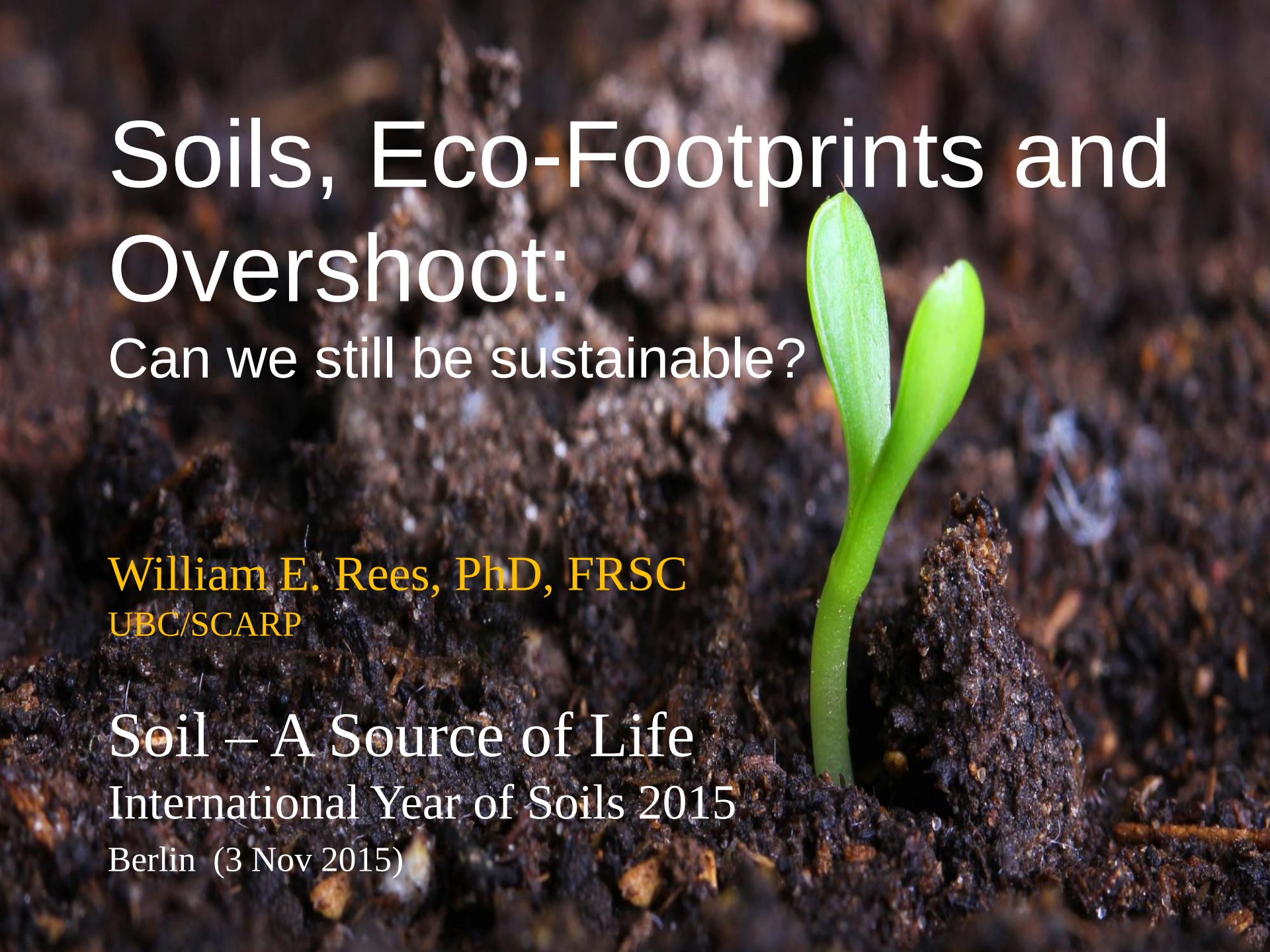

Soils, Eco-Footprints and Overshoot:

Can we still be sustainable?

