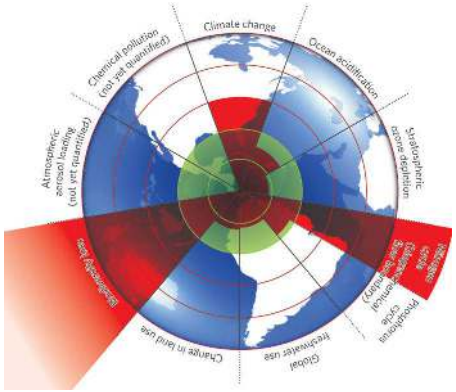
better, more, and faster



Comptetition

Worried responsibility

Limits to growth



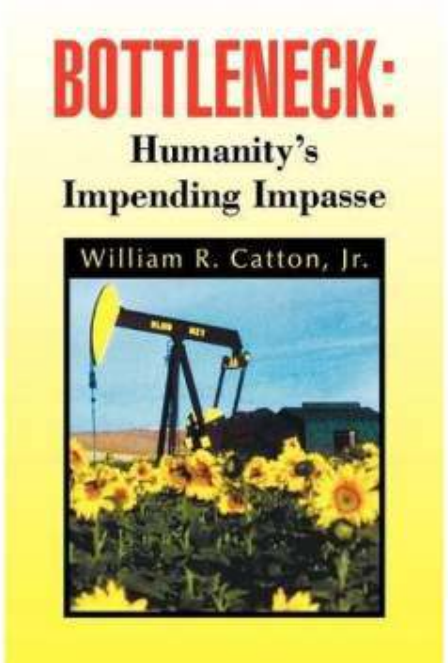
otherwise

Cooperation

Despondency

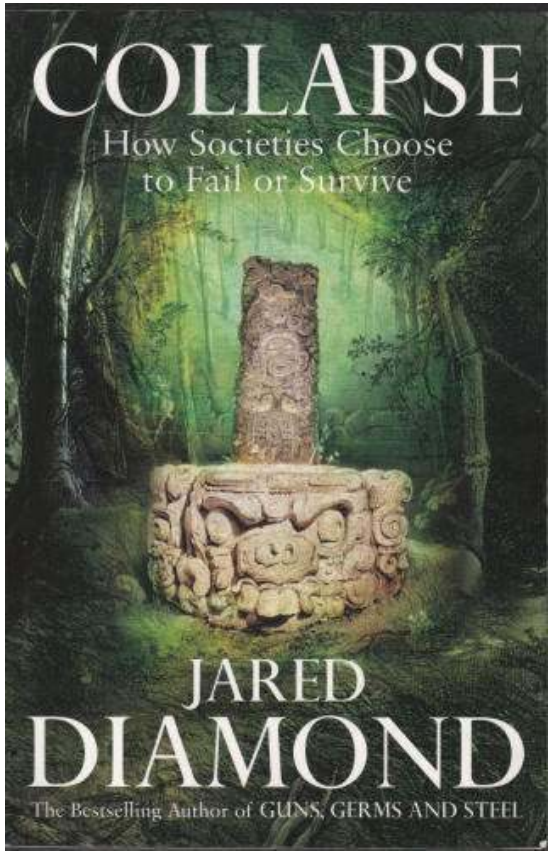
Apocalypse with possible rebirth

too late



Rebirth

Jared Diamond has identified the 12 most serious environmental problems, which the past (and future) societies faced (will face), and which often led to the collapse of the ancient societies:



1) Loss of habitats and ecosystems,
2) Over-fishing,
3) Loss of biodiversity,
4) Soil erosion, soil degradation,
5) Limitations in energy consumption,
6) Limitations of freshwater resources,
7) Limitations in photosynthetic capability,
8) Toxic chemicals,
9) Appearance of alien species,
10) Climate change,
11) **Population growth,** and
12) Change of the levels of human consumption.

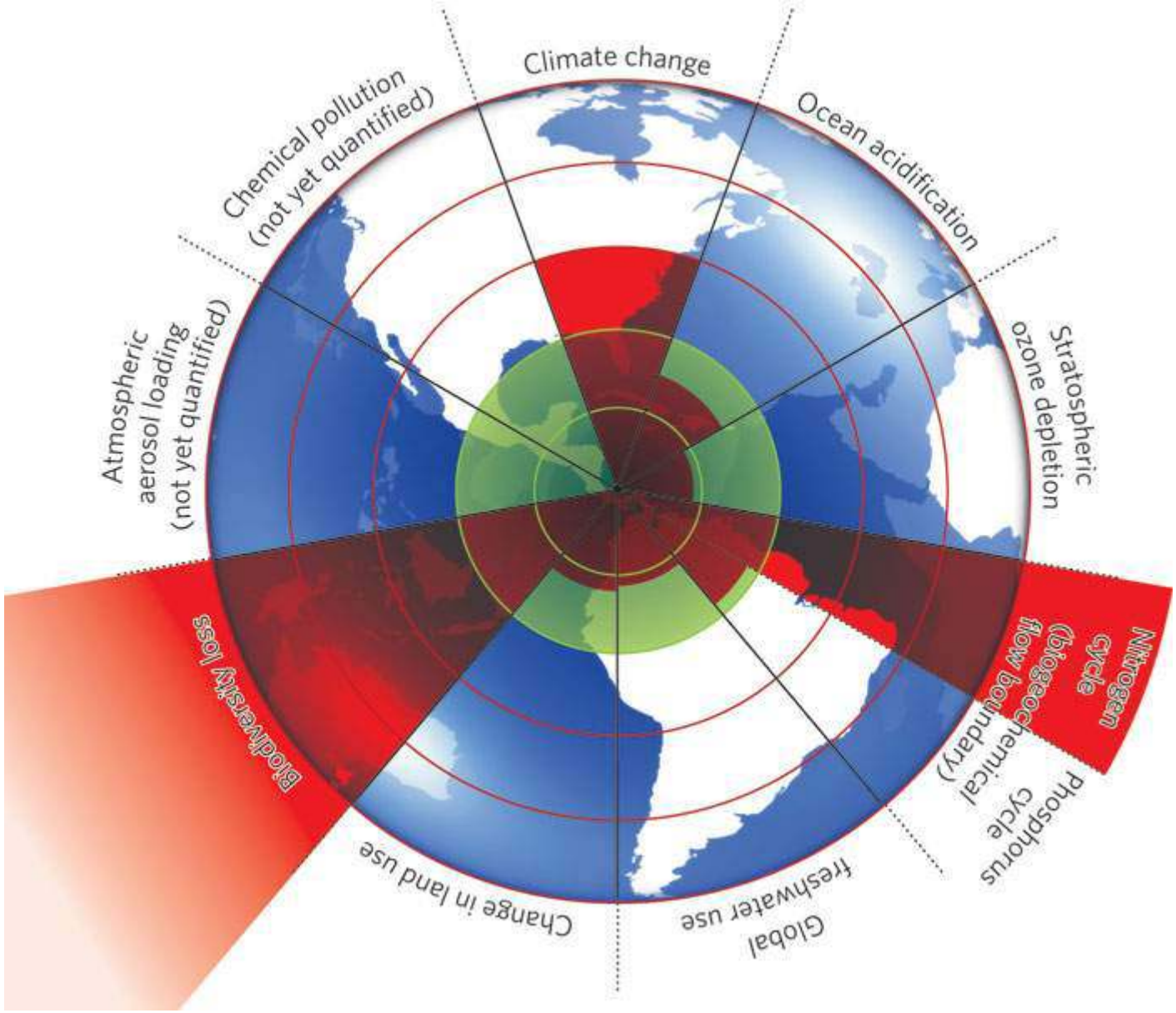
APOCALYPSE

Diamond and several other researchers have stressed formerly that a combination of several factors is almost always far more dangerous than a single factor.

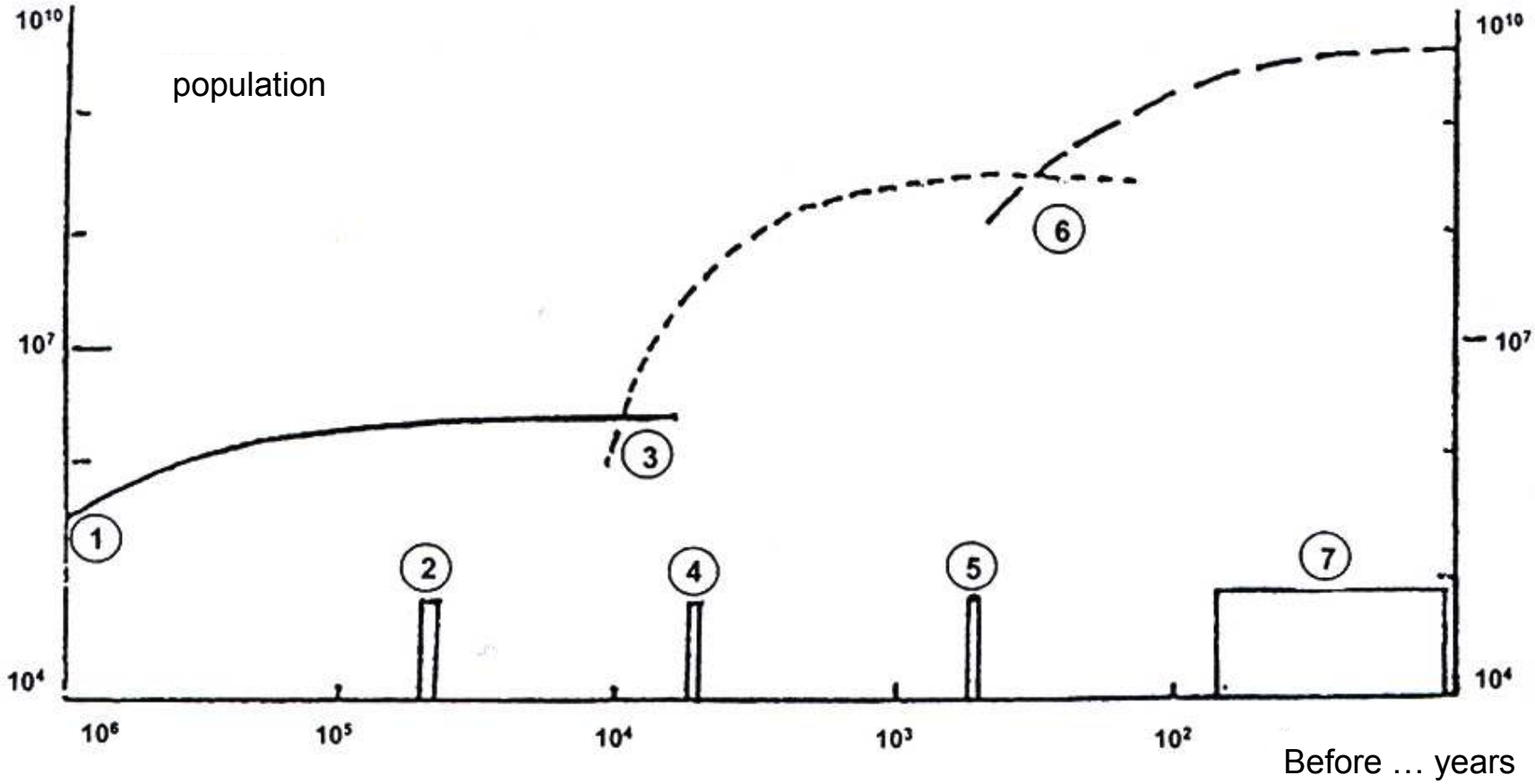
Those systems, which lose their elasticity, are much more vulnerable to the shocks coming from multiple sources.

What costume will you wear, when you come to the end of the world?

A safe operating space for humanity

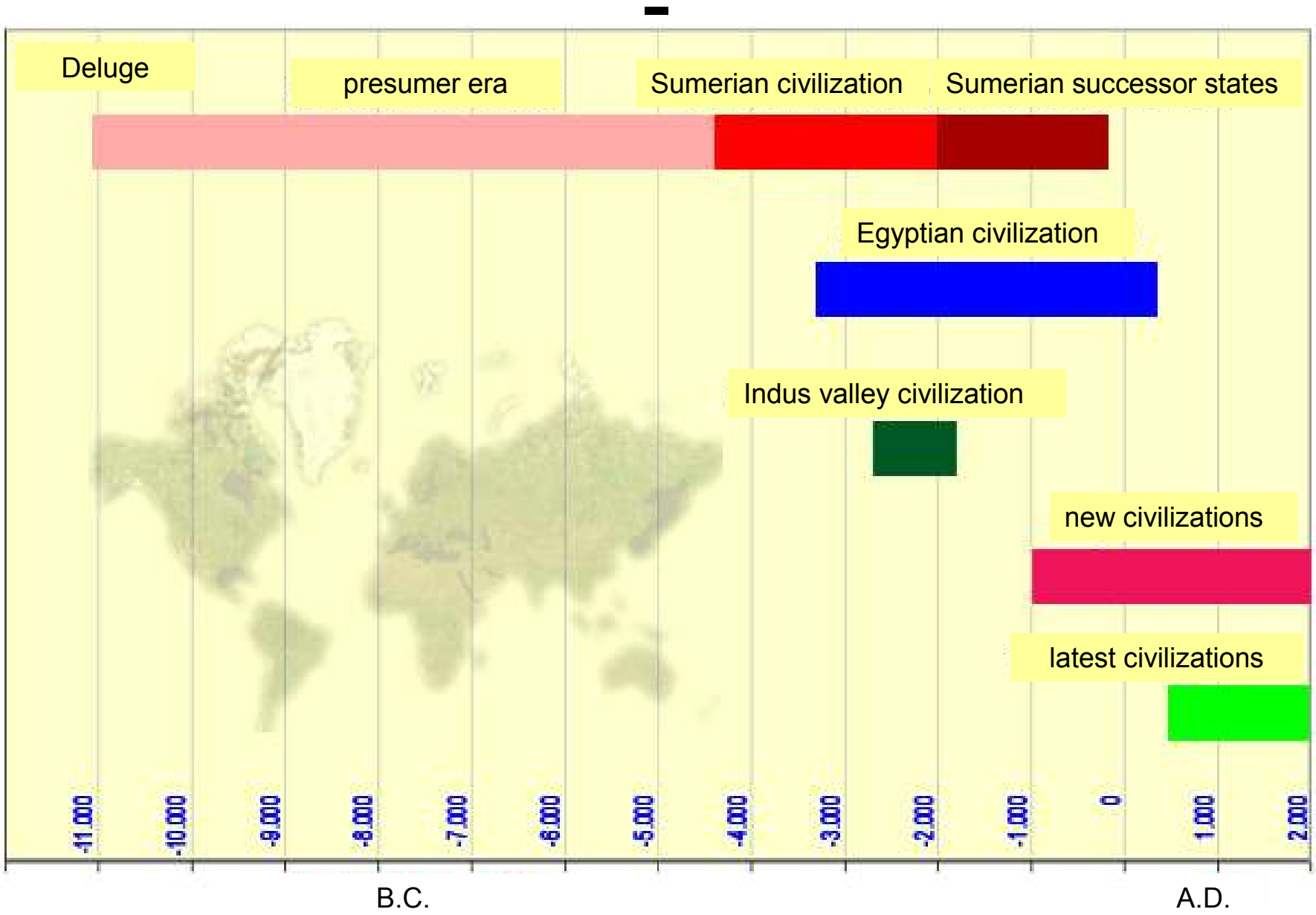


Rockström et al., 2009; ***Nature* 461**, 472-475.



