World consumption of natural resources

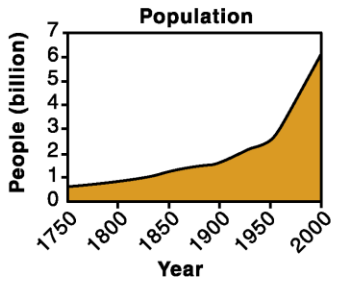
Lučka Kajfež Bogataj

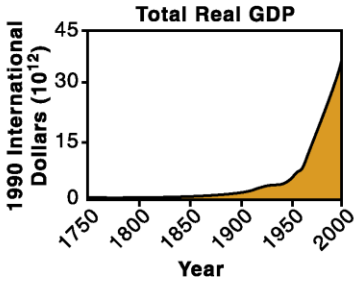
GOOD PLANETS ARE HARD TO FIND

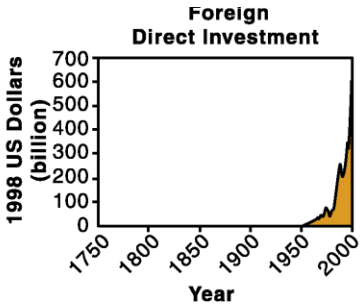
Global Population 1800

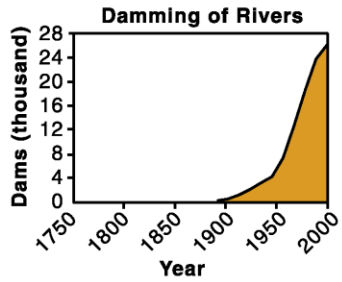
Global Population 1960

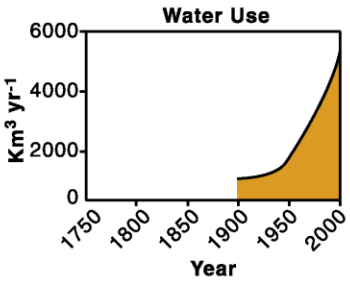
Global Population 2050

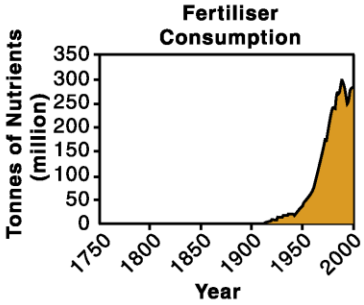

Population
People (billion)
0
1
2
3
4
5
6
7
1750
1800
1850
1900
1950
2000
Year

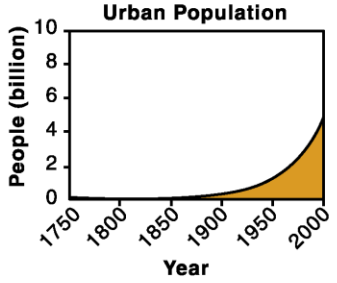

Total Real GDP
1990 International Dollars (10^{12})
0
15
30
45
1750
1800
1850
1900
1950
2000
Year

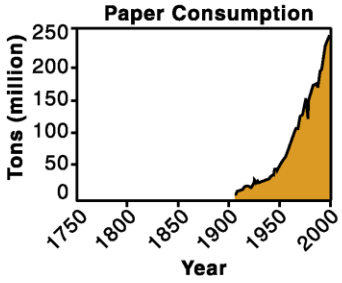

Foreign Direct Investment
1998 US Dollars (billion)
0
100
200
300
400
500
600
700
1750
1800
1850
1900
1950
2000
Year

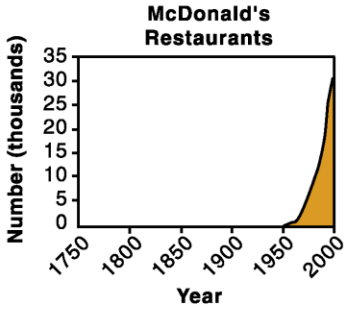

Damming of Rivers
Dams (thousand)
0
4
8
12
16
20
24
28
1750
1800
1850
1900
1950
2000
Year

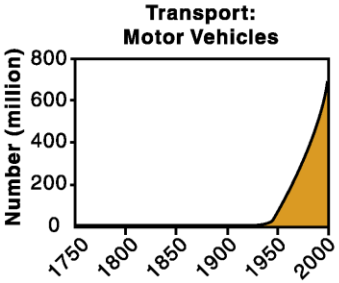

Water Use
$Km^3\ yr^{-1}$
0
2000
4000
6000
1750
1800
1850
1900
1950
2000
Year

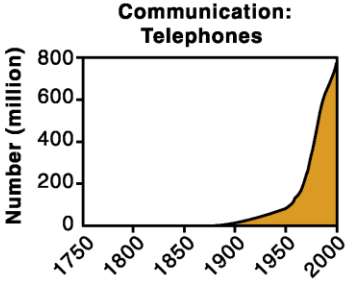

Fertiliser Consumption
Tonnes of Nutrients (million)
0
50
100
150
200
250
300
350
1750
1800
1850
1900
1950
2000
Year

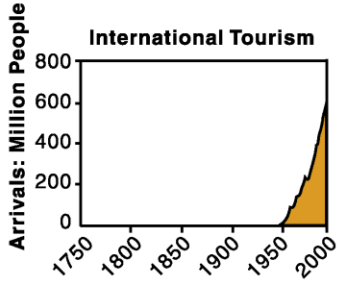

Urban Population
People (billion)
0
2
4
6
8
10
1750
1800
1850
1900
1950
2000
Year


Paper Consumption
Tons (million)
0
50
100
150
200
250
1750
1800
1850
1900
1950
2000
Year


McDonald's Restaurants
Number (thousands)
0
5
10
15
20
25
30
35
1750
1800
1850
1900
1950
2000
Year


Transport: Motor Vehicles
Number (million)
0
200
400
600
800
1750
1800
1850
1900
1950
2000

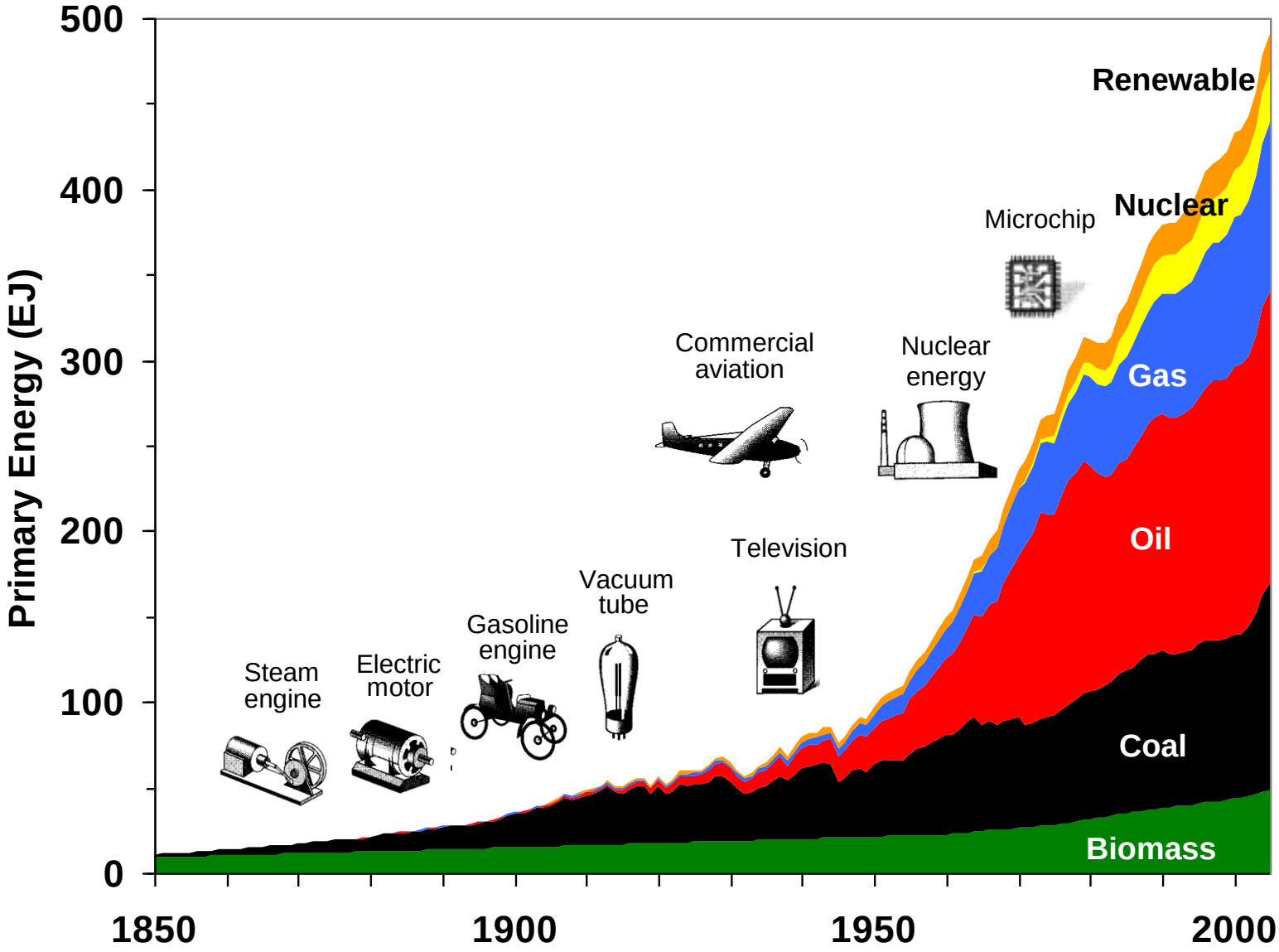

Communication: Telephones
Number (million)
0
200
400
600
800
1750
1800
1850
1900
1950
2000


International Tourism
Arrivals: Million People
0
200
400
600
800
1750
1800
1850
1900
1950
2000

	1800	2000	Δf
Population (billion)	1	6	x6
GDP (trillion 1990 $)	0.3	30	x100
Primary energy (EJ)	13	420	x30
CO_2 emissions (GtC)	0.3	6.4	x20
Mobility (km/person/day)	0.04	40	x1,000

World Energy Council, 2004

World Primary Energy



Crisis of the Traditional Industrialism

- The 20th Century model of industrialism was resource-intensive, based on cheap resources.
- **Resource-intensive growth** is limited because cheap resources have become limited.
- **The environmental impacts** have surpassed critical limits and threaten the natural capital basis of production.
- **A sustainable future** must be brought about by eco-efficient use of resources.