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Soil – A Source of Life

International Year of Soils 2015

Berlin (3 Nov 2015)

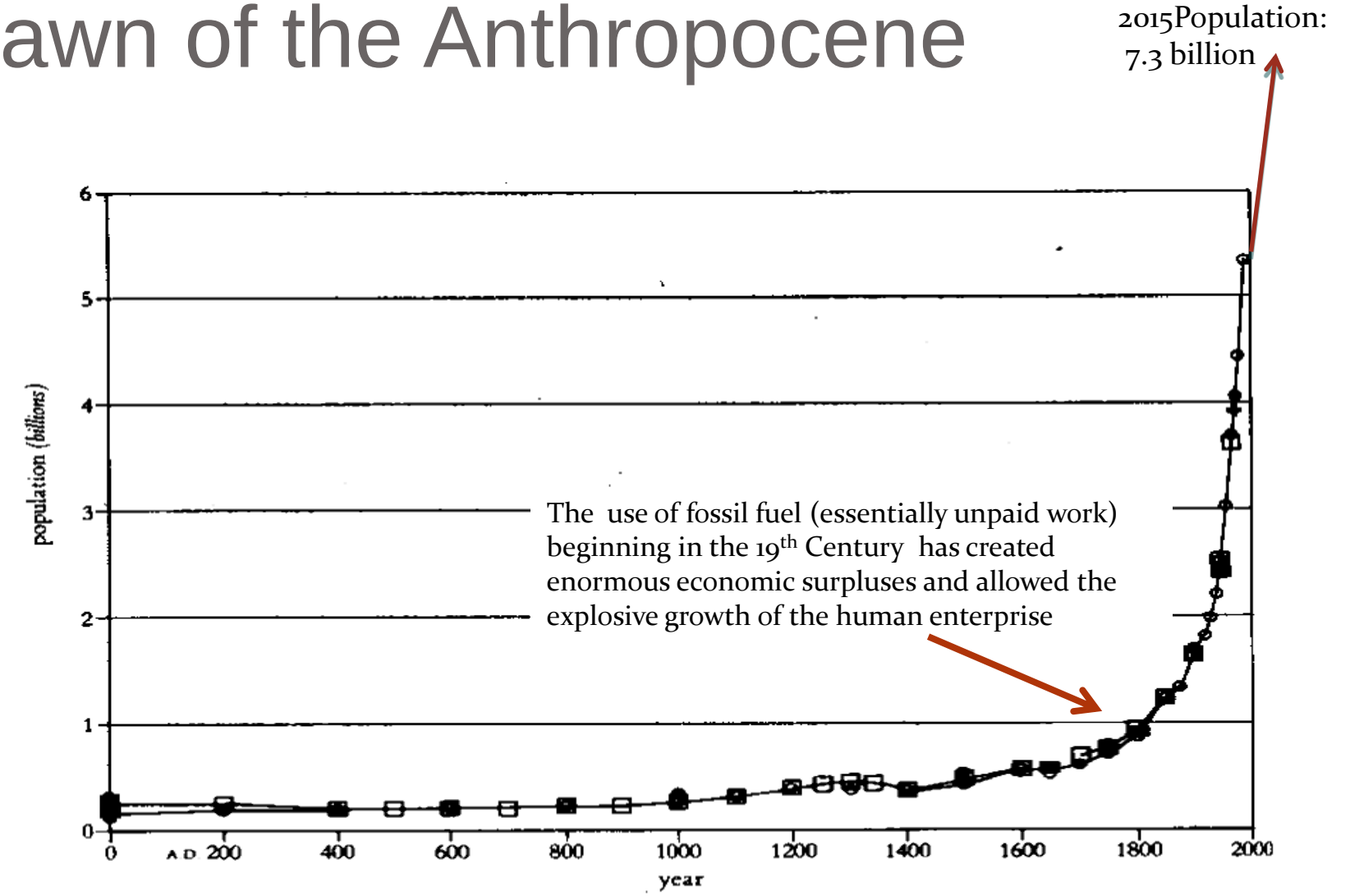
Soil: Some basic ecology

- Soil is the thin living skin of the Earth.
- Soils are complex heterotrophic ecosystems populated and *created* by thousands of species of soil micro-organisms.
- Soil is a major component of the carbon cycle – it contains 3.3 times as much carbon as the atmosphere and 4.5 times as much as the biota.
- With commercial-scale deforestation and industrial agriculture in the 20th Century, soils became a net contributor to atmospheric carbon and thus a driver of climate change.