1: Widespread distribution of the production of stone tools and their community use;
2: Continuous speech on thousands of languages;
3: Widespread distribution of the crop production; formation of villages, city-states;
4: Beginning of literacy;
5: Start of printing press;
6: Start of scientific-, technical-, industrial- and economic revolutions and the beginning of the globalization trends;
7: Continued development and rapid deployment of electronic communications;

The main turning points in human planetary conquest (after Polányi, 1957 and Deevey, 1960)


Deluge
presumer era
Sumerian civilization
Sumerian successor states
Egyptian civilization
Indus valley civilization
new civilizations
latest civilizations
-11,000
-10,000
-9,000
-8,000
-7,000
-6,000
-5,000
-4,000
-3,000
-2,000
-1,000
0
1,000
2,000
B.C.
A.D.

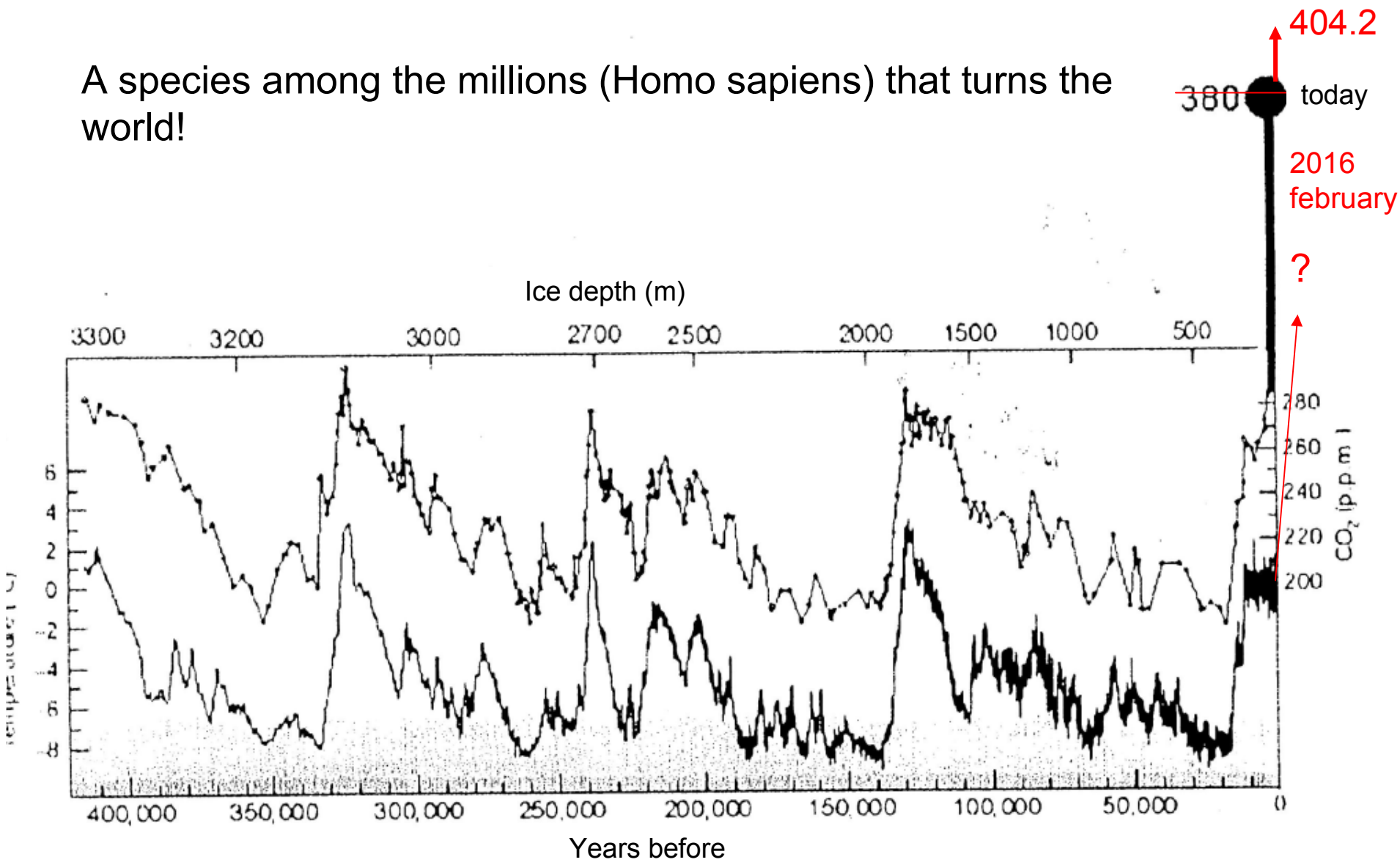
Human evolution in the last thousand years

- food gathering, hunting;
- animal husbandry, conscious crop production;
- big-families, tribes, tribal alliances;
- irrigated farming, education of people – struggle of Sumerian people, robber wars / conquests;
- (Bronze Age, Copper Age, Iron Age), Iron Age 3,000 years ago;
- Developmemt of Sumerian writing – clay tablets, parchment;
- Troy - Sicambria – scythians, Avars, Huns, Attila, migrations, Hungarians;
- formation of national states;

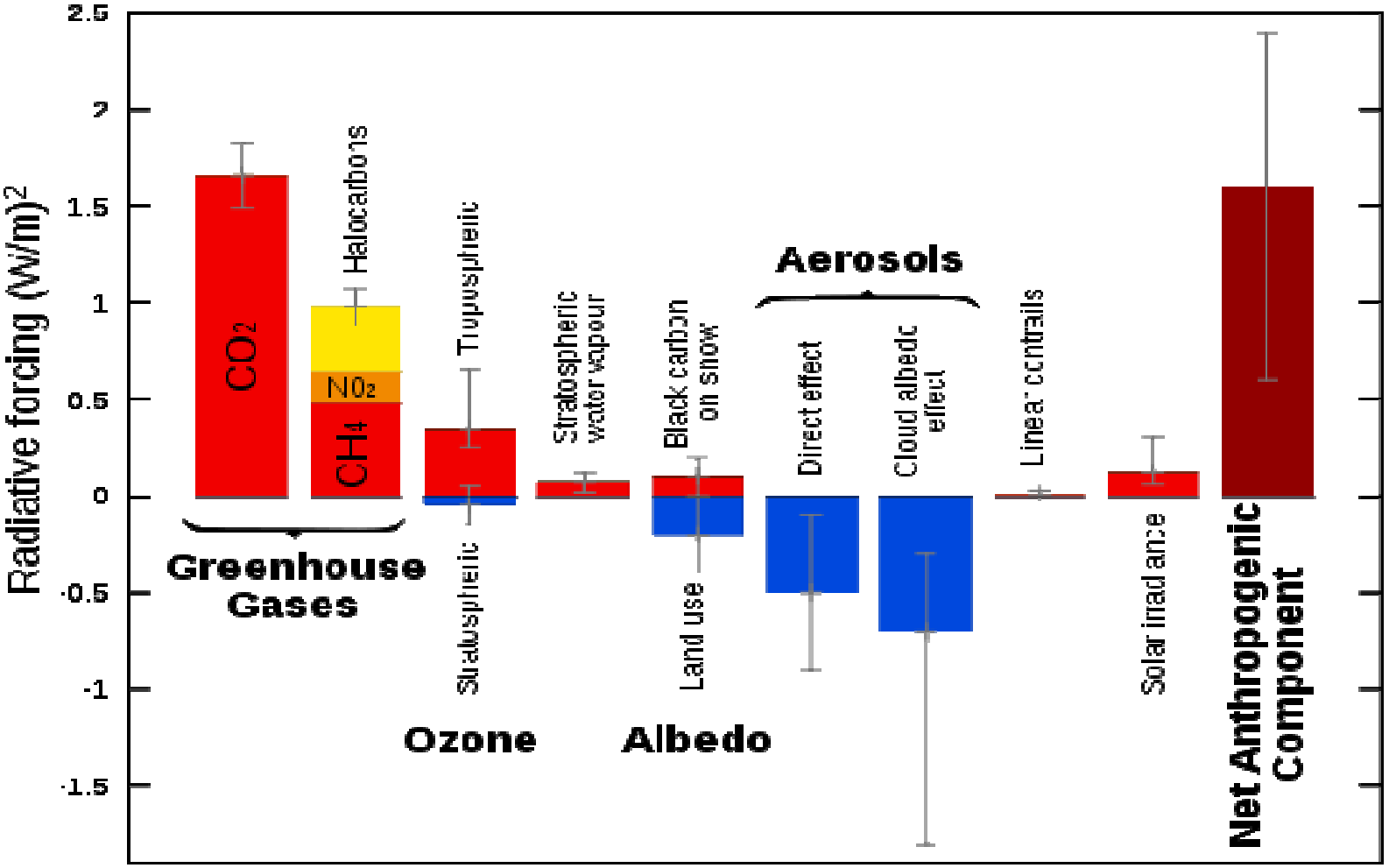
The impact of the last 50-100 years is really critical!

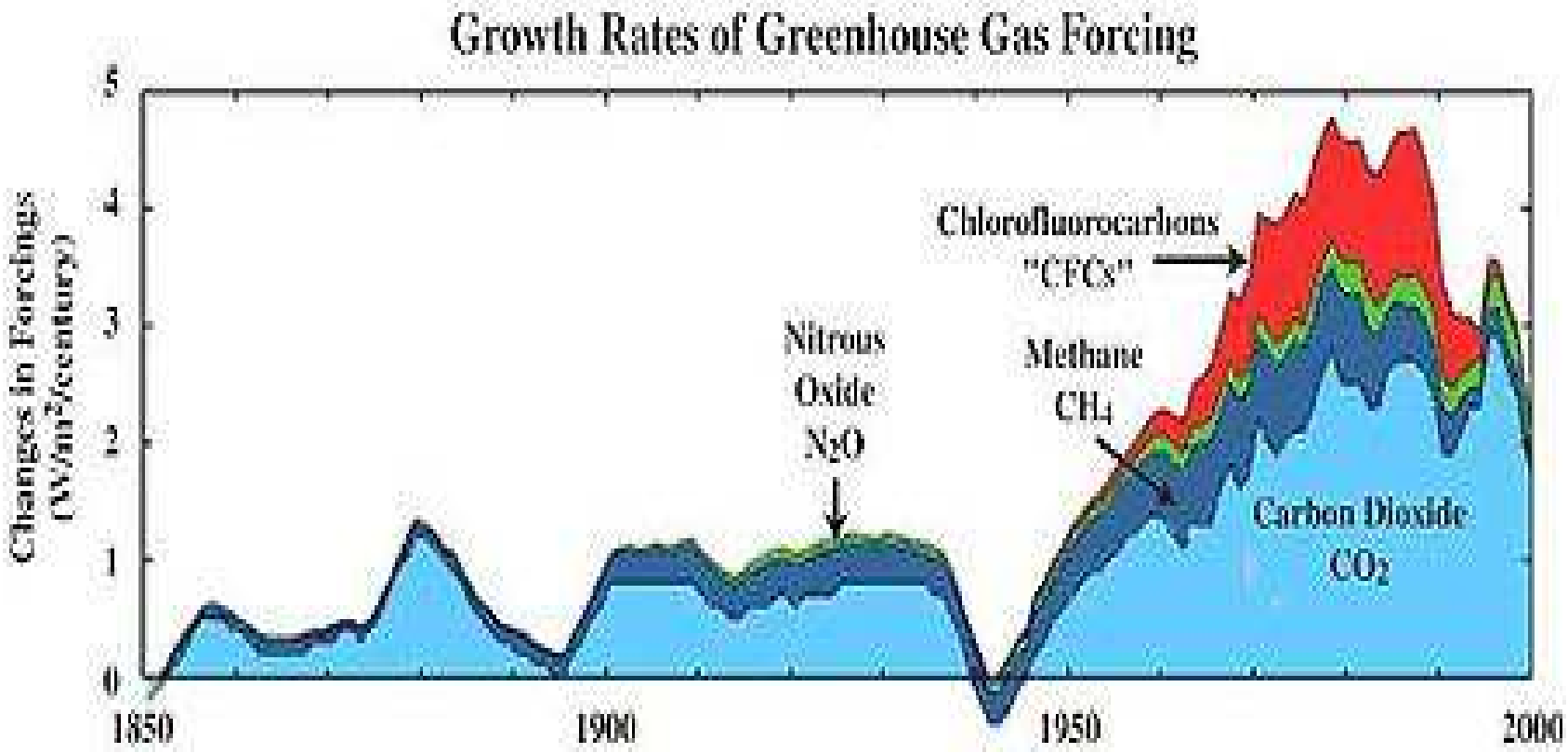
Combined temporal course of temperature and carbon dioxide in the past 400,000 years and the carbon dioxide recently

A species among the millions (Homo sapiens) that turns the world!