World we live in...(1)

If the World were a Village of just 100 People …

- 80 would live in bad housing conditions,
- 50 would suffer from malnutrition,
- 19 would live on less than 1 € per day,
- 17 would not have access to safe drinking water,
- 6 would possess 60 % of the village‘s wealth,
- 1 would have a university education.

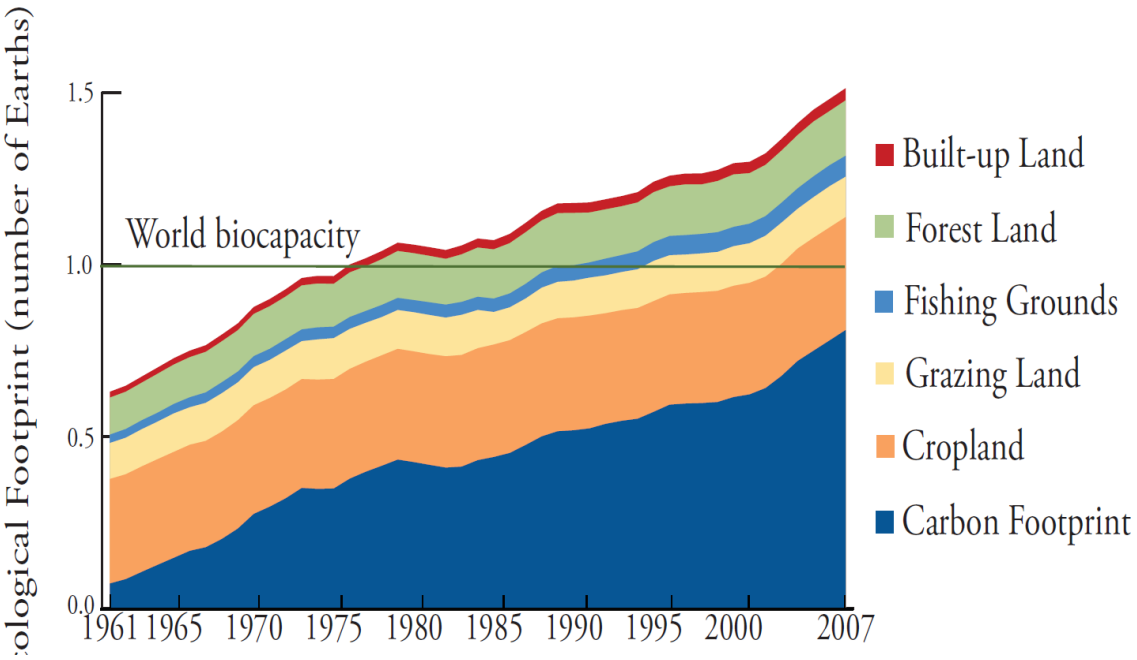
World we live in...(2)

- turning coal into light is only 3% efficient,
- only 15% of the energy you put in your petrol tank is used to move your car down the road,
- 80% of what we produce is used once and discarded,
- 80% of resources are used by 20% of the earth's population …

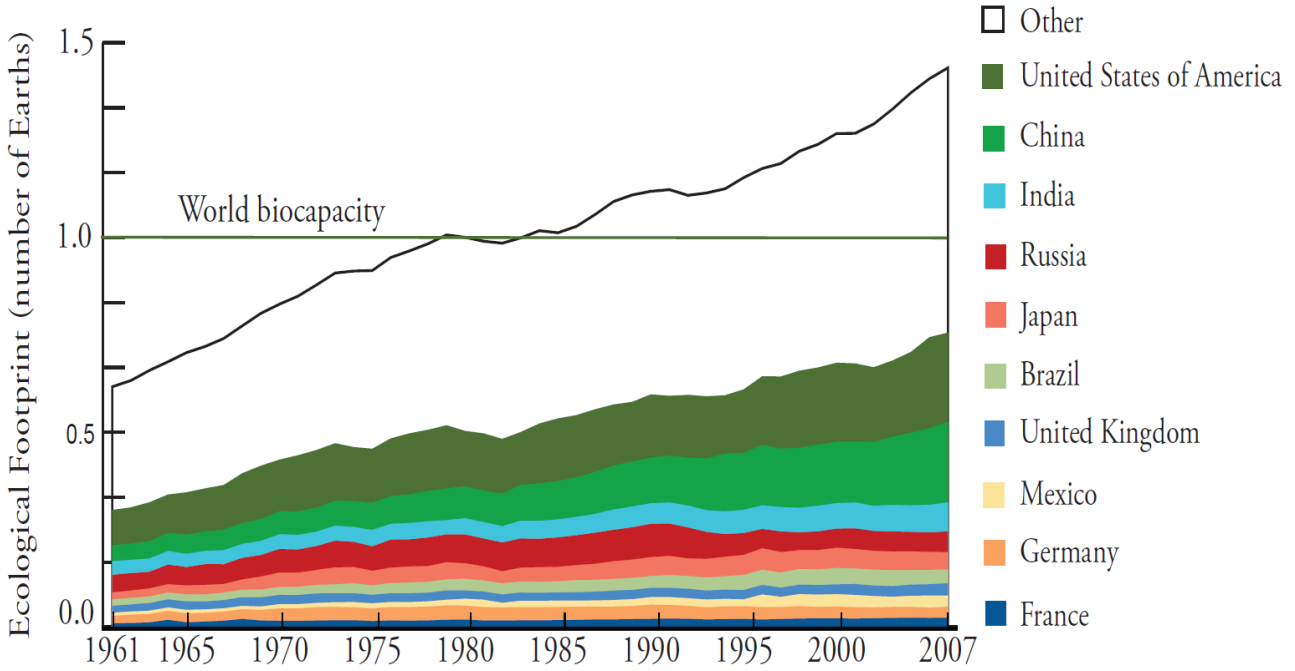
A Wasteful Mode of Production

- More than 95% of the resources lifted from nature are wasted before the finished goods reach the market.

- And many industrial products – such as cars – demand additional resources while being used.



'Ecological Footprint' already exceeds Earth's regenerative capacity… our demands on the planet have doubled over the last 40 years…



ECOLOGICAL FOOTPRINT ATLAS, 2010

Every hour,

10,000 people join the global population

Every hour,

1,500 hectares of forests are cut

Every hour,

1.7 Million Kg N are added to soils

Every hour,

4 Million tons of CO_2 are emitted

Every hour,

3 species go extinct

(1000x faster than natural rates)

Every hour 24 million plastic bottles wasted

Every hour

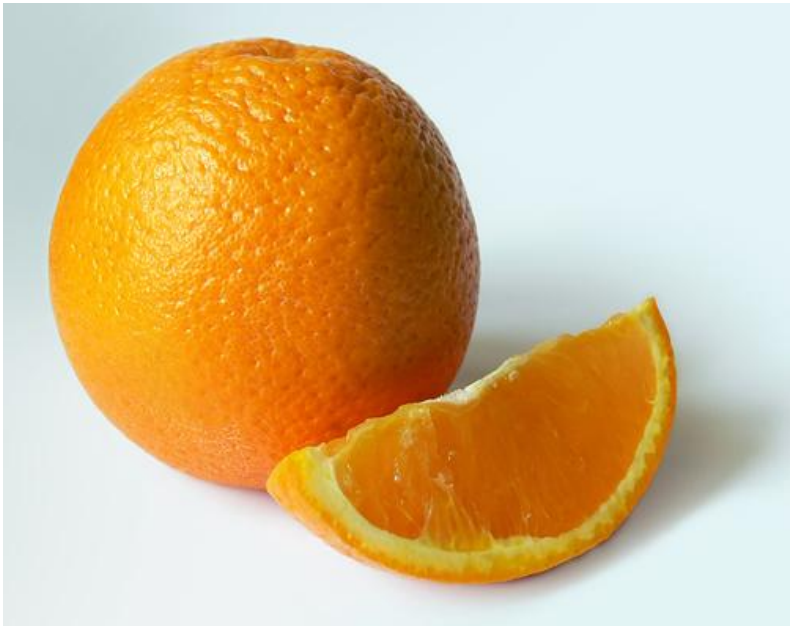
13 millions alluminium cans wasted

Every hour
45 millions plastic bags wasted

Every hour
20.000 mobile phones wasted

Banana peel decomposes in 2 to 10 days.