Urban civilization was spawned by fertile soils and agriculture

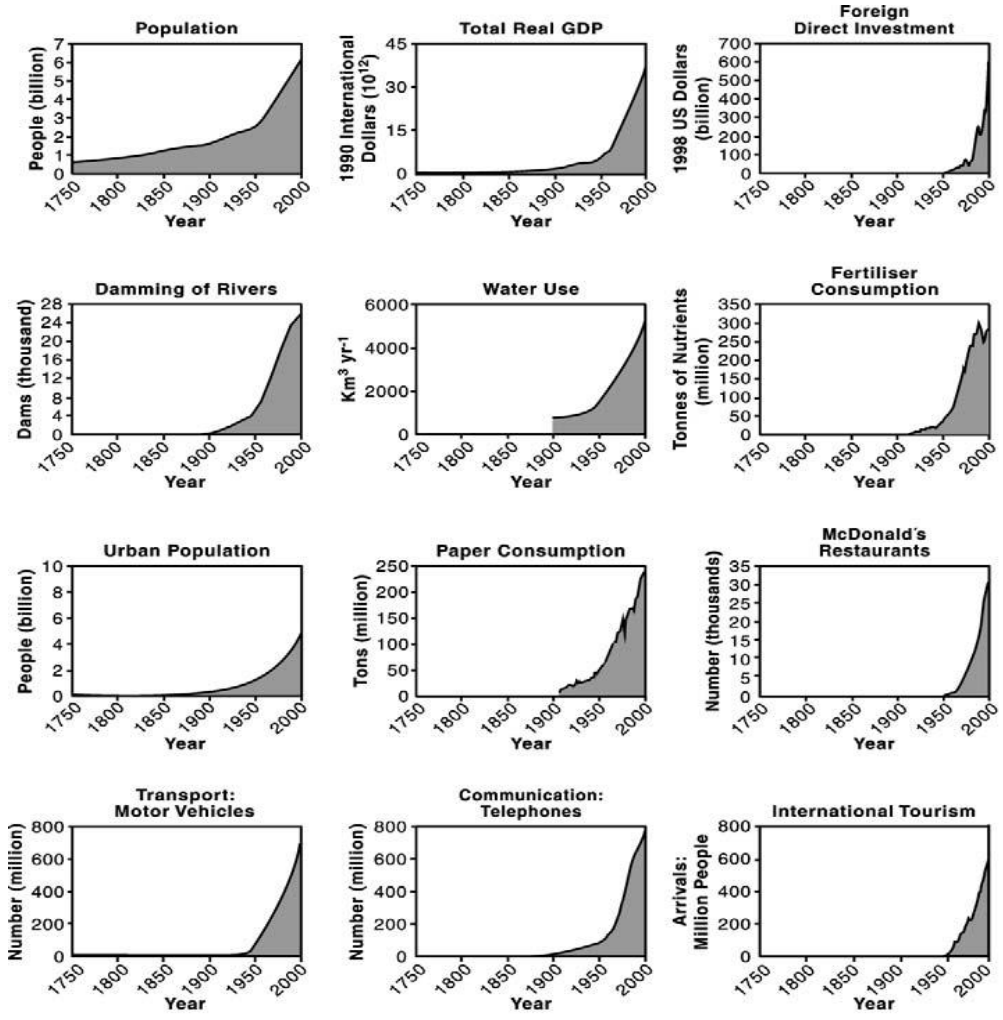
- The first human settlements 9000 years ago, and the emergence of ‘major’ cities 1500 years later were made possible by agriculture.
- The increasing capacity to produce regular food surpluses triggered a truly ‘autocatalytic process—one that catalyses itself in a positive feedback cycle of growth.
- Food surpluses fostered the division of labour the flowering of the arts and sciences, the emergence of governing elites, priesthoods (class structure generally) and armies—all the necessary elements of civilization.

The “great acceleration” and the dawn of the Anthropocene



Continuous growth—population and economic—is an anomaly. The growth spurt that recent generations take to be the norm is the single most abnormal period of human history.

Exponential growth of consumption: Civilization on steroids



- "The Great Acceleration is clearly shown in every component of the human enterprise included in the figure…" (Steffen, Crutzen & McNeill 2007 [Ambio 36: 314-321])
- Note that his explosion of energy and material throughput (i.e., consumption and pollution) has occurred during ***a period of unprecedented technological and economic efficiency gains***.
- The perpetual growth paradigm is based on economic models that make no reference to soils, the land or anything else outside themselves.

Is this sustainable?

Consider the strong sustainability criterion: Constant *per capita* capital stocks

- Economist Sir John Hicks defined *sustainable* income as: "That level of consumption that can be enjoyed from one accounting period to the next without depleting wealth" [where real wealth = income-producing natural, human made or financial capital] .
- Corollary: no society is sustainable if its 'metabolism and growth are being financed by the depletion of essential, non-substitutable forms of *natural* capital