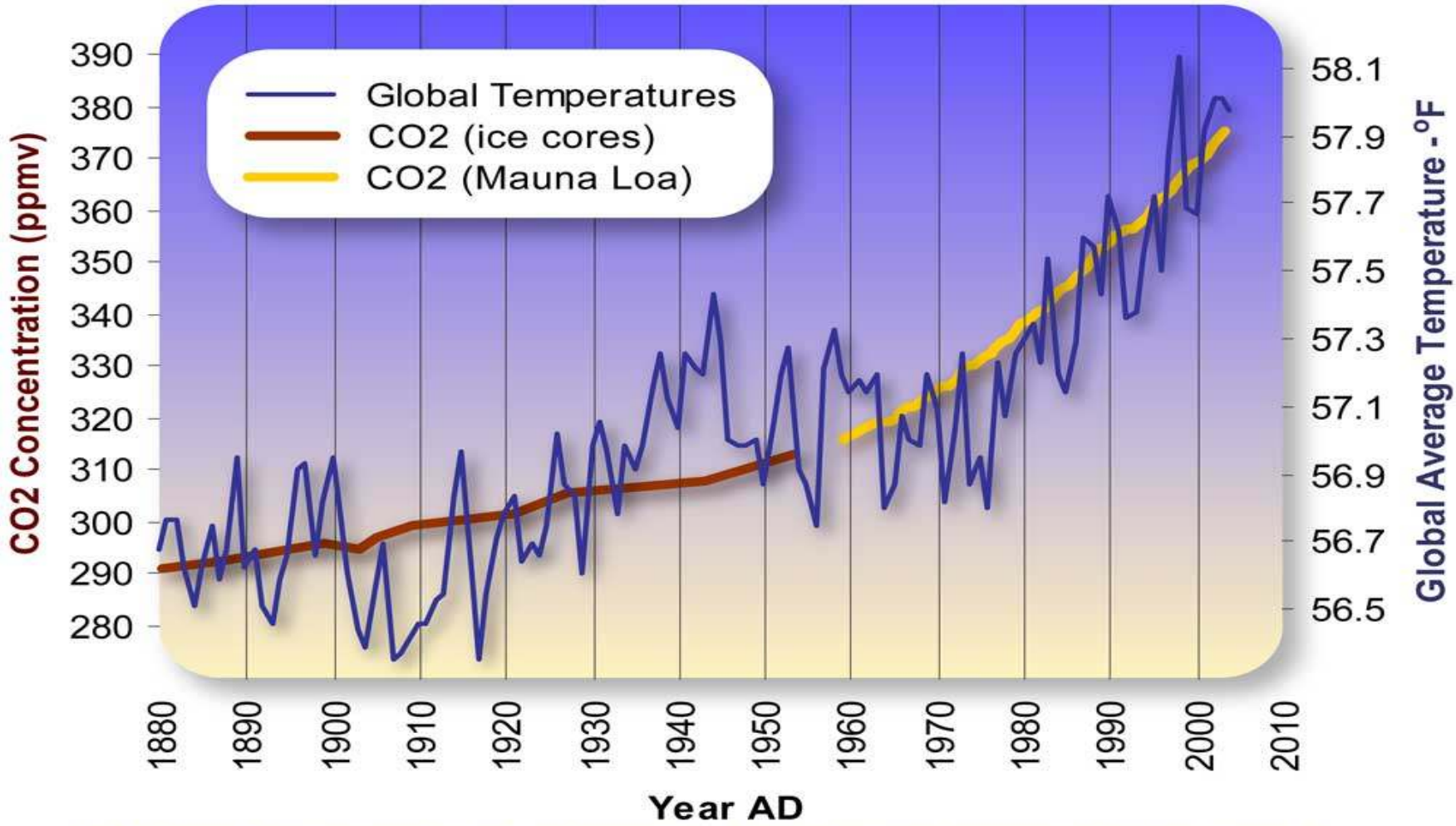


Radiative Forcing Components



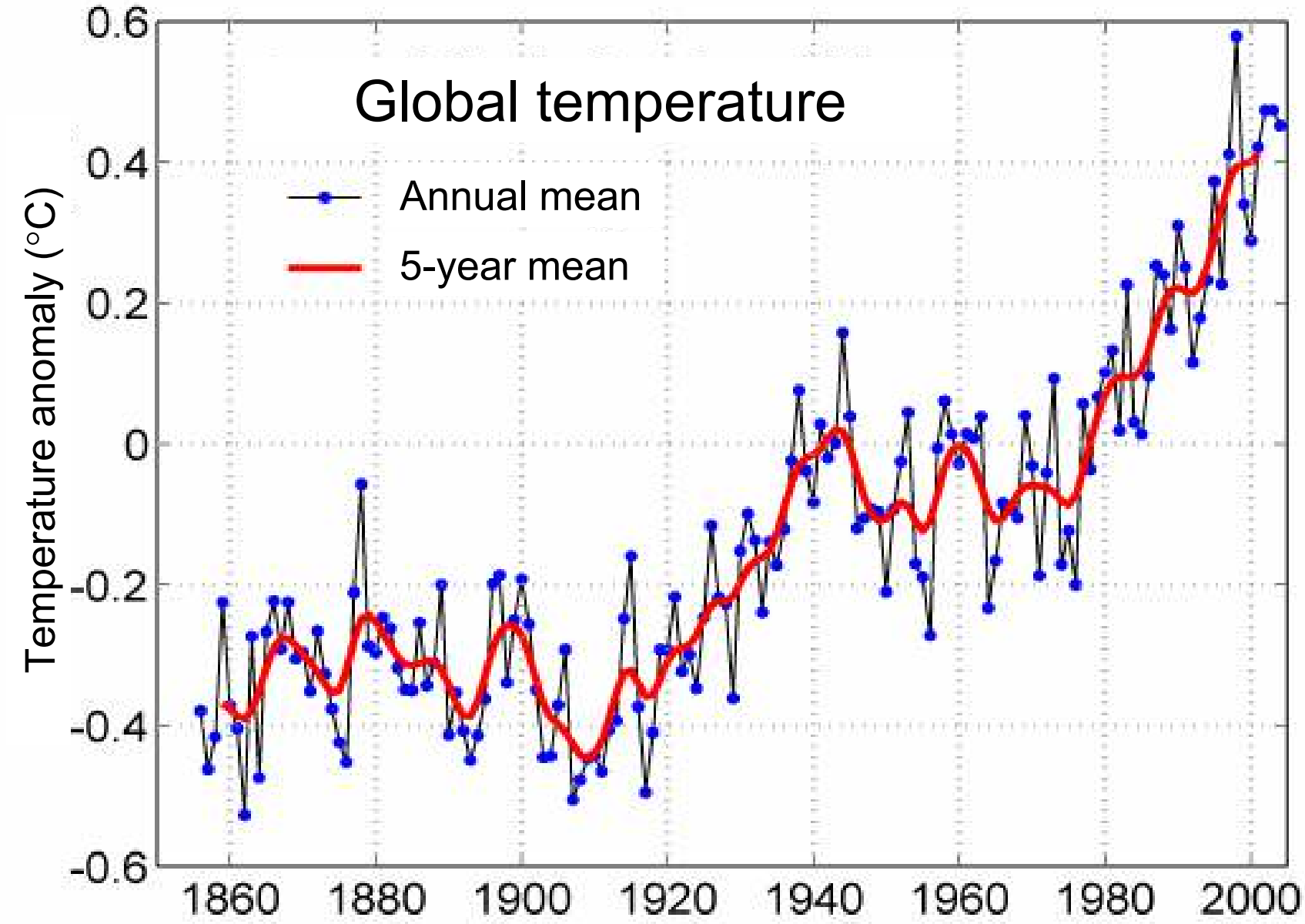

Growth Rates of Greenhouse Gas Forcing
Changes in Forcings (W/m²/century)
5
4
3
2
1
0
1850
1900
1950
2000
Chlorofluorocarbons "CFCs"
Nitrous Oxide N2O
Methane CH4
Carbon Dioxide CO2

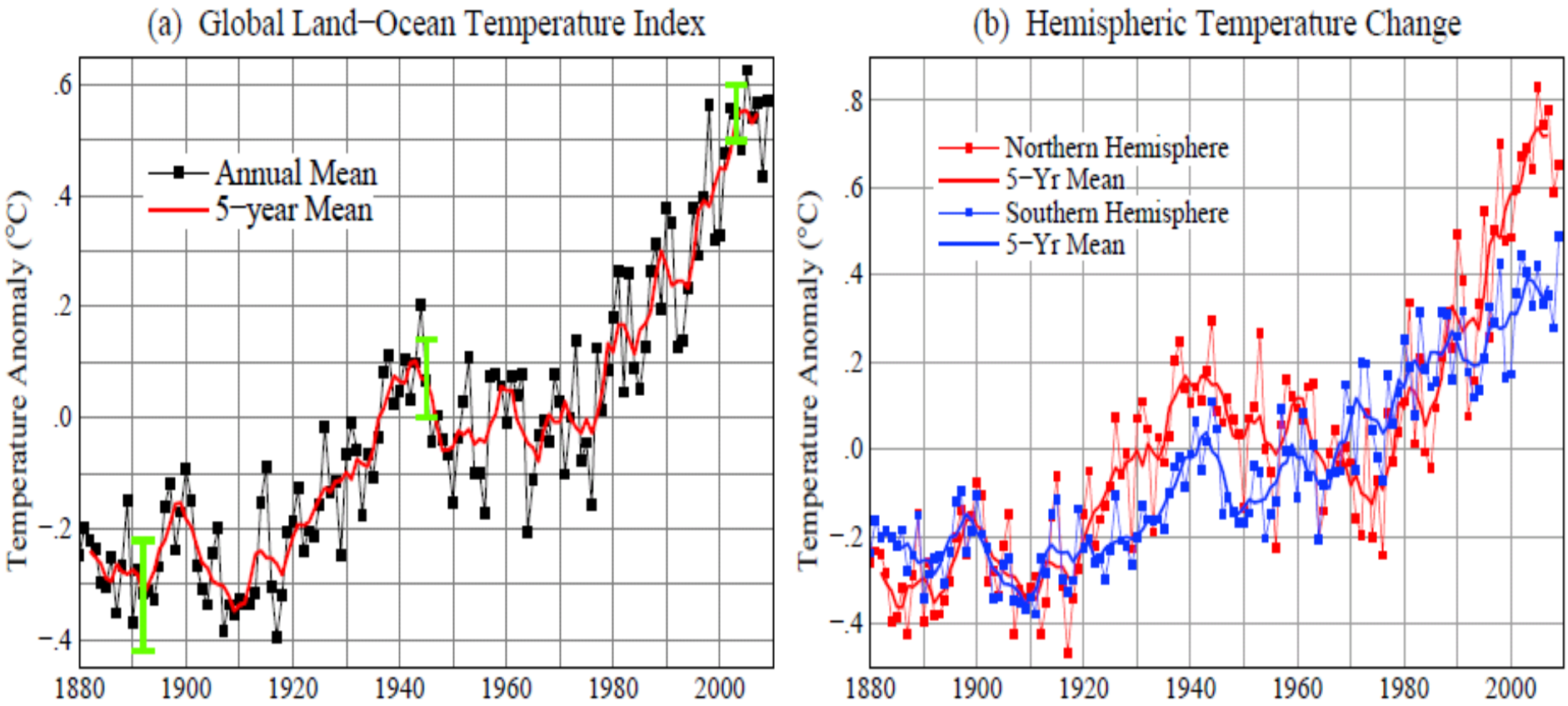
Global Average Temperature and Carbon Dioxide Concentrations, 1880 - 2004



Data Source Temperature: ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/annual_land.and.ocean.ts
Data Source CO2 (Siple Ice Cores): http://cdiac.esd.ornl.gov/ftp/trends/co2/siple2.013
Data Source CO2 (Mauna Loa): http://cdiac.esd.ornl.gov/ftp/trends/co2/maunaloa.co2

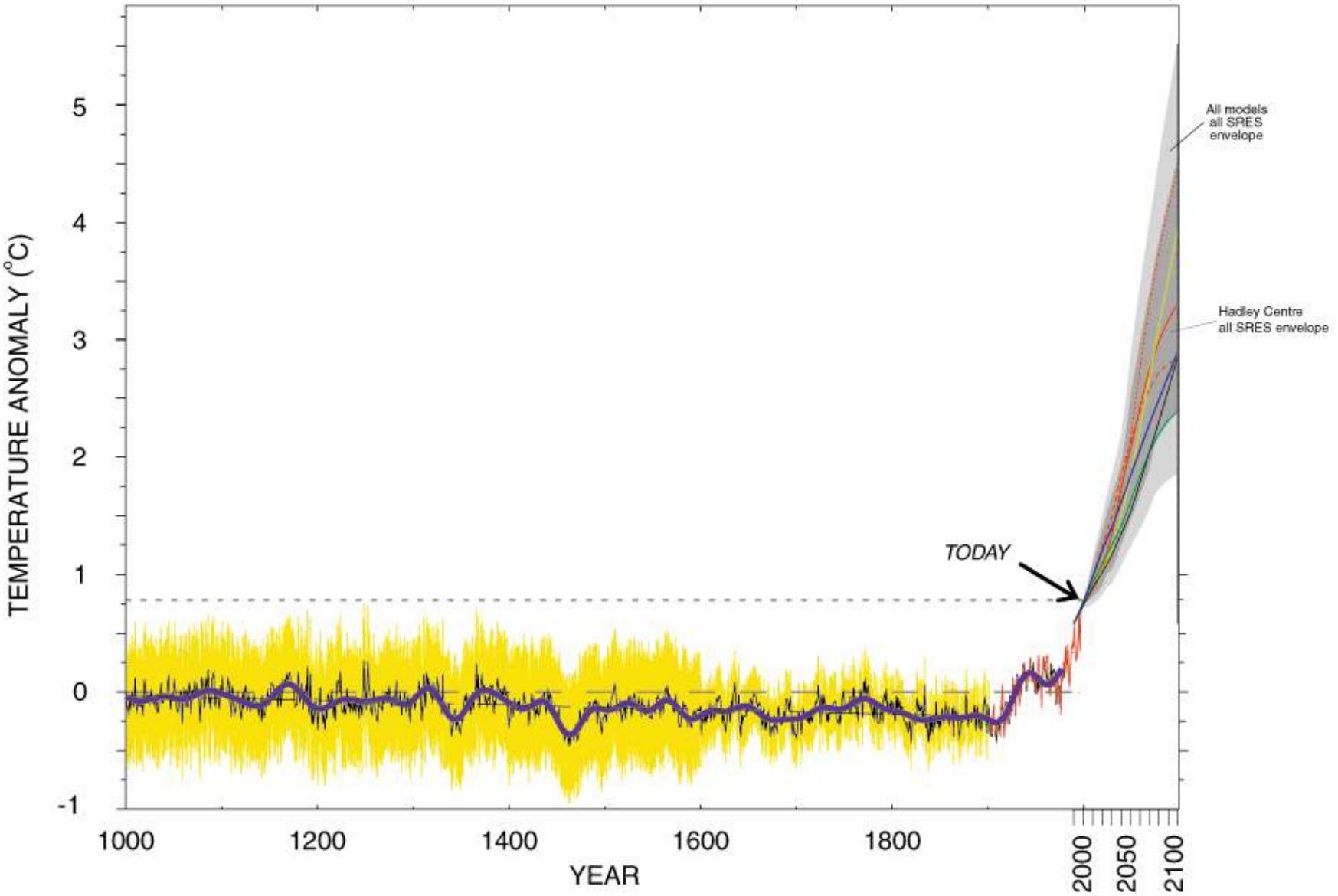
Graphic Design: Michael Ernst, The Woods Hole Research Center


Global temperature
Annual mean
5-year mean
Temperature anomaly (°C)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000