Orange peel decomposes within 6 months



Leather shoes decompose in 25 to 40 years

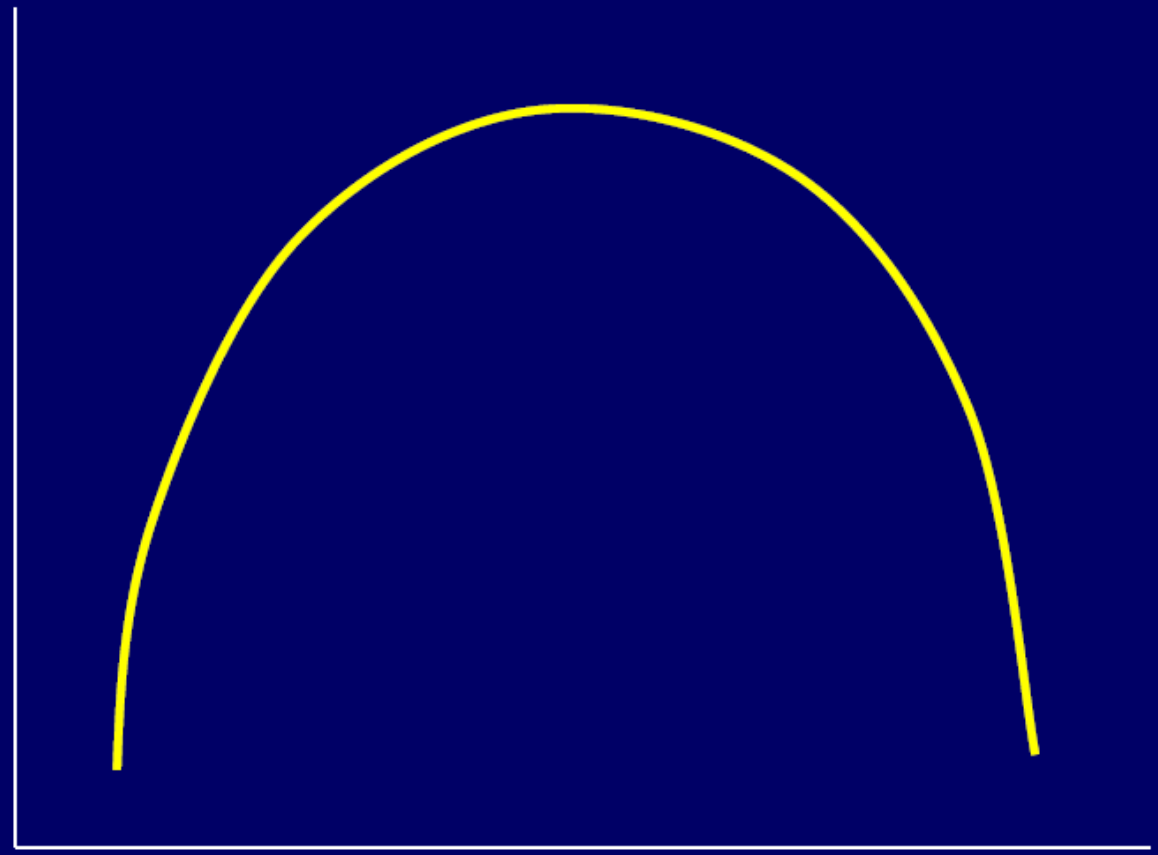
Nylon clothes take 30 to 40 years for decomposition

Glass bottles decompose in 1,000,000 years

Plastic bottles and cans never decompose...

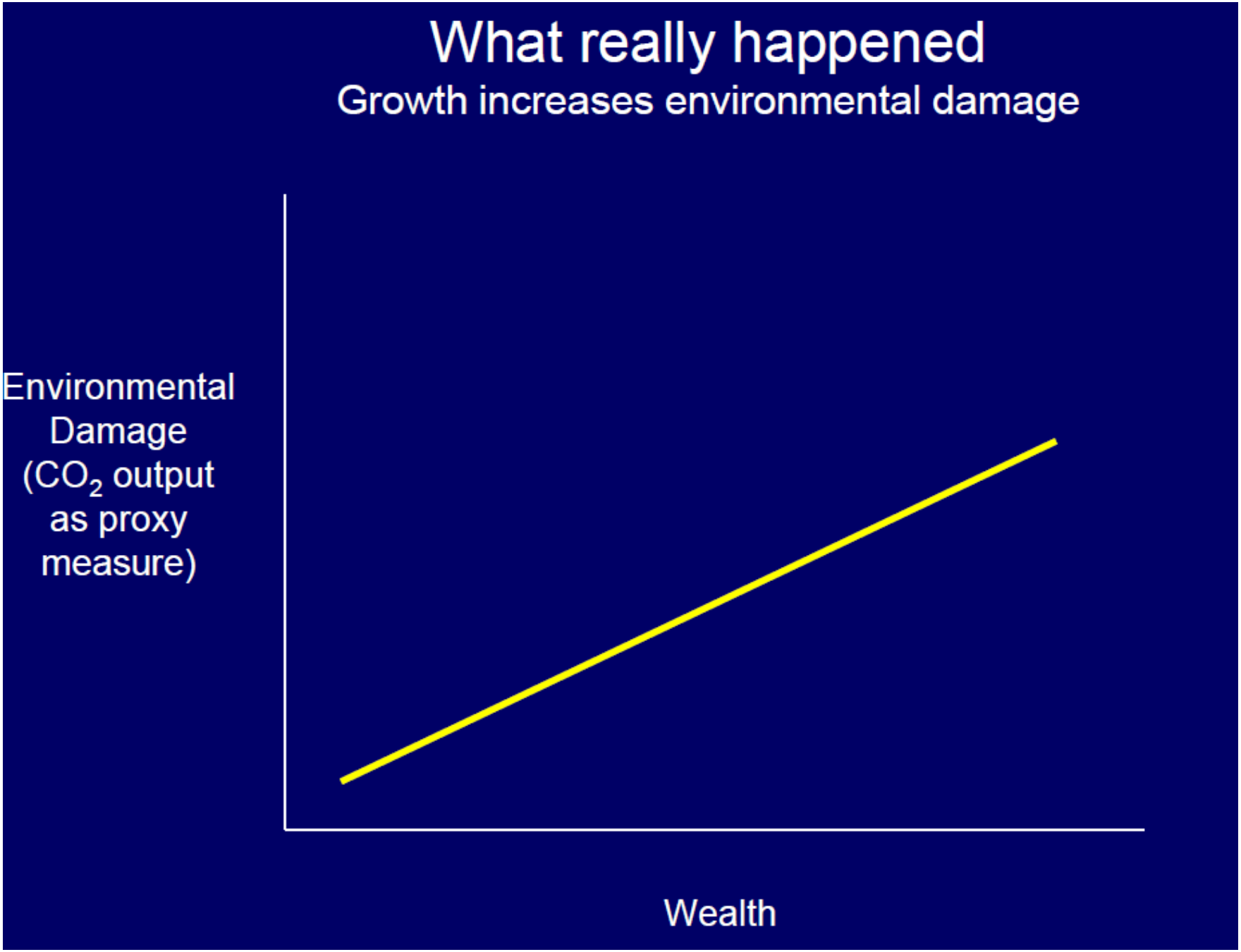
What conventional economists hoped would happen

Growth reduces environmental damage



What really happened

Growth increases environmental damage

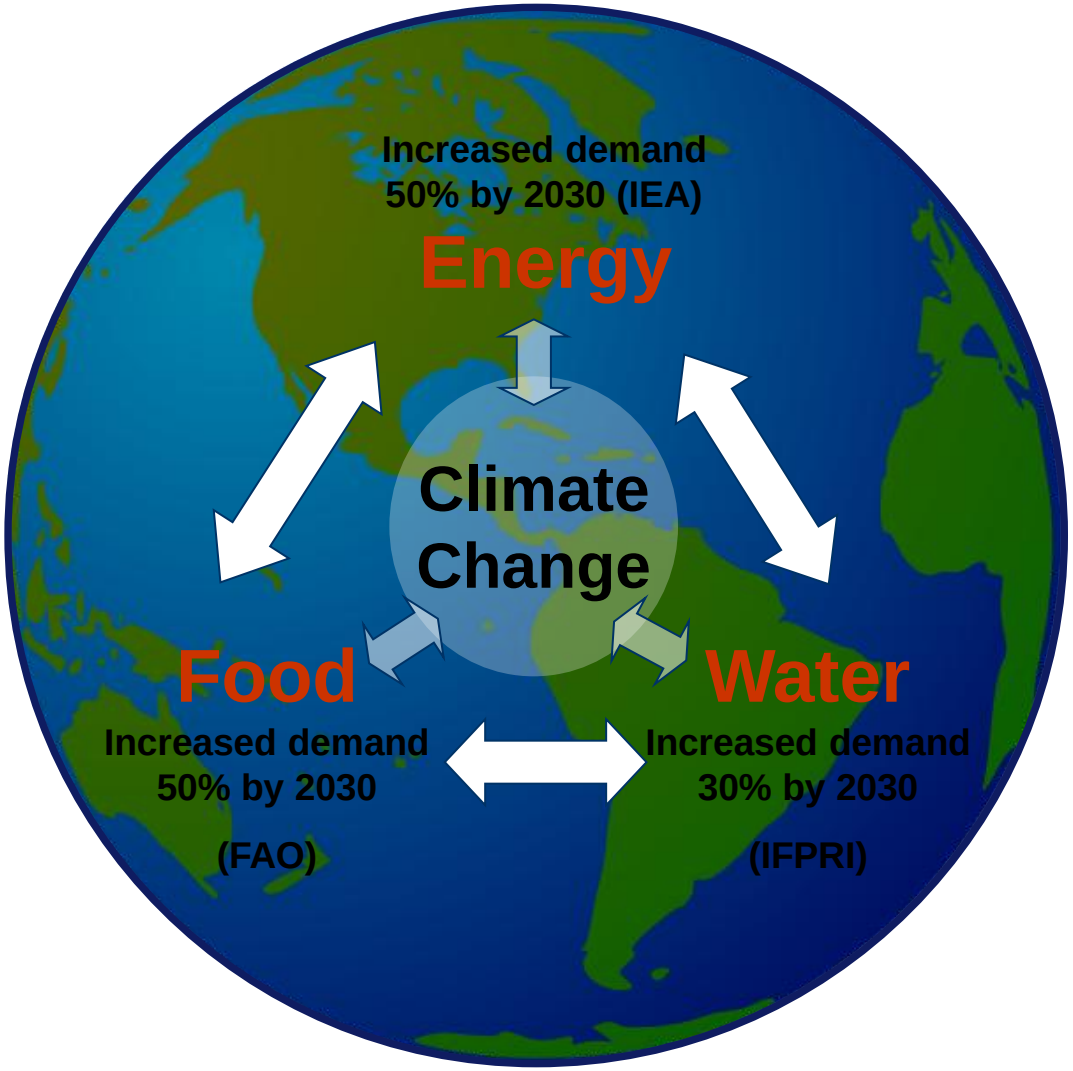


Multiple crisis

1. Rising Food/Water Insecurity
2. Climate Change
3. Peak Oil
4. Finantial, credit, economic crisis
5. Most developing countries are projected not to meet most MDGs
6. ..
7. ..

.....

Key questions to 2030



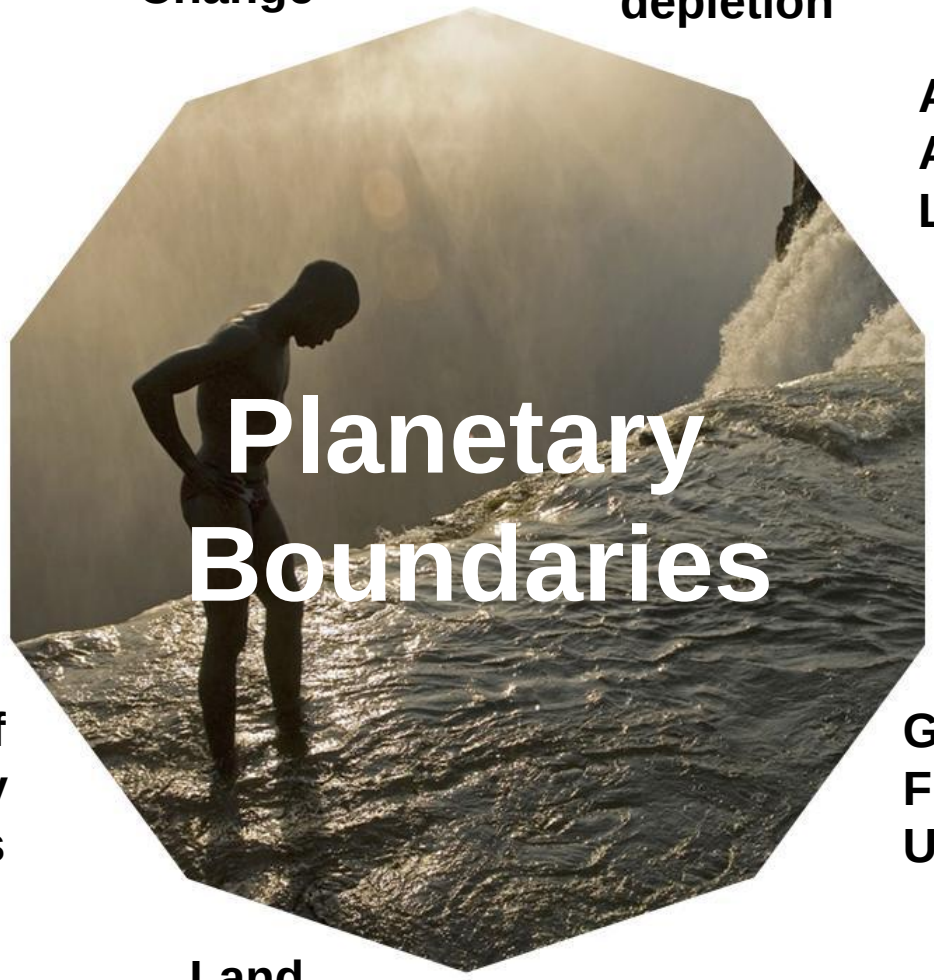
'The Perfect Storm?'
Beddington, 2009

The Sequence of Objections

- 1970s: There are no limits.
- 1980s: There are limits, but they are distant in time.
- 1990s: The limits are near, but they are irrelevant, since they will be dealt with by the market.
- 2000s: The market is not adequate, but new technologies will let us evade the limits without requiring that we stop growth.

Limits to Growth: What's Sustainable?

- In 1972 models expected another 40-80 years of growth.
- Growth ending in the period 2010-2050 (Club of Rome).
- The preponderant mode:s overshoot and decline, not gradual slowing within a limit.
- Changes in technology may delay the end of growth by a few years, but they do not avoid it, and they do not avoid the decline.
- Social changes are essential for the attractive futures.
- What are today considered to be problems are actually symptoms. The real problem is physical growth in material and energy flows pressing against the limits of a finite planet.