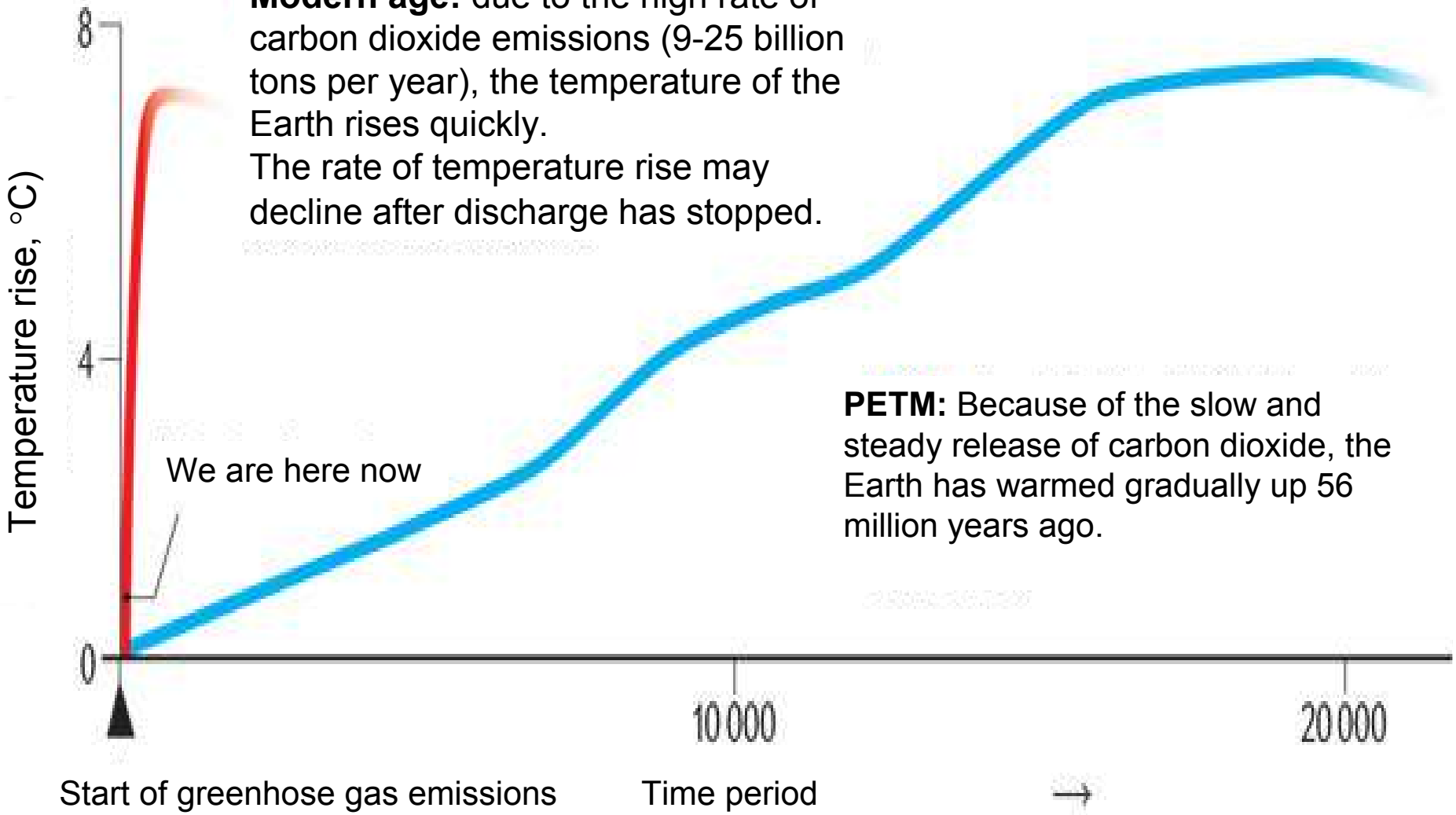


Hansen et al., 2010

Temperature, past and future



Mean temperature of the Earth increases much faster today than during PETM



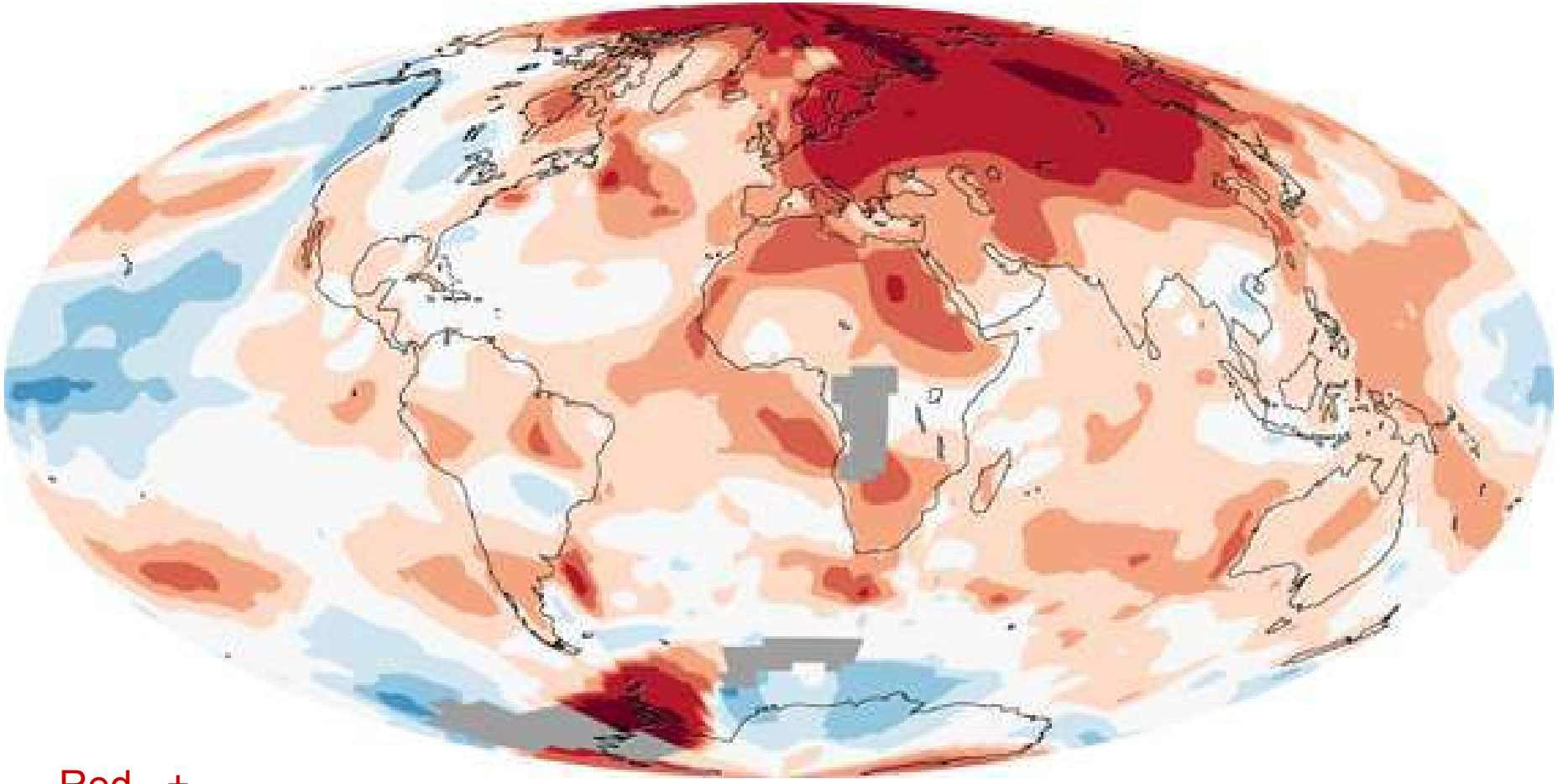
Modern age: due to the high rate of carbon dioxide emissions (9-25 billion tons per year), the temperature of the Earth rises quickly.
The rate of temperature rise may decline after discharge has stopped.

PETM: Because of the slow and steady release of carbon dioxide, the Earth has warmed gradually up 56 million years ago.

***PETM: Paleocene - Eocene Thermal Maximum**

Temperature difference of the last 30 years

(based on satellite measurements)



Red +

Blue -

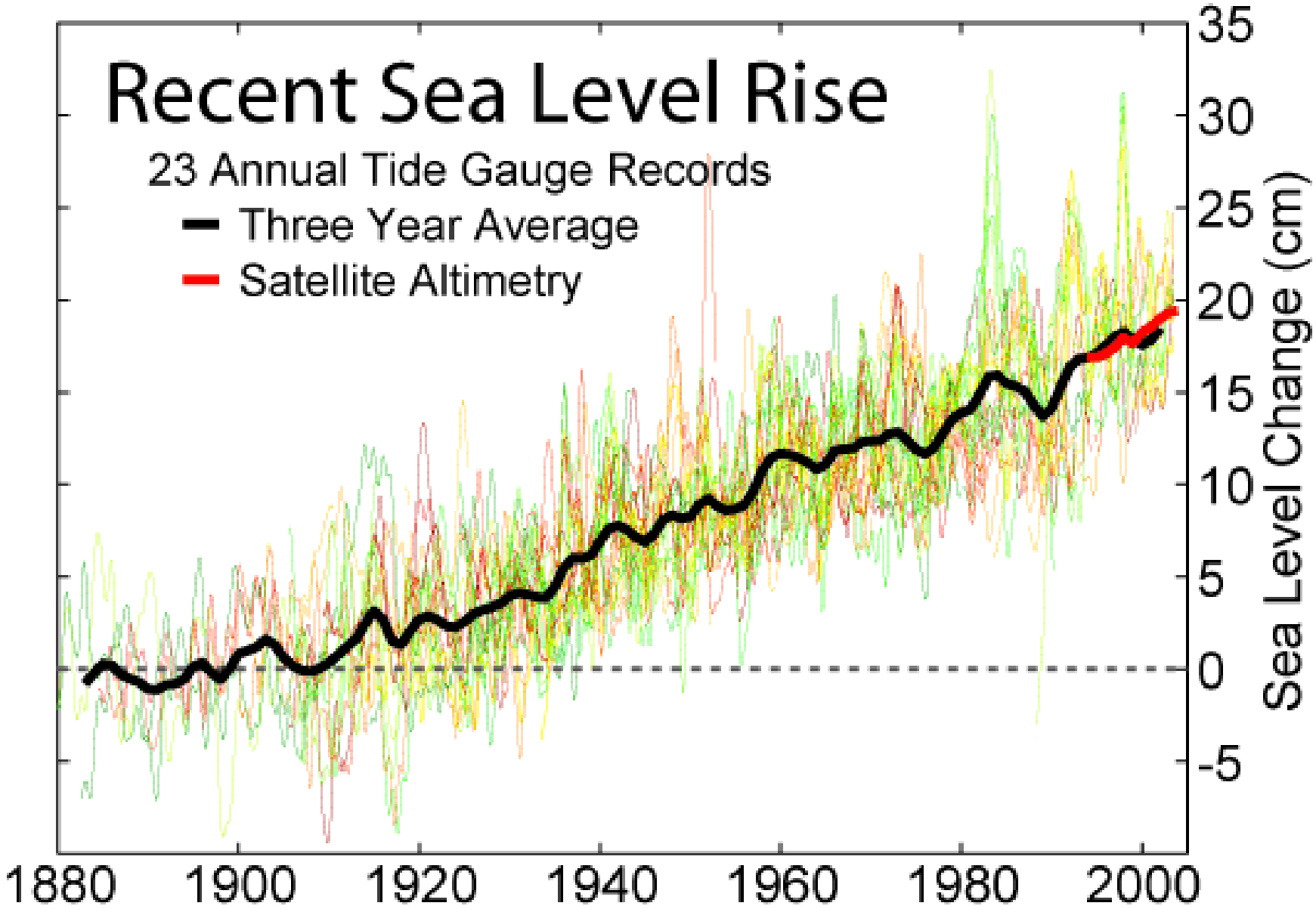
Data of the warmest ten years during the period 1880-2006	year	Difference from the mean of the period 1951-1980
1.	2005	0.63°C
2.	1998	0.57°C
3.	2002	0.56°C
4.	2003	0.55°C
5.	2006	0.54°C
6.	2004	0.49°C
7.	2001	0.48°C
8.	1997	0.40°C
9.	1995	0.38°C
10.	1990	0.38°C

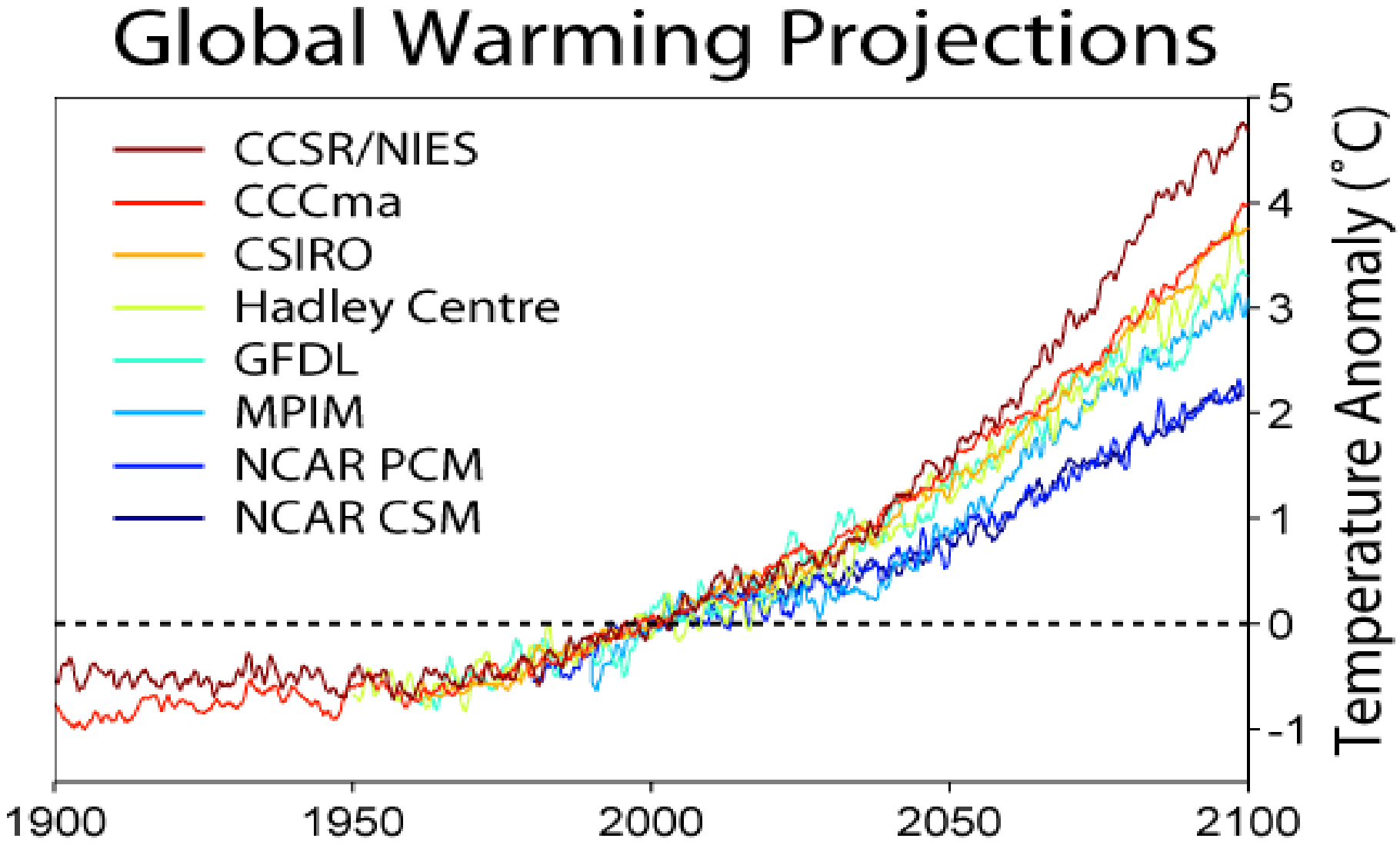
Source: NASA GISS

Due to the warming the Arctic sea ice cover decreases, and glaciers are melting in the mountains.