Climate Change

Ozone depletion

Atmospheric Aerosol Loading

Biogeochemical loading: Global N & P Cycles

Ocean acidification

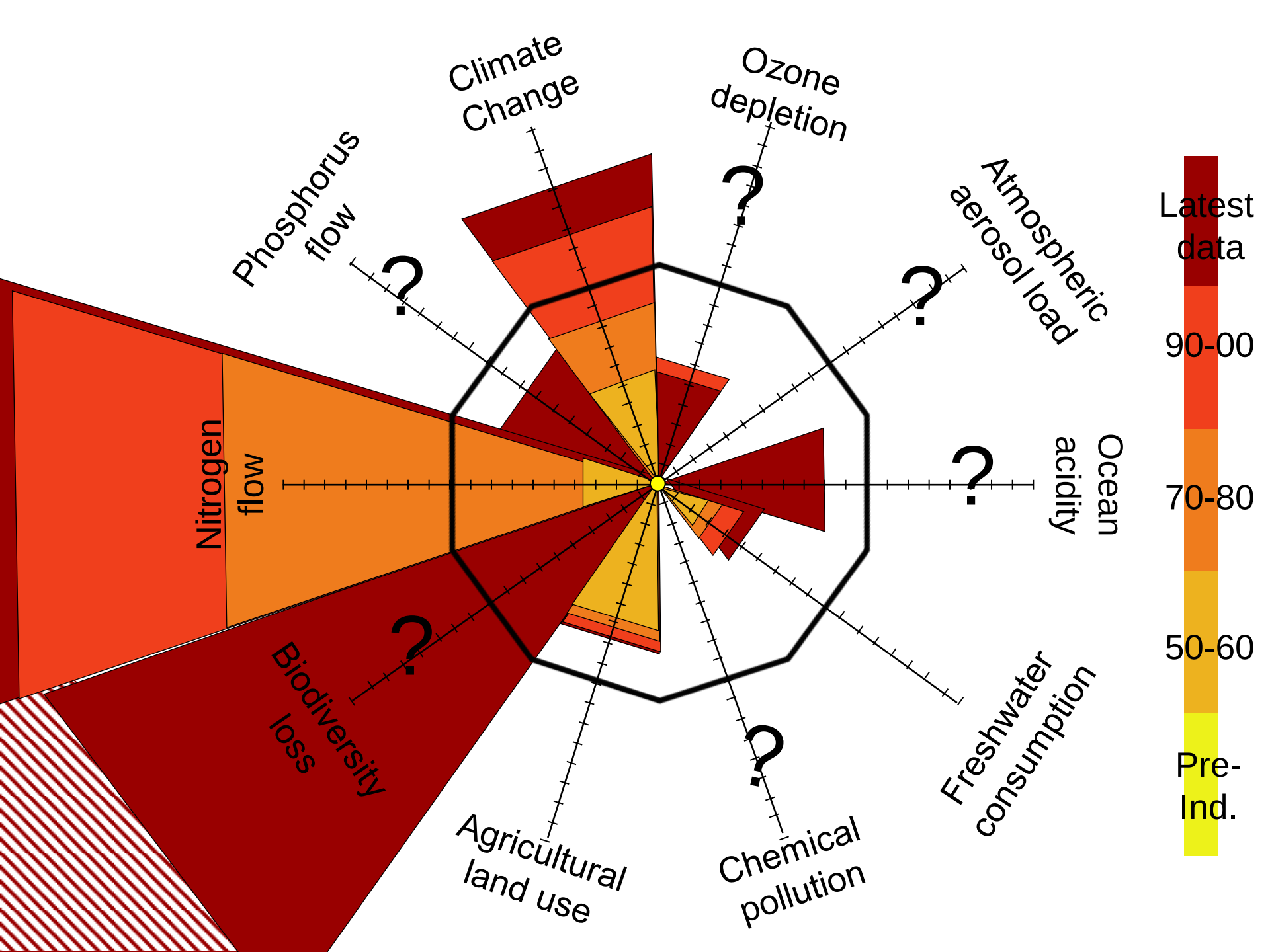
Rate of Biodiversity Loss

Global Freshwater Use

Land System Change

Chemical Pollution

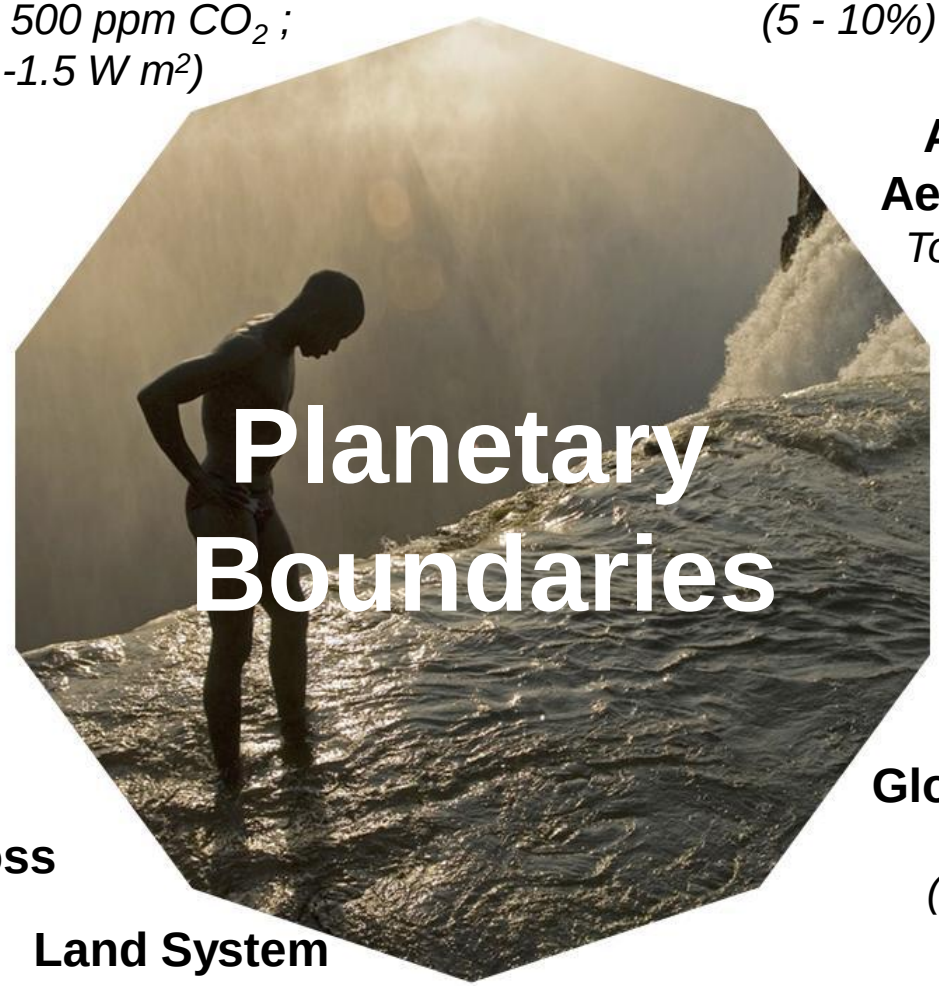
(Nature, Sep 2009)


Climate Change
Ozone depletion
Atmospheric aerosol load
Ocean acidity
Freshwater consumption
Chemical pollution
Agricultural land use
Biodiversity loss
Nitrogen flow
Phosphorus flow
?
?
?
?
?
?
?
?
?
Latest data
90-00
70-80
50-60
Pre-Ind.

Climate Change
< 350 ppm CO_2 < 1W m^2
(350 – 500 ppm CO_2 ;
1-1.5 W m^2)

Ozone depletion
< 5 % of Pre-Industrial 290 DU
(5 - 10%)

Biogeochemical loading: Global N & P Cycles
Limit industrial fixation of N_2 to 35 Tg N yr^{-1}(25 % of natural fixation)
(25%-35%)
P < 10× natural weathering inflow to Oceans
(10× – 100×)



Atmospheric Aerosol Loading
To be determined

Ocean acidification
Aragonite saturation ratio > 80 % above pre-industrial levels
(> 80% - > 70 %)

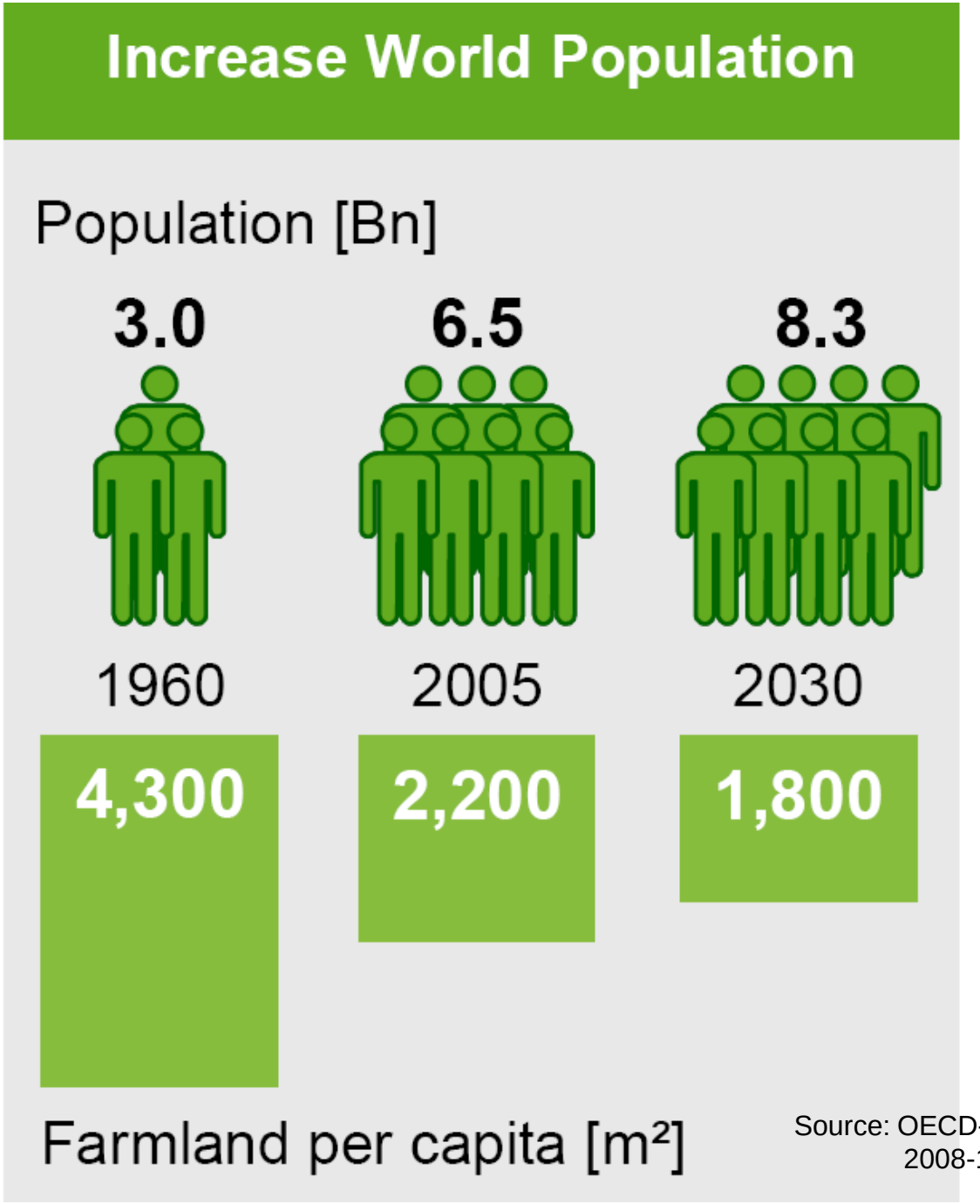
Rate of Biodiversity Loss
< 10 E/MSY
(< 10 - < 1000 E/MSY)

Global Freshwater Use
<4000 km^3/yr
(4000 – 6000 km^3/yr)

Land System Change
≤15 % of land under crops
(15-20%)

Chemical Pollution
Plastics, Endocrine Desruptors, Nuclear Waste Emitted globally
To be determined

Increase World Population



Source: OECD-FAO Agricultural Outlook 2008-17 WORLDBANK

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(350 – 500 ppm CO_2 ;
1-1.5 W m^2)

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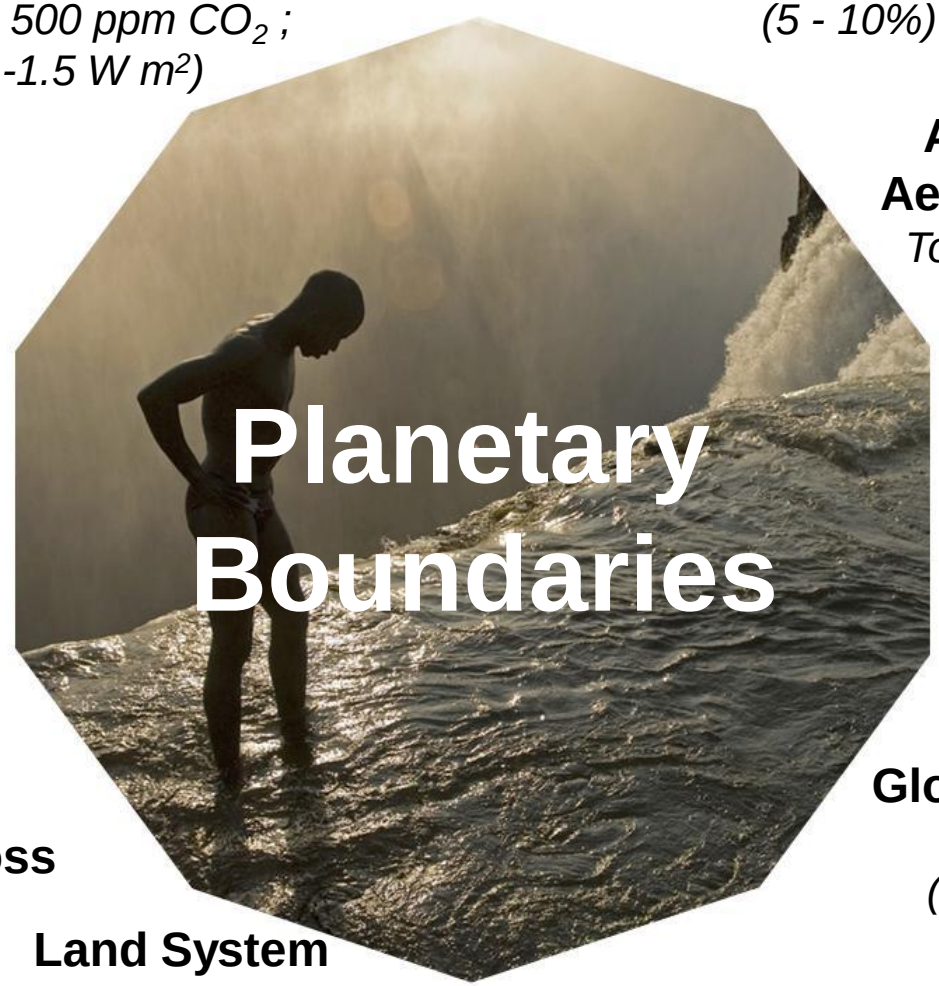

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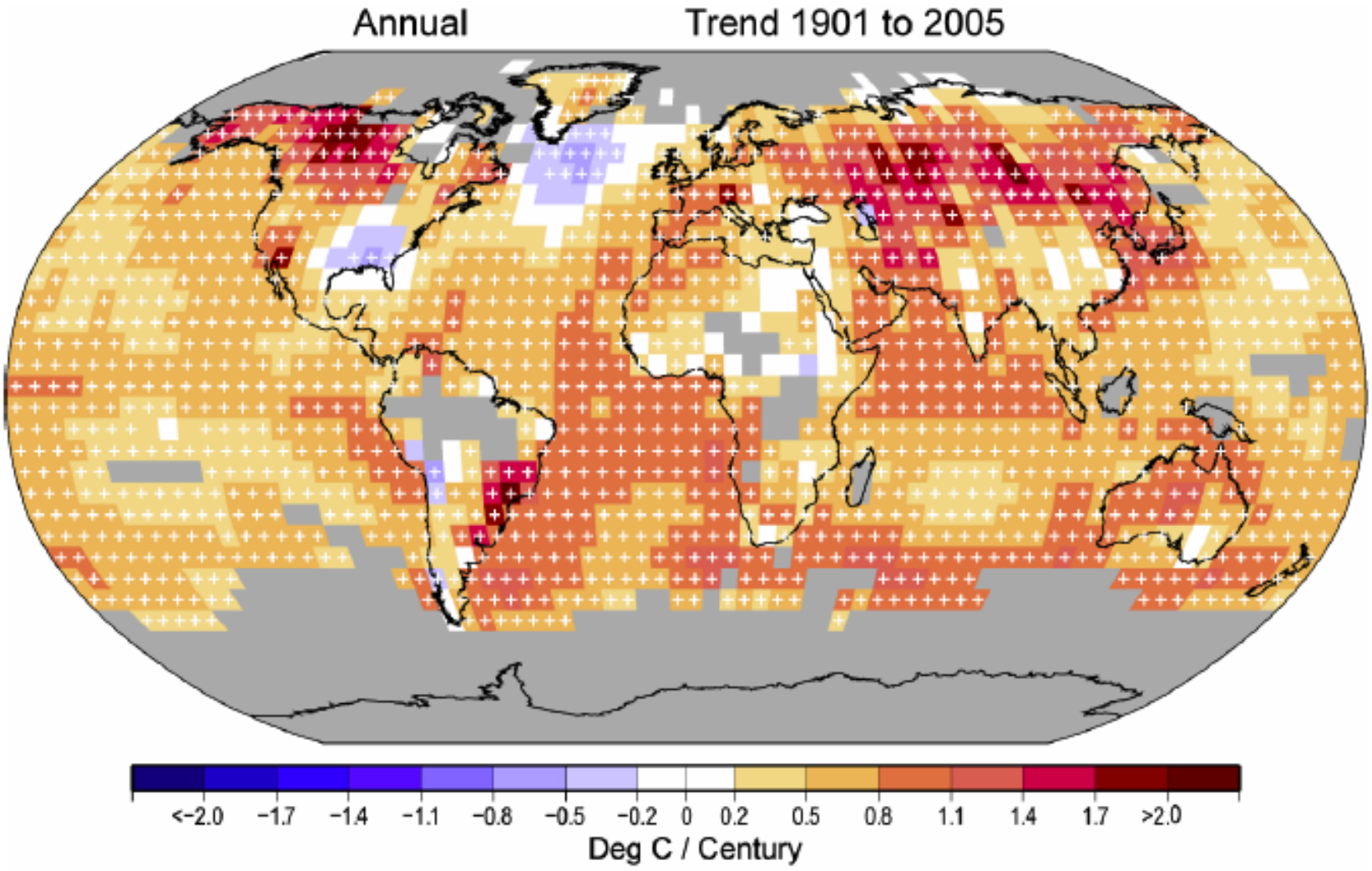
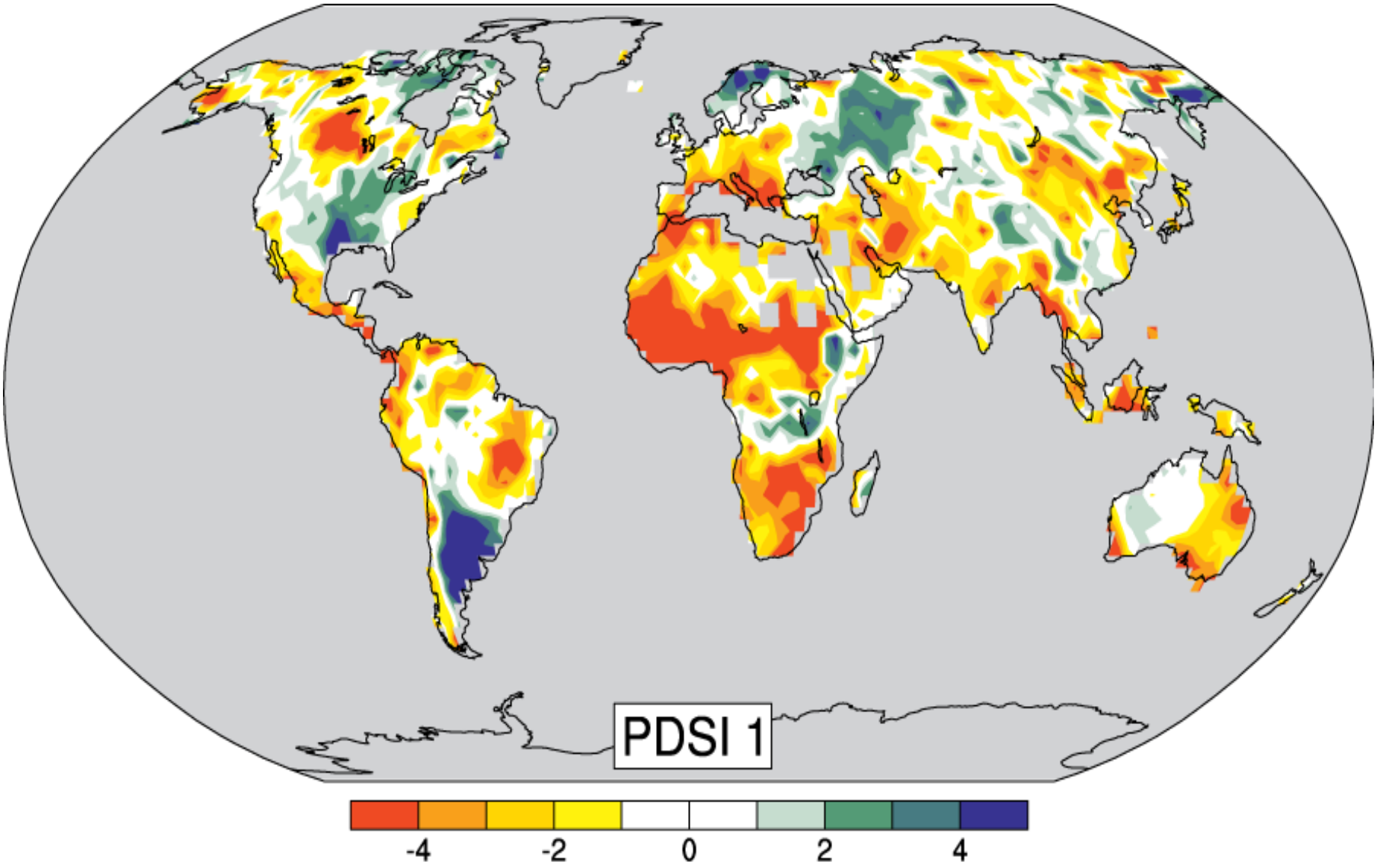
To be determined