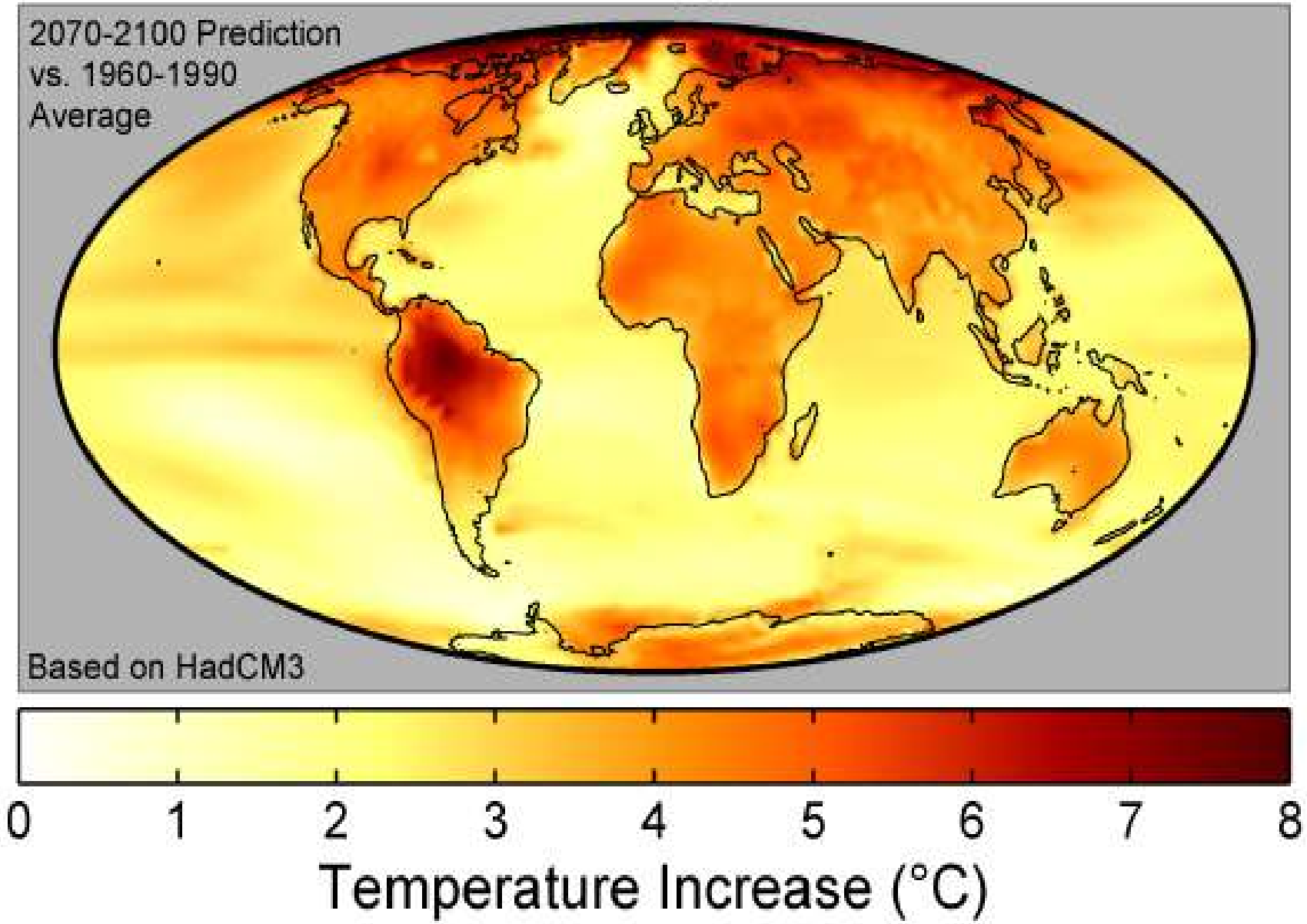
1910 **The Rhône glacier in Switzerland** 2003

Khunjerab Pass (elevation 4,693 m), Karakoram Mountains; on the northern border of Pakistan's Gilgit –Baltistan Hunza - Nagar District on the southwest border of the Xinjiang region of China: **László Makra, China-expedition, July 1994**

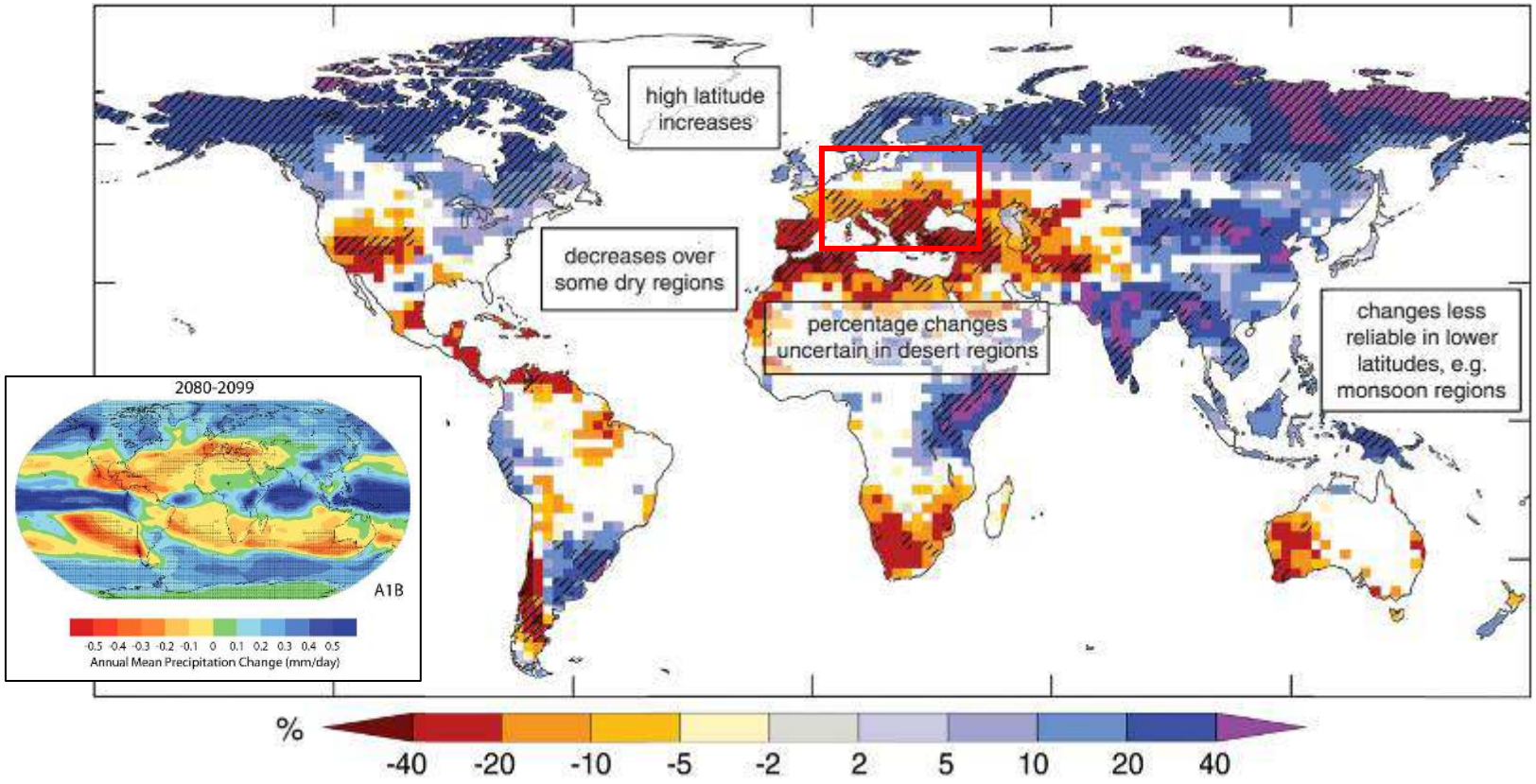

Recent Sea Level Rise
23 Annual Tide Gauge Records
Three Year Average
Satellite Altimetry
35
30
25
20
15
10
5
0
-5
Sea Level Change (cm)
1880
1900
1920
1940
1960
1980
2000


Global Warming Projections
CCSR/NIES
CCCma
CSIRO
Hadley Centre
GFDL
MPIM
NCAR PCM
NCAR CSM
5
4
3
2
1
0
-1
Temperature Anomaly (°C)
1900
1950
2000
2050
2100

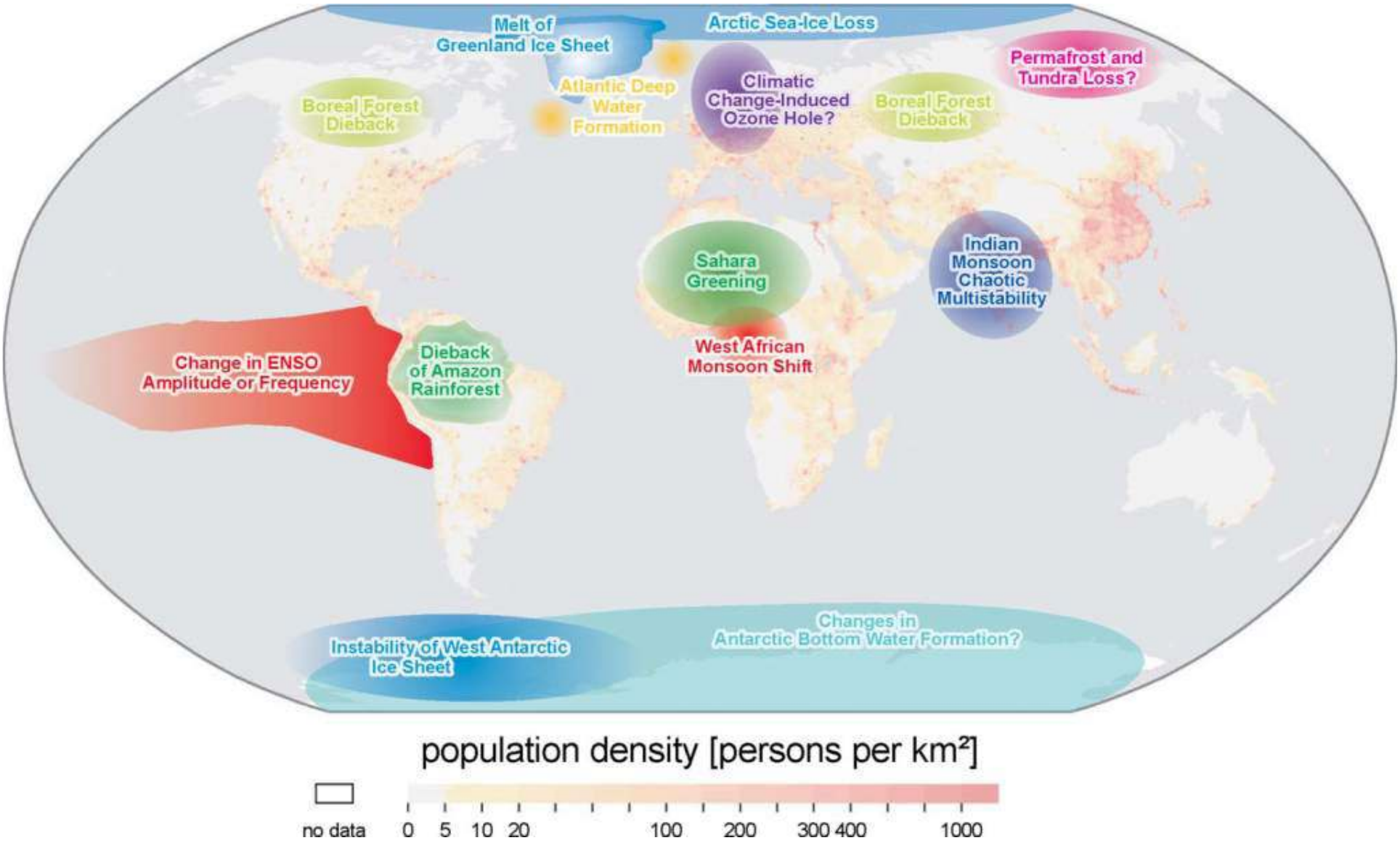
Global Warming Predictions



On a global scale, renewable water resources in the water cycle increase – with significant regional differences



IPCC 2007



Potential key factors in the global climate system

(Lenton et al., 2008)

For the survival of mankind a real paradigm shift is required

- **In values**
- **In economy**

See: Korten, D., 2009: Murderer or humane economy.

Agenda for a new economy – From fantom wealth to real wealth.

Like Jonah in Niniveh market … (Climate summit, Copenhagen, 2009)

Babits, M.: Book of Jonah
(part)

FACTS
(INFORMATION)

Rational (cost-benefit)

Value, identity (meets, differs)

ACCEPTANCE, or REJECTION

Components of the value system

Extrinsic

What others think of me?

Status, career, financial success, fame, and appearance are important.

Intrinsic

How do I accept myself?

Relationships, friends, family, community, and inner peace are important.

An analysis of 70 countries (with different cultures) revealed that values move in clusters (together).

Eg. those who prefer financial success, show less compassion, less environmental and social sensitivity, and less acceptance of human rights; at the same time, social hierarchy plays an important role (external values).