It is warmer across the globe than it was a century ago

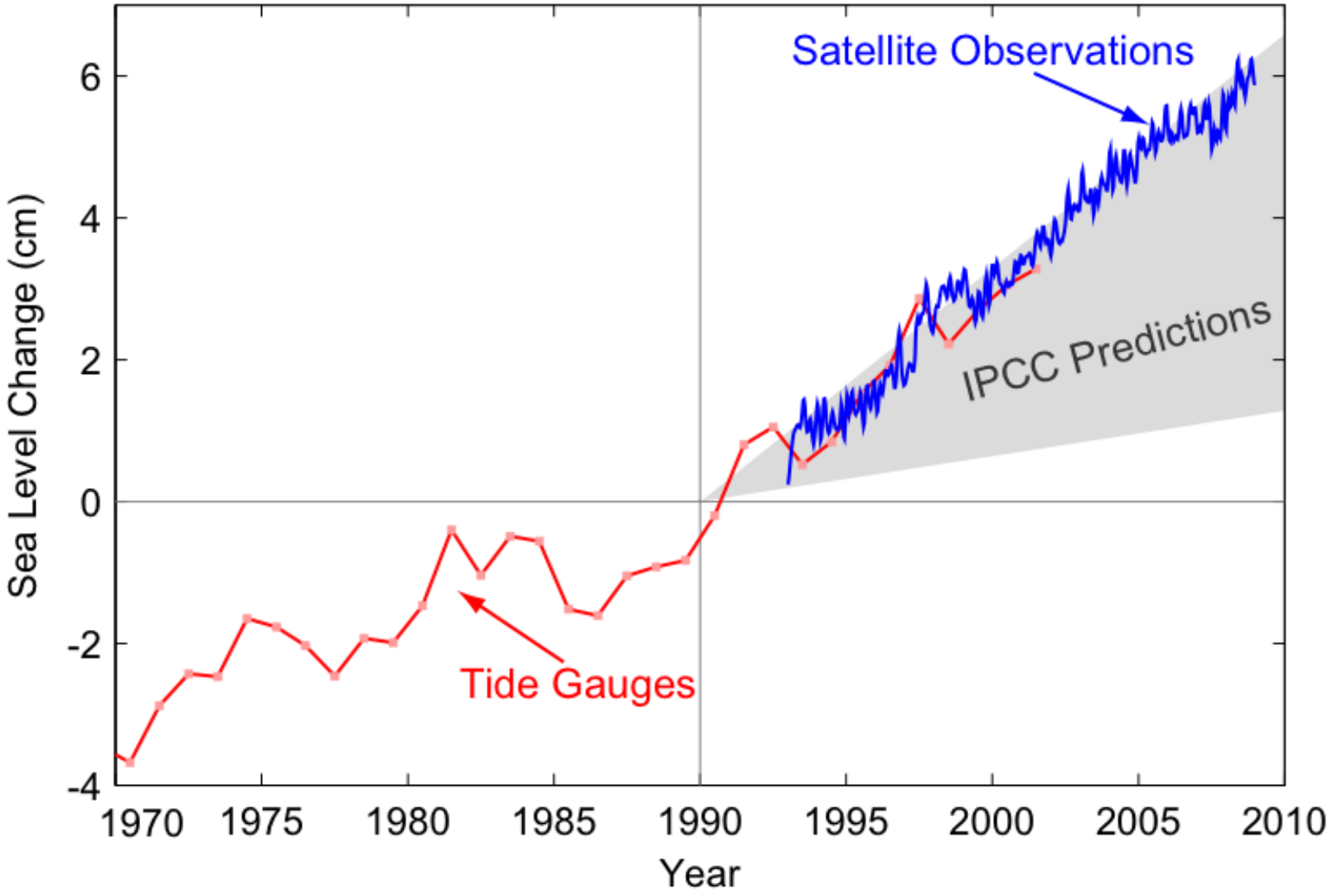


Globally averaged, the planet is ~0.8°C warmer than it was in 1860

Drought is increasing most places



Spatial pattern of the monthly Palmer Drought Severity Index (PDSI) for 1900 to 2002.



Sea-level change 1970-2010

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(350 – 500 ppm CO_2 ;
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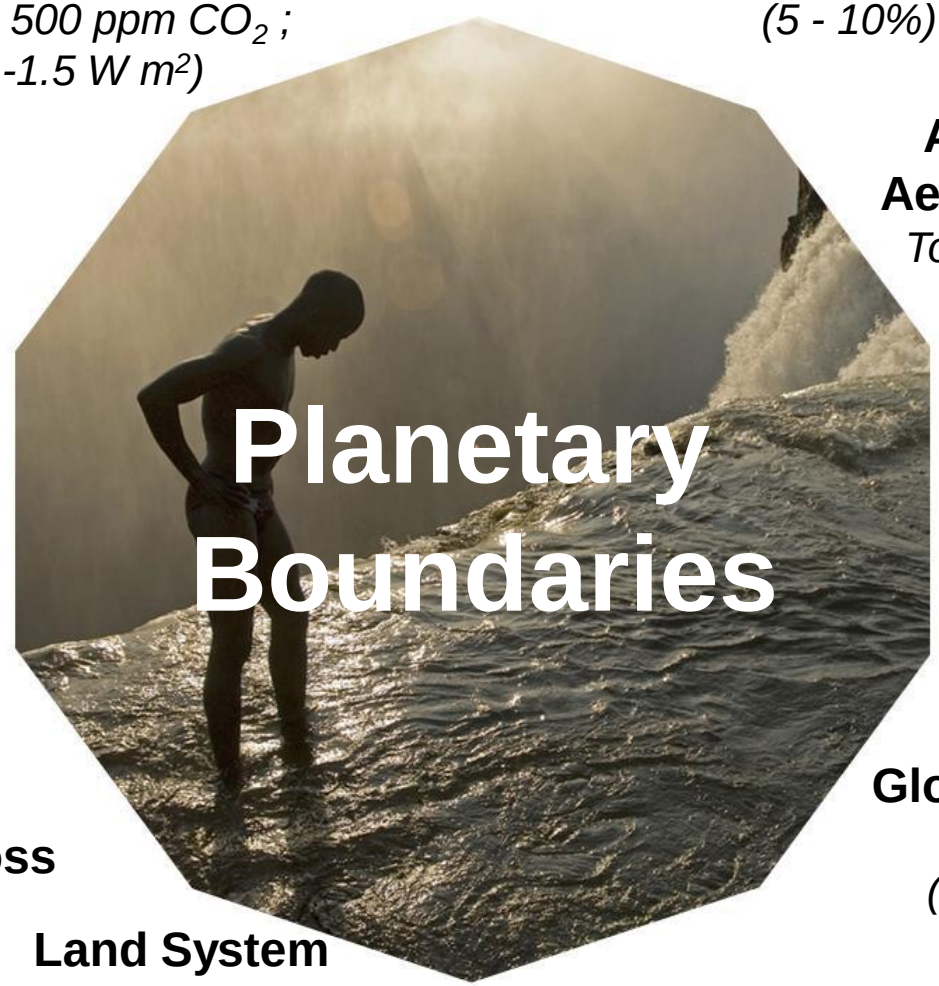

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To be determined

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To be determined

[Hoekstra & Chapagain, 2008]

[Hoekstra & Chapagain, 2008]

Personal computer

- Making a personal computer (energy and raw materials) costs 1800 kWh of energy

1,8 t CO_2 made in China
0,018 t CO_2 made in Norway

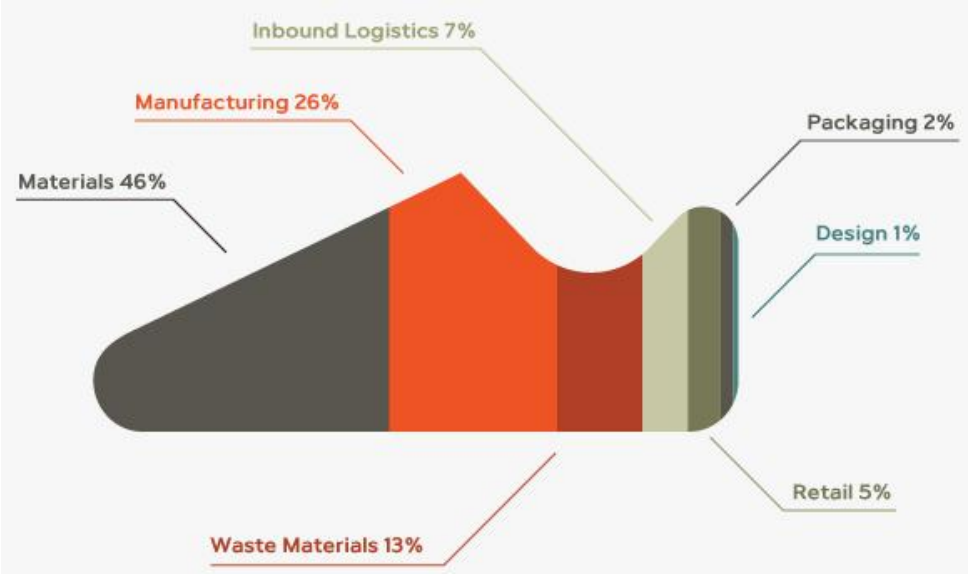
A new car's embodied energy is 76 000 kWh

If we manufacture a car different places the impact, in terms of CO_2, will differ according to the conversion factors. Same car, same manufacturing process and this is before any use effects are considered - big difference in impact.

A few manufacturing locations:
- France 6.3 t CO_2
- Japan 36.7 t CO2
- USA 46.6 t CO2
- India 71.8 t CO2
- Poland 83,6 t CO2

Treloar, G., et al,2004. J. Const. Eng. and Mgmt., 130, 1:43-49.

Average pair of Nike running shoes results in the use of a total of **42 kWh of energy** throughout its life.



Examples of Energy Costs of Raw Materials and Production

- The production of metals is energy intensive, especially for aluminum.
- Making 1 aluminum drinks-can needs 0.6 kWh.