The self-takers show more compassion, more sensitivity to human rights and social justice and environmental issues.

The value system is not an inborn trait. It is shaped by the social environment!

Proven examples for changing values (UK)

The Thatcher and Blair and Brown governments, especially over the favoured spirit of competition, by focusing on market and financial success - on the basis of reliable scientific research - significantly reduced public support of the social aspirations. This was further intensified by the media-celebrated " the most-s" series (the 100 richest, most successful, most beautiful, best, etc.) and advertising material consumption.

The advertising industry consciously seek to manipulate our values – with a major success!

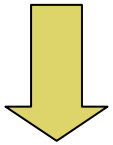
Proposals for change

Current	Alternative
Growth	Balance
Competition	Cooperation
Material wealth	Spiritual richness
Soft sustainability	Hard sustainability
Dominance of business interests	Ethical, intellectual, aesthetic priorities
Profit orientation	Public welfare orientation
Selfishness (excuse the "invisible hand")	Altrusim
Consumer society (disposable)	Sustainable society
Measure of progress: GDP growth	Better standards: ISEW, GPI, etc.
Neoliberal economics	Ecological economics
Life is fight	Life is beautiful
It is never enough	„Logic of Sufficiency" (T. Princeton)
...	…

Vida G., Magyar Tudomány, 2007/12

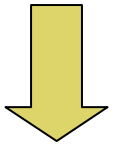
Measurement of well-being

- 60s: starting debate:
  ”infinite” economic growth ⟷ finite world;
  Economic growth is good? (= whether growth is development?)



What is growth?

- Economic growth: means the growth of GDP (GNP)



What is GDP?

GDP: economic-statistical problems

- A GDP, as errors of the indicator of the monetised economic sector:
  - amortization;
  - can not handle technological development;
  - limit of production;
  - gray and black economy;
  - uncertainties of data sources and data service;
  - evaluation of services;
  - imputation;

Consequences

GDP is not what it is sad

- **economics**: gross output of the monetised economy;
- **in fact**: indicator of success and failure - a psychological phenomenon, deeply embedded in the brain of decision-makers;

Alternatives (1)

Measure of Economic Welfare, **MEW**
(Nordhaus and Tobin, 1972)

- health and education expenses were regarded investments;
- certain expenses are „intermediate" (e.g. police) and do not generate wealth in themselves;
- Imputed items: rent, leisure, services of consumer durables, some non-market goods;
- **their conclusion**: GDP and MEW are highly correlated (1926-1965);

Alternatives (2)

Net Economic Welfare, **NEW**
(Nordhaus and Samuelson, 2009)

- the first measure, which tried to assess environmental changes, as well;
- **plus**: leisure, volunteering and gray / black economy;
- **minus**: environmental damages;

Alternatives (3)

System of Economic and Environmental accounts, **SEEA** (1993)

- it leaves intact the original national accounts, it is organized around them;
- its elements are the accounts led on various various natural "stocks";
- it is an important source of data, but it is only an environmental dimension without social components;

Alternatives (4)

Index of Sustainable Economic Welfare, **ISEW** (1989)

- **Income inequality-adjusted household consumption;**
- + non-defensive public expenditures;
- - defensive public expenditures;
- - defensive private expenditure;
- - creation of capital;
- + value of housework;
- - value of environmental pollution;
- - degradation of natural capital;

Alternatives (4)

ISEW

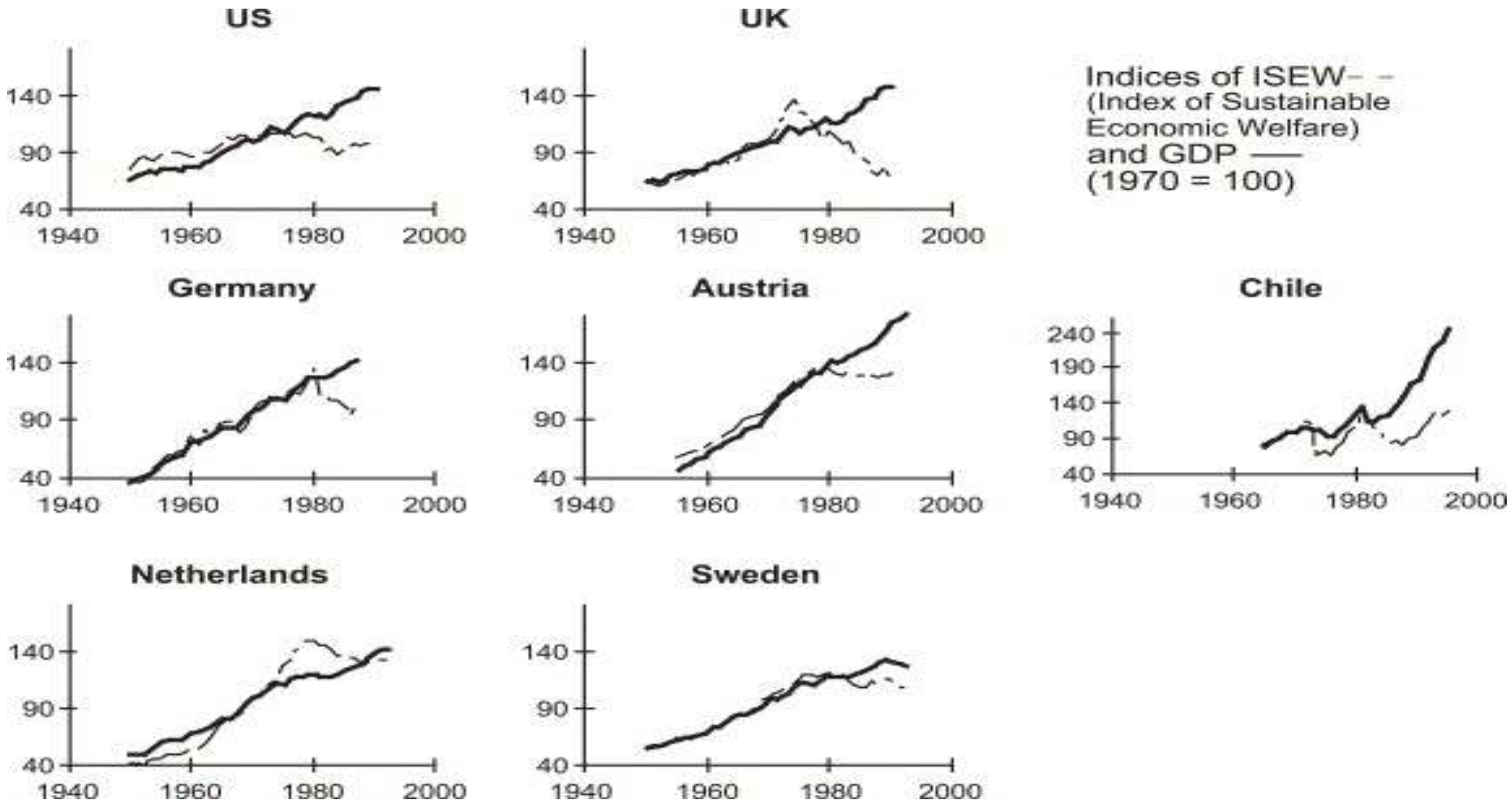
The index is based on household consumption, ie, more precisely, the **income inequality-adjusted index of household consumption.**

Added: 1. the value of household work; 2. the annual value of the services of consumer durables; 3. the value of services provided by roads and rural roads and **4.** health and education and public spending.

Subtracted: 5. the annual amount spent on the purchase of consumer durables; **6.** private health and education spending do not contributing to the prosperity; **7.** the national level of advertising spending; **8.** direct costs of commuting, to work; **9.** costs of urbanization; **10.** costs of accidents in the motorized transport; **11.** costs of water pollution; **12.** costs of air pollution; **13.** damages caused by noise; **14.** damage resulting from the loss of marshes and wetlands; **15.** damage caused by the decrease in agricultural areas; **16.** the costs resulting from the depletion of Finally, two additional items with changing sign are added to the the indicator: **18.** net capital increase, and **19.** the change of the net international capital position of the country.

Alternatives (4)

ISEW



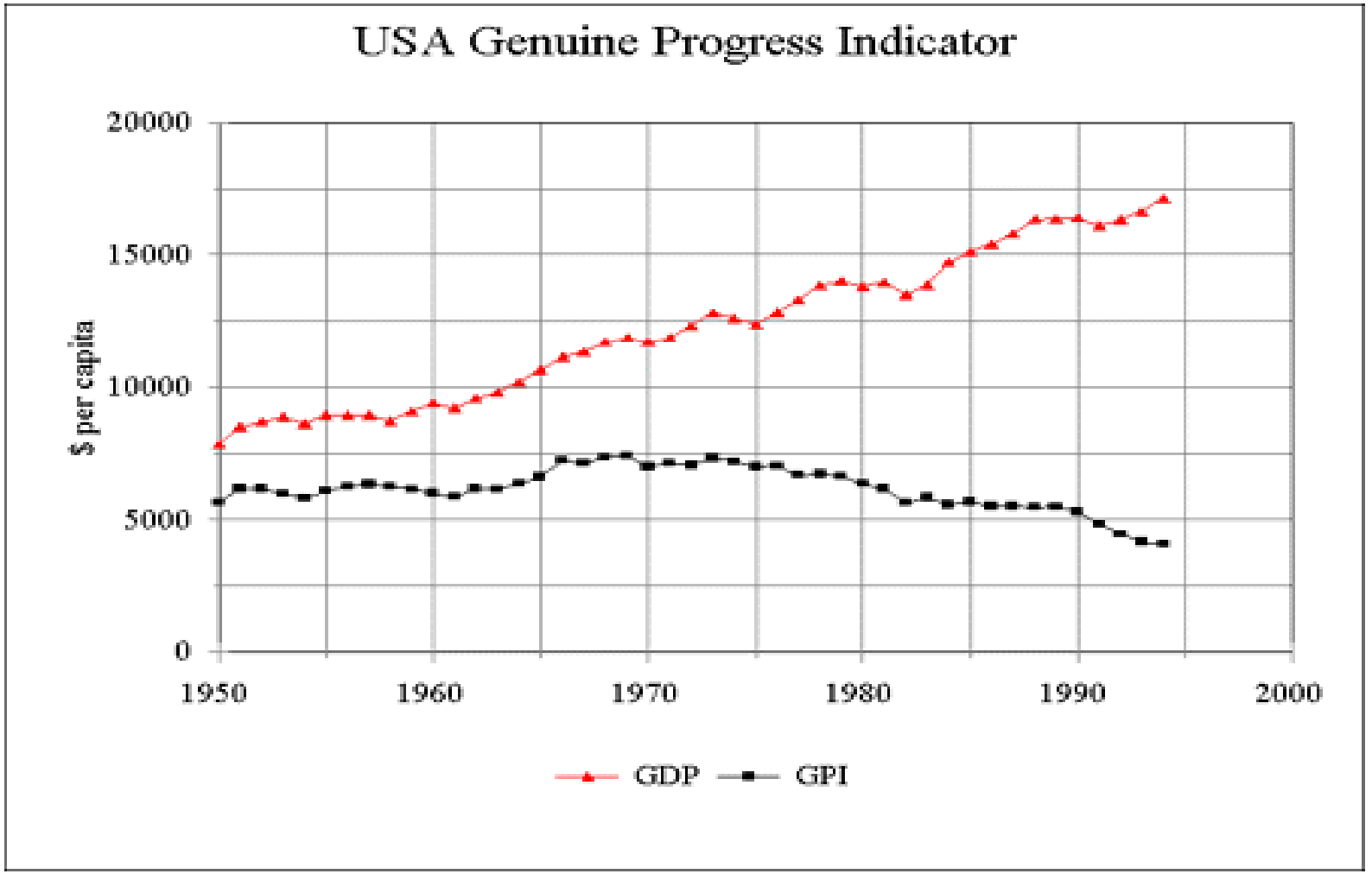
Alternatives (5)

Genuine Progress Indicator, **GPI** (1995)

- revised version of the ISEW;
- it contains five more social and two more environmnetal items compared to ISEW;
- a great need for statistical information;

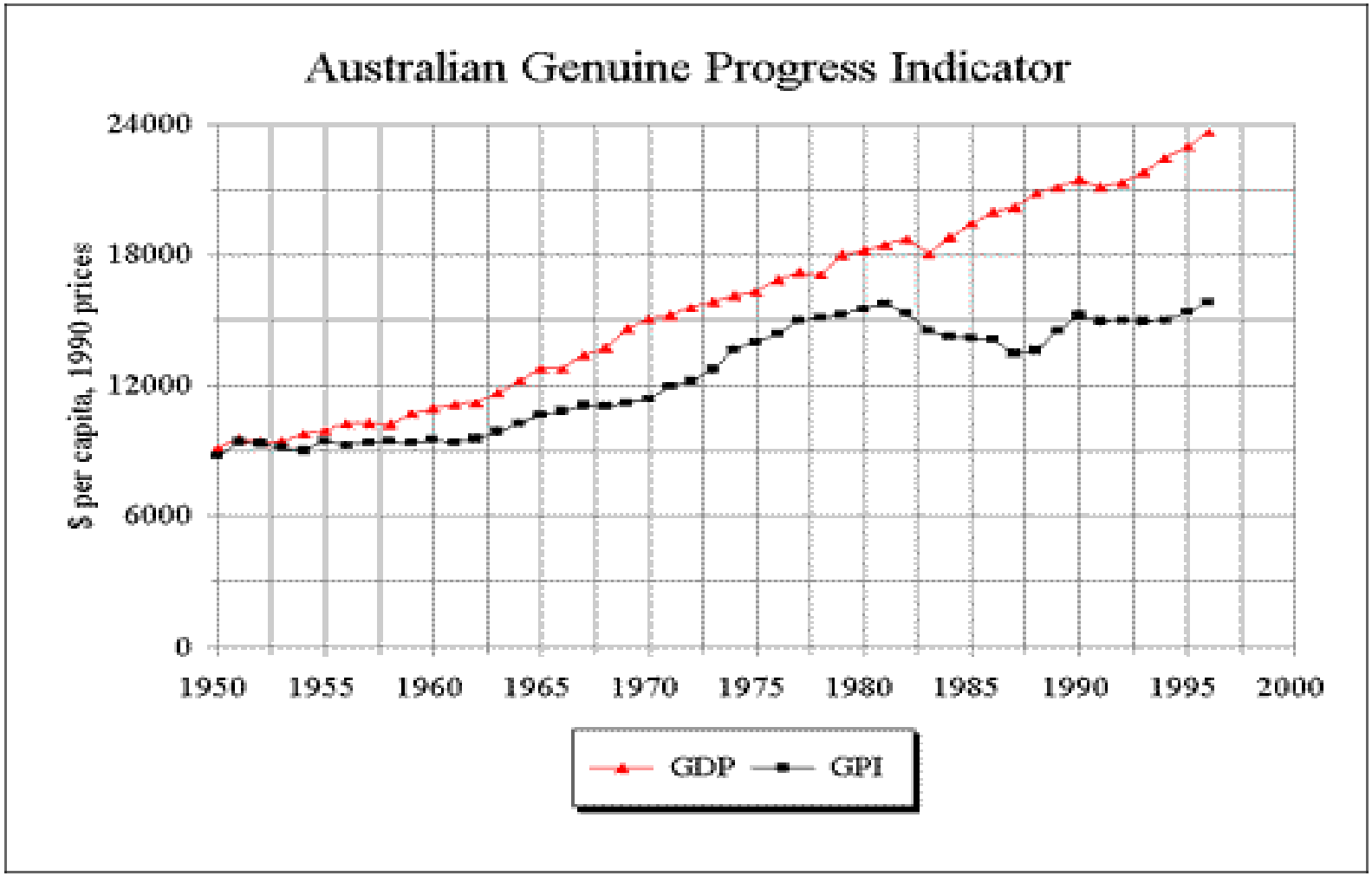
Alternatives (5)

GPI



Alternatives (5)

GPI



Alternatives (6)

Human Development Index, **HDI** (1990)

- in terms of GDP per capita purchasing power parity;
- education (educated ratio);
- health (life expectancy);
- it is suitable for sophisticated measurement only where there is a developed statistical system (e.g. correction by gender);
- very small differences - the order is irrelevant;

;

Alternatives (7)

Ecological footprint

- only environmental dimension;
- It depends on several factors (eating meat, quality of soil, etc.);

Alternatives (8)

Living Planet Index, **LPI**

- it measures the amount of 1313 species of vertebrate animals;
- only natural dimension, and within it only higher animal species;
- easy to communicate;
- the index has decreased by 30% since 1970;
- very different trends between areas and species;

Alternatives (9)

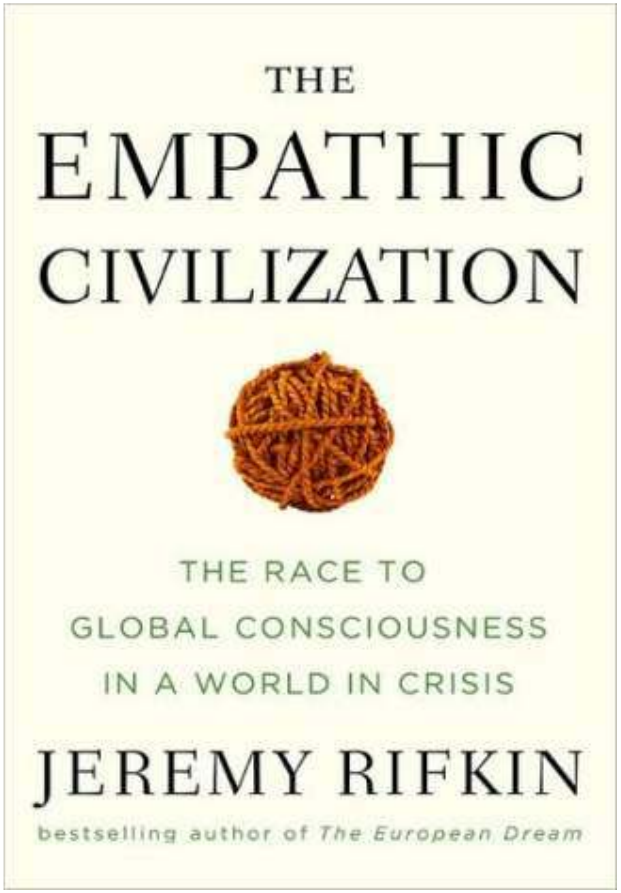
Happy Planet Index, **HPI**

- it measures not happiness, but to where people live long, happy lives without having to go beyond the ecological limits;
- HPI = satisfaction * life expectancy / ecological footprint (ha);
- **best**: Vanuatu, Columbia, Costa Rica, Dominica, Panama, Cuba, Honduras, Guatemala, Salvador (Bhutan 13., Sri Lanka 15.;)

Alternatives (10)

Satisfaction With Life Scale, **SFWS**

- 5-question survey, scoring 1-7;
- strongly correlates with the following components: health (0.7); income (poverty) (0.6); access to basic education (0.6);
- **best 12**: Denmark, Switzerland, Austria, Iceland, Bahamas, Finland, Sweden, Bhutan, Brunei, Canada, Ireland, Luxembourg;
- USA: 23.; Hungary: 107.;
- **worst:** East Asian powers (Japan 90.!, South-Korea 103., China 82.), Mediterranean countries (Spain 46, Italy 50, Portugal 92!)



2010

Endgame of the "Modern" world: two striking events:

1) July 2008 - the oil price 147 USD → twilight of the era of fossil fuels;

2) December 2009 - The failure of the Copenhagen climate summit;

Entropy treatment failure of the world leaders;

The reason of the problem: the world's decision-makers are still in the 18th Century.

⇒ man is a rational, dispassionate, self-interest validator;

On the contrary: according to evolutionary biology, neuroscience, anthropology, child psychology etc., **man is basically a compassionate, concerned for others, social beings (see: mirror neurons)**

1st industrial revolution: after 1750 cole

2nd ” : after 1860 crude oil, natural gas

3rd ” : after 2010 rebewable, global awareness

World of irrealities

- The need for constant economic growth on a finite Earth;
- Through gradual dematerialization of the economy the growth limit can be handled. See: T.Jackson: Prosperity without growth, March 2009
- Man is a rational consumer machine, a self-interest validator. See: R. Lucas, 2003: „Central problem of depression prevention has been solved…for many decades" -2008!
- A world economy manipulated with phantom funds. We trust miracles (power source - capacity, switching time, etc.) See: R.Heinberg: Searching for a Miracle, Nov. 2009

SUMMARY

1. *Using cheap fossil energy, the population of the Earth has increased tenfold over 300 years, and is expected to exceed 8 billion people by 2020.*
2. *Today's consumer society, the industrial and agricultural production, the globalized free trade, and the whole modern civilization was created based on this cheap energy.*
3. *Mankind has been arranged for further increase and development. Most people beleive that science and technology will solve all problems.*
4. *Fossile energy sources are finite, with their decrease they become more expensive. Inventories are increasingly difficult to access. The same is true for nuclear fissile materials, and other raw materials, as well.*

5. *The transition to renewable energy sources needs a substantial infrastructure, lots of time (> 20 years), matter and energy.*
6. *If this fails in due time, our civilization will collapse with decreasing energy. We can not even feed 7-8 billion people without machines and chemicals. We do not know how much time we have.*
7. *The high conversion is hindered by difficulties associated with climate change, deteriorating ecosystem services, depletion of freshwater supplies and soils, as well as tensions caused by the huge differences in welfare.*
8. *In our selfish, self-interest validating, profit-driven, competitive world the cooperation, common cause and long-term thinking are pushed into the background.*

The large miss

Goal is the economic growth, for this „human resources" is a device

The measure is GDP (Gross Domestic Product)

The big aim The big miss

Goal **is the economic growth, for this „human resources" is a device.**

The measure is GDP (Gross Domestic Product)

The goal is a sustainable and desirable present and future for all mankind. For this economy is a device.

The measure is GNH (Gross National Happiness)

Further global concerns

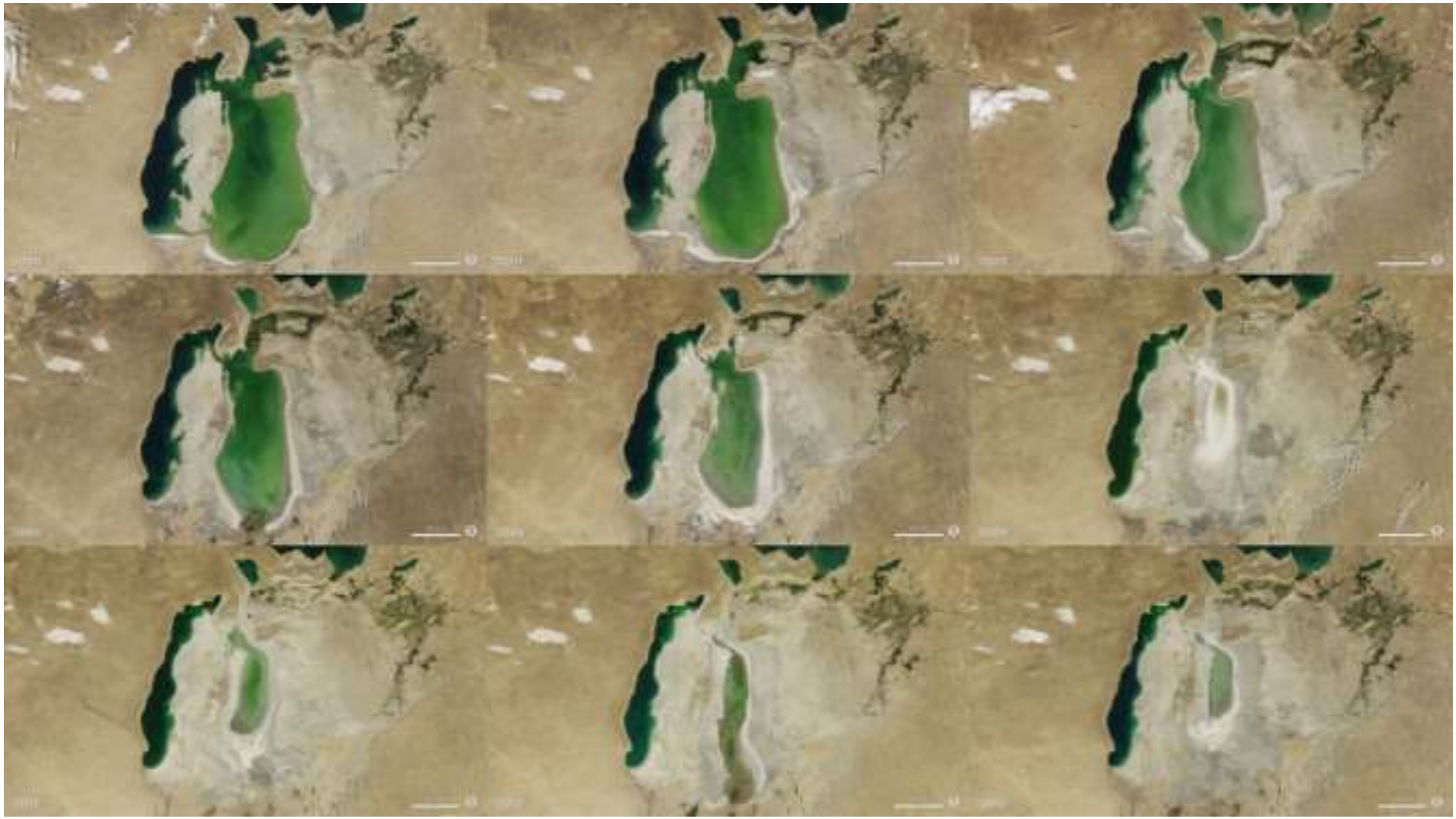
Deforestation…

- One-third of the forests of the Earth are rain-forests;
- Recently, the fate of deforestation exceeds 200,000 km^2 per year.
- Rain-forests of Amazonia have already lost 25% of their original area;

Lake Chad 1972 / 2007

Desertification…

Desertification…

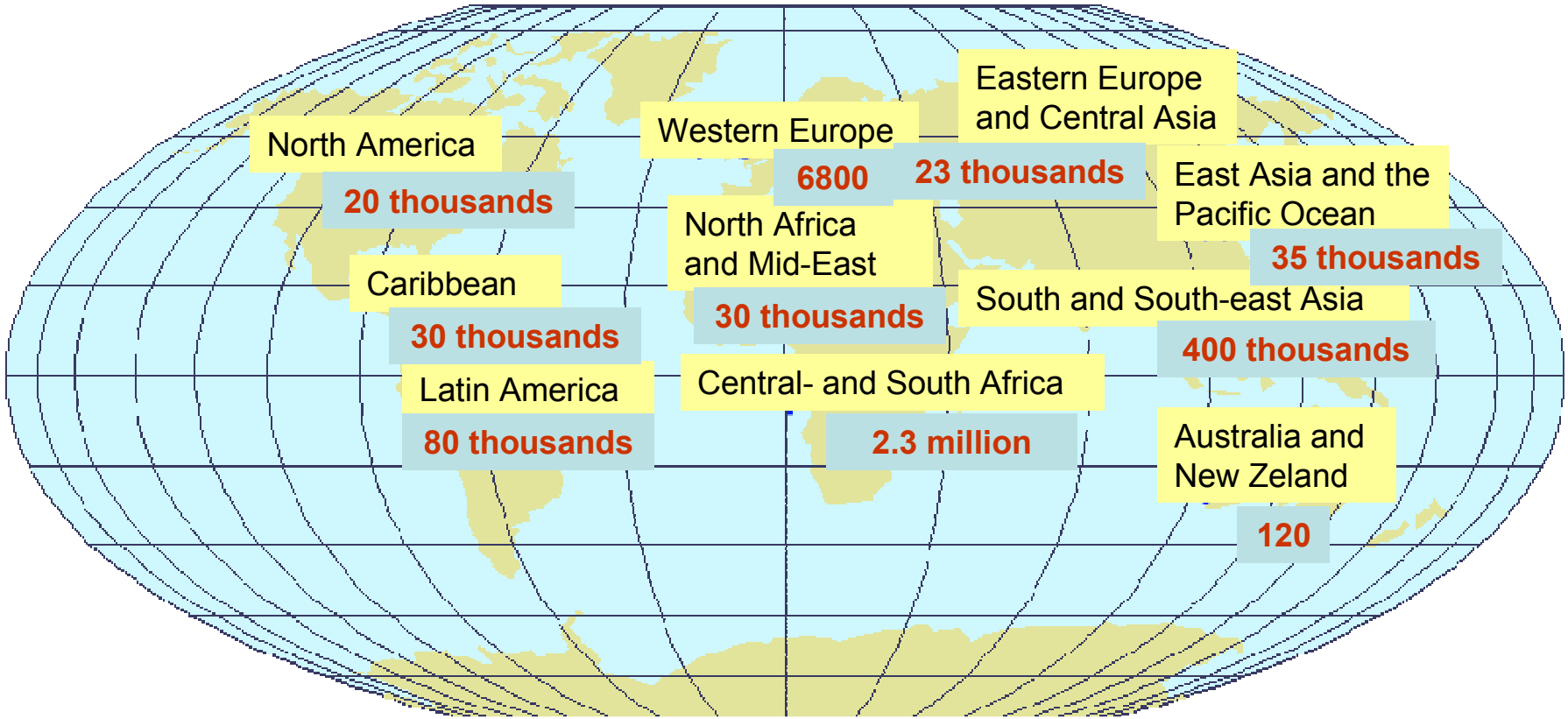


Decrease in the Aral Sea surface in the period 2000-2004
(NASA satellite images)

Desertification…

Drinking water shortage…

Around 1.1 billion people do not have safe drinking water, and 2 billions do not have secure sanitary opportunity.