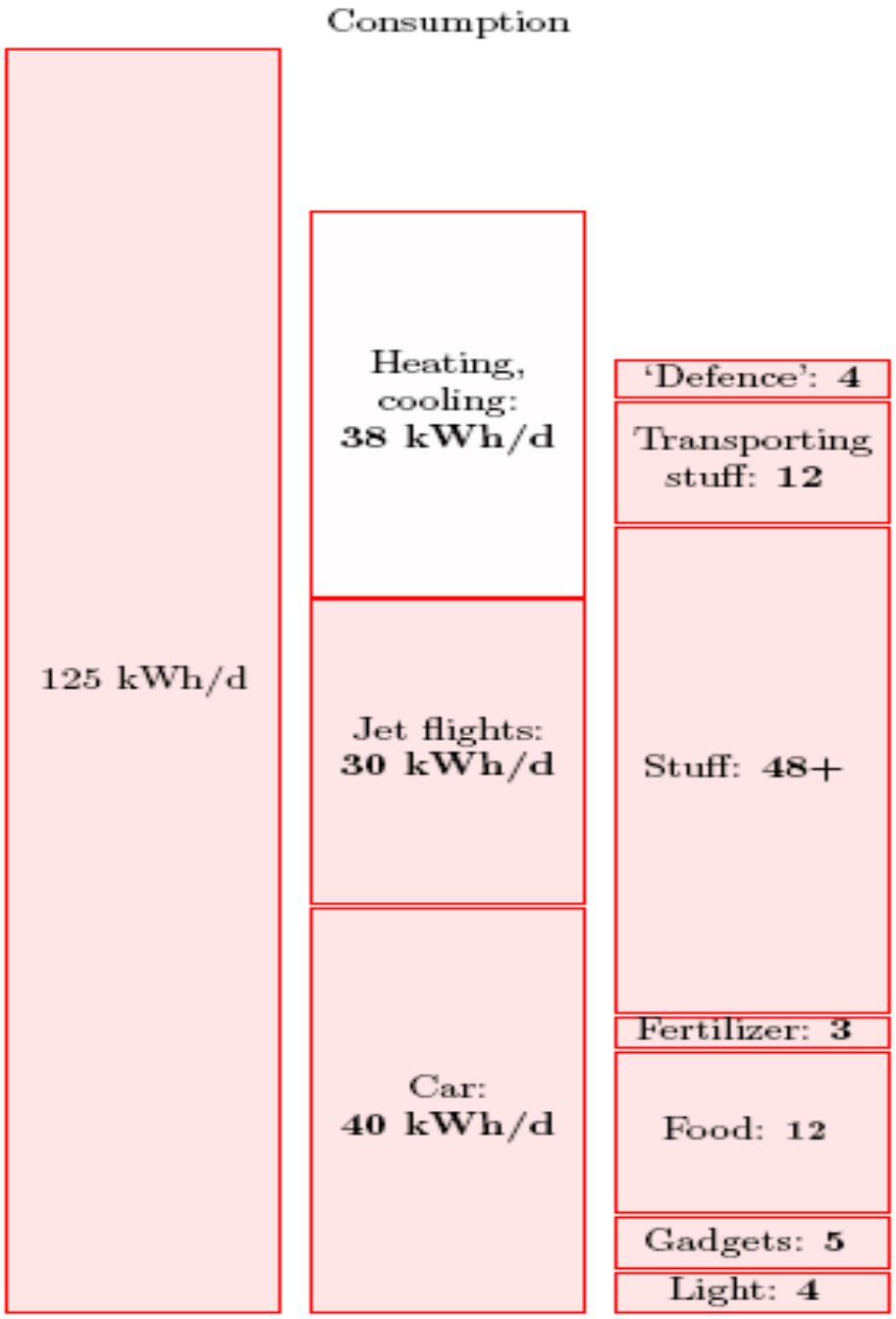
- As for a 500 ml water bottle made of PET the embodied energy is 0.7 kWh – just as bad as an aluminum can!

Personal flow of junk mail, magazines, newspapers

• Paper has an embodied energy of 10 kWh per kg.

• The energy embodied in a typical personal flow of junk mail, magazines, and newspapers, amounting to 200 g of paper per day is about 2 kWh per day.

• Recycling saves about half of the energy of manufacture; waste incineration or burning uses some of the contained energy.



- **EU person 125 kWh/d**
- **USA person 250 kWh/d**

125 kWh/d≈ 12,5 t CO_2/ y

Be Realistic about waste

(Cynical View)

One of the main sinks of energy and water in the "developed" world is the creation of stuff.

In its natural life cycle, stuff passes through **three** stages.

3 stages of stuff

1. New-born stuff is displayed in shiny packaging on a shelf in a shop. At this stage, stuff is called “goods.”

2. As soon as the stuff is taken home and sheds its packaging, it undergoes a transformation from “goods” to its second form, “clutter.” The clutter lives with its owner for a period of months or years. During this period, the clutter is largely ignored by its owner, who is off at the shops buying more goods.

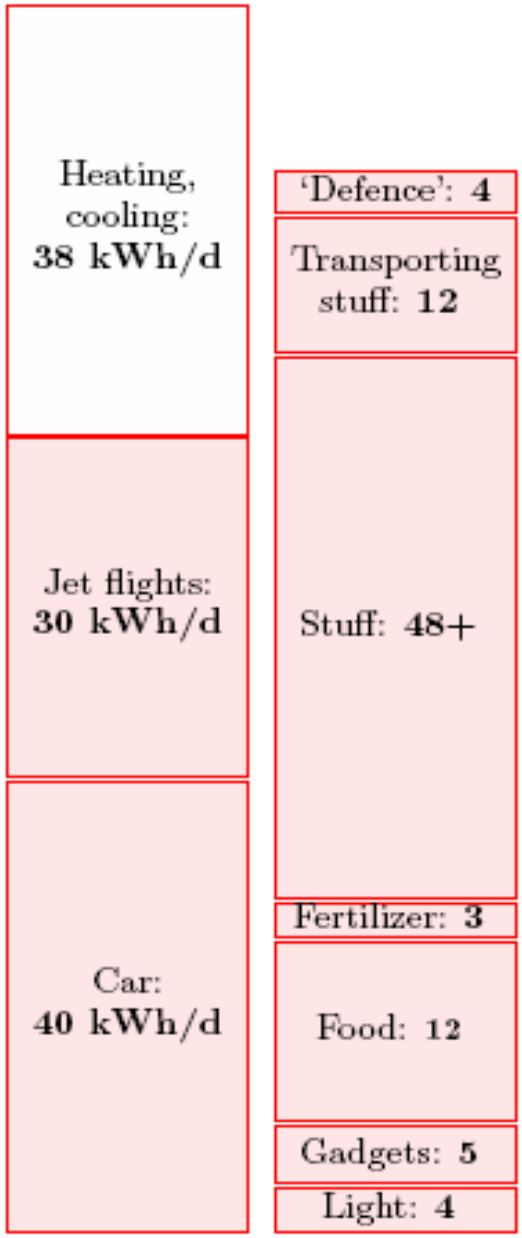
3. Eventually, by a miracle of modern alchemy, the clutter is transformed into its final form, garbage. To the untrained eye, it can be difficult to distinguish this “garbage” from the highly desirable “goods” that it used to be. Nonetheless, at this stage the discerning owner pays the garbage collector to transport the stuff away

Focus on what one really wants,

not what one will settle for

Really Want	**Settle For**
Self esteem	Fancy car
Serenity	Drugs
Health	Medicine
Human Happiness	GDP
Permanent Prosperity	Unsustainable Growth

HOW TO REDUCE?



Simple actions	Possible saving (kWh/d/p)
Frugal heating system	20
Switch off appliances at home/work	4
Stop flying	35
Efficient transport	20
Do not replace gadgets	4
Use CFL or LED	4
Avoid clutter	20
Become vegetarian	10
Difficult actions	
Eliminate draughts	5
Double glazing	10
Improve insulation	10
Solar hot water panels	8
Photovoltaic panels	5
Replace old building with new	35
Replace fossil-fuel heating by electric heat pump	10

- Environmental sustainability
- more useful products
- less energy and water consumed
- less emissions
- less final inert waste

- Economic sustainability
- less money to pay for the system

Let's clean The Balkans in one day!

Waste-prevention potentials

manure and food waste	• reducing meat consumption
food and vegetable waste	• better planning and logistics in the food industry
beverage packages	• better packaging design
paper waste	• reducing unwanted advertising

Waste-prevention potentials

construction and demolition waste	• better planning of construction activities
waste from chemical products and refined chemical products	• reduced fuel consumption of cars
waste from metal products	• more efficient use and eco-design
waste from vehicles, equipment, machines and instruments	• technological innovation

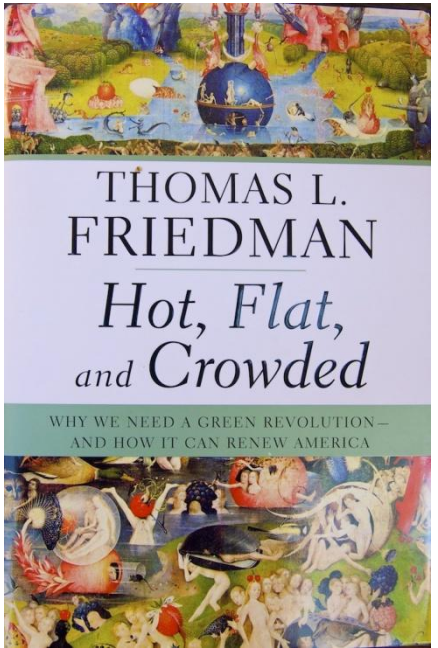
Final thoughts

- Environmentally, time is running out.
- Economically, much of what we have been told was true has been shown to be false
- We are at a once-in-a-century crossroads when a different path must be taken.
- Transition will require fundamental changes to the way we live our lives, but the rewards from doing so will be great.

Let's clean The Balkans in one day!

In a world that is getting hot, flat, and crowded, the task of creating the tools, systems, energy sources, and ethics that will allow the planet to grow in cleaner, more sustainable ways is going going to be the biggest challenge of our lifetime

– Thomas Friedman



Relying on Present Net Value to Choose Assumes:

- All consequences of an action are known
- All consequences can be expressed in monetary units; they are commensurate
- We are the ones entitled to pick the interest rate
- Maximizing financial benefits is the goal of society
- Current mistakes can be corrected by paying some cost in the future

Every single one of these assumptions is false for the current issues !!

Crutial decisions obout our future are upon us and our limiting factor **is not money** – it never was...

The limiting factor
is time !

“If there’s no action before in near future, may be too late.

Thanks for listening

and

good luck with your work!