The number of deaths due to **AIDS** by regions

Diseases

Malaria, AIDS, ebola, etc.

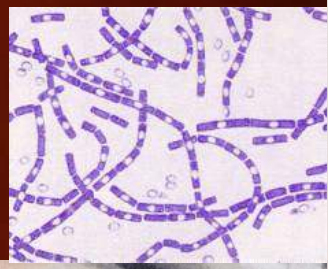
In Zambia, 34% of younger than 15 are AIDS patients;

In South-Africa, 6 millions are HIV infected;

Nuclear weapons

wars

antrax



Nuclear power plant accidents

Animated presentation of the Chernobyl radioactive cloud spread between 26 April and 9 May 1986, using the 30-year half-life of 137 Cs (Cesium) isotope concentration.

You should pay attention to the dates (eg. 1 May 1986)!

Chernobyl radioactive cloud model 1986 (video playback!)

http://www.irsn.fr/FR/popup/Pages/tchernobyl_video_nuage.aspx

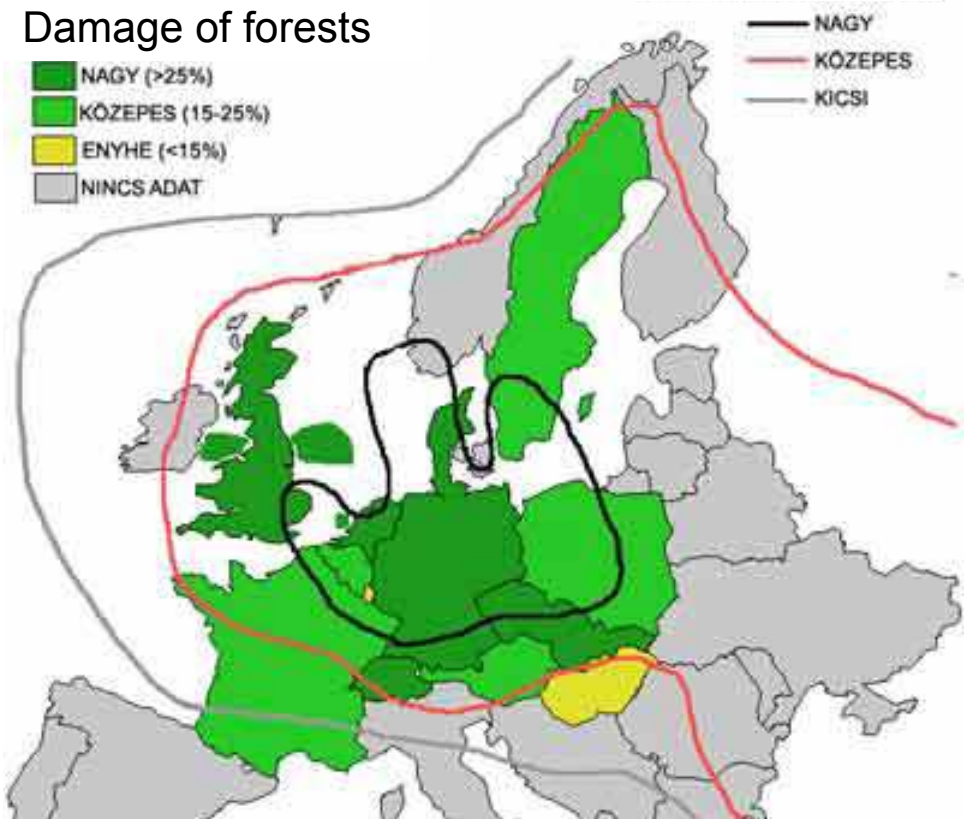
Drugs…

Environmental pollution…

Acid rains

Acidity of rains

Damage of forests



How acid rain affects stonework.
The picture on the left was taken in 1908.
The picture on the right was taken in 1968

pH of rainwater is slightly acidic due to its dissolved CO_2 : $pH_{rainwater} = 5.6$;

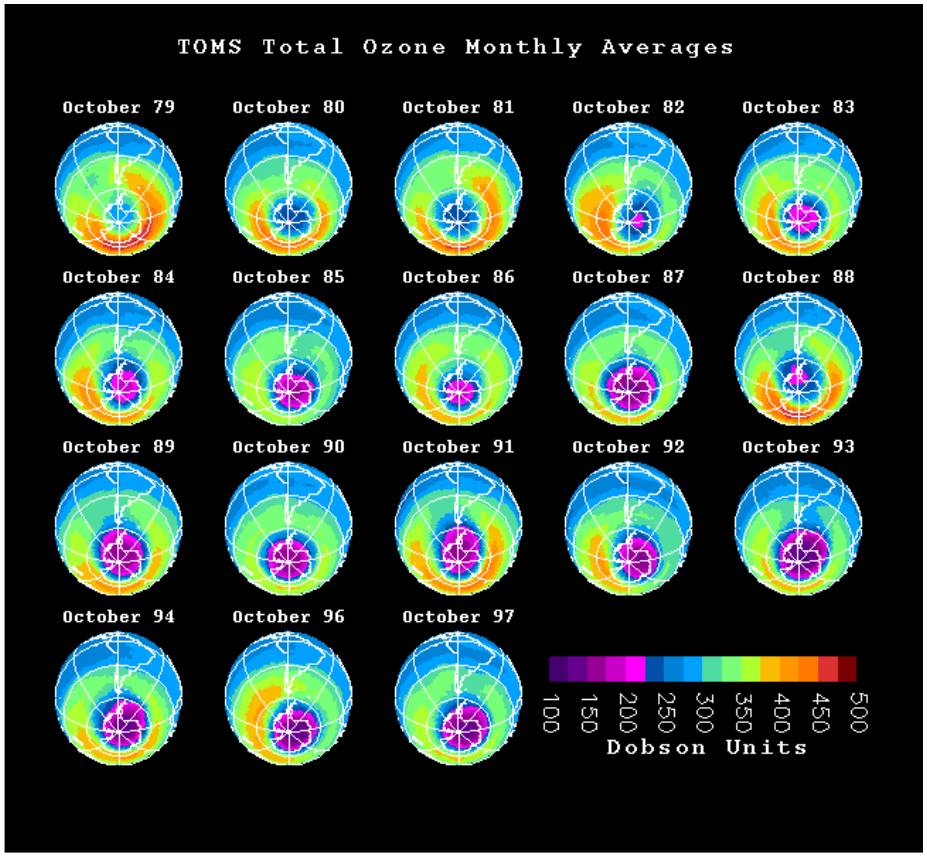
Human activity + industry + transportation + sulphur content of brown coal (powr plants) $\Rightarrow$ large amounts of SO_2 + NO + NO_2 (atmosphere)

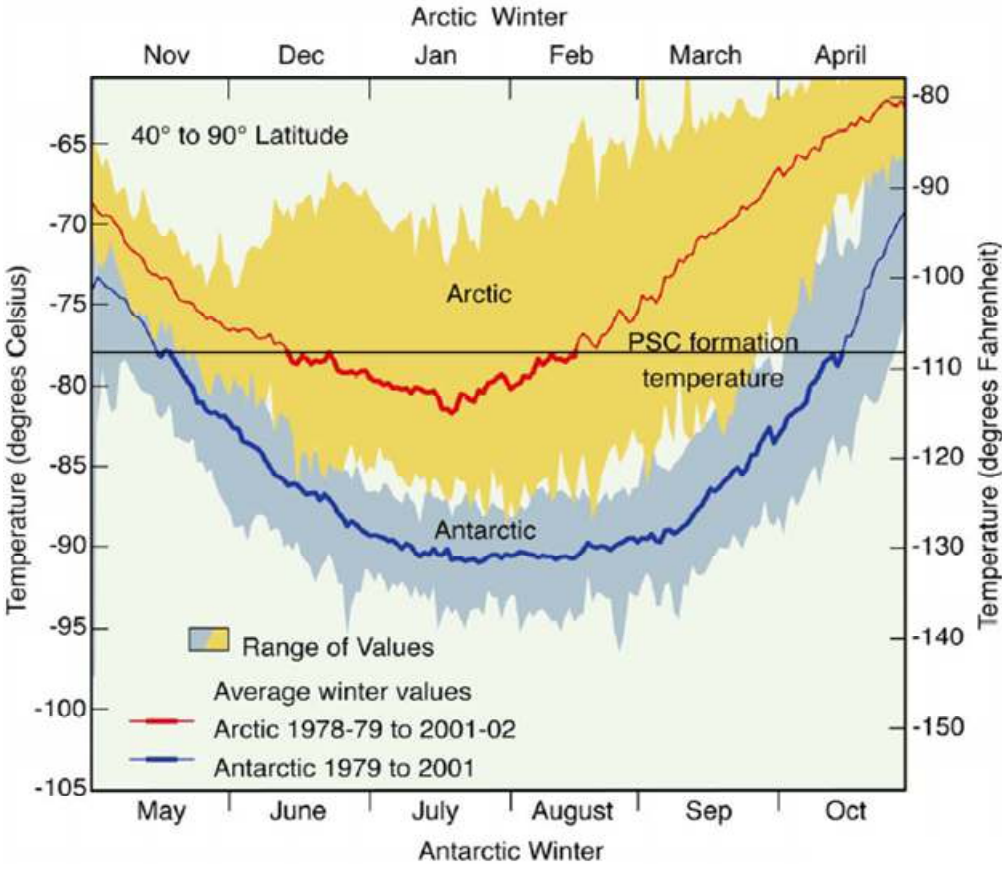
+ atmospheric water vapour $\Rightarrow$ **acids;**


Waste…

„Ozone hole”…

Ozone hole, Antarctica, 1979-1997





Biodiversity loss


"Peace and the survival of our planet, as we all know, is threatened by human activities that lack a commitment to humanitarian values. The destruction of nature and natural resources is a consequence of ignorance, greed and disrespect for the earth wildlife. Many of the earth rare wildlife creatures, animals, plants, insects and even microorganisms will be unknown for the coming generations. We have the responsibility and ability. We need to move before it is too late."
(Tendzin Gyaco, a XIV. Dalai Lama)

We finished for today, goodbye!

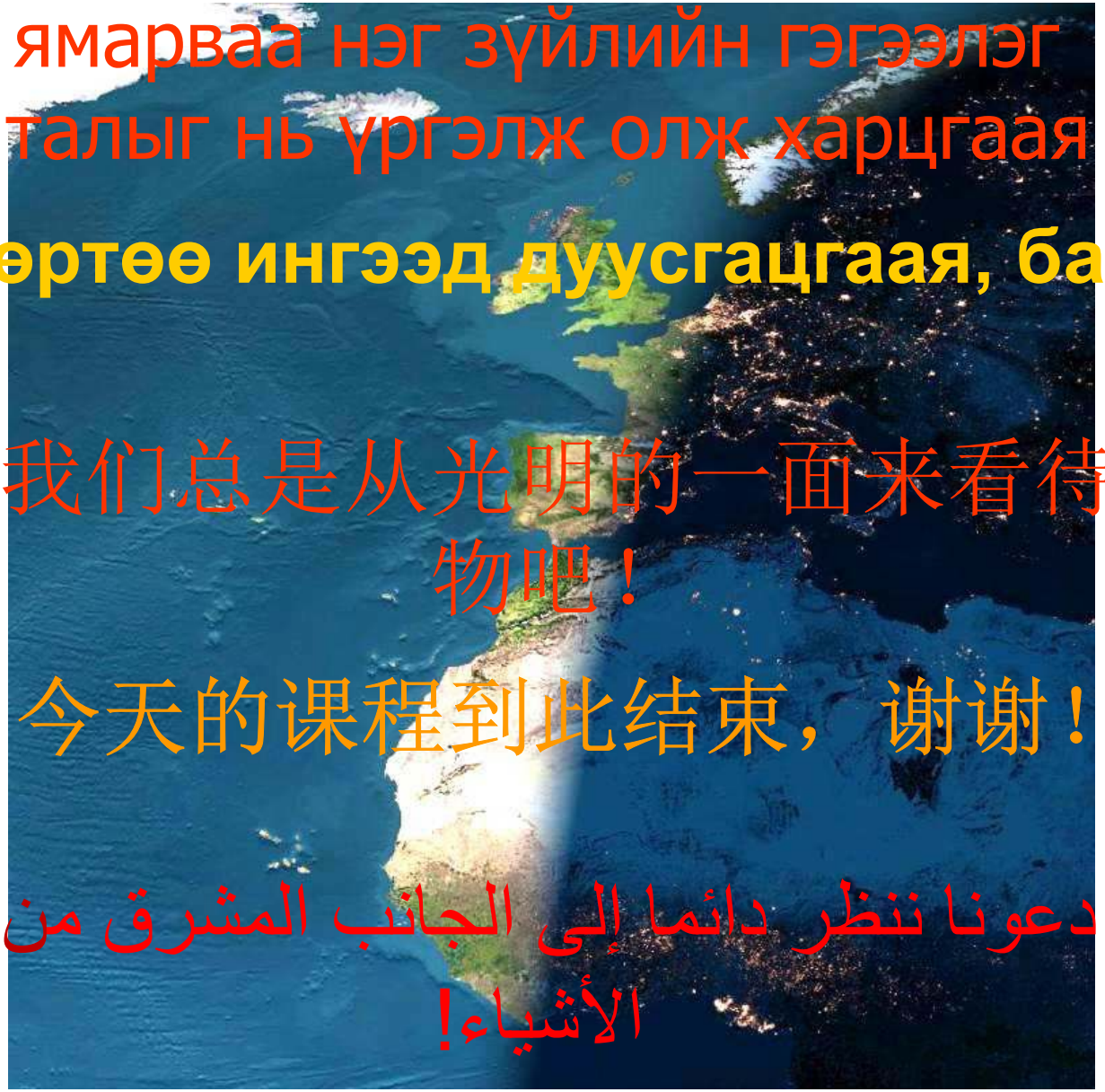
ямарваа нэг зүйлийн гэгээлэг
талыг нь үргэлж олж харцгаая

өнөөдөртөө ингээд дуусгацгаая, баяртай

让我们总是从光明的一面来看待事物吧！

今天的课程到此结束，谢谢！

دعونا ننظر دائما إلى الجانب المشرق من الأشياء!



انتهينا لهذا اليوم، وداعا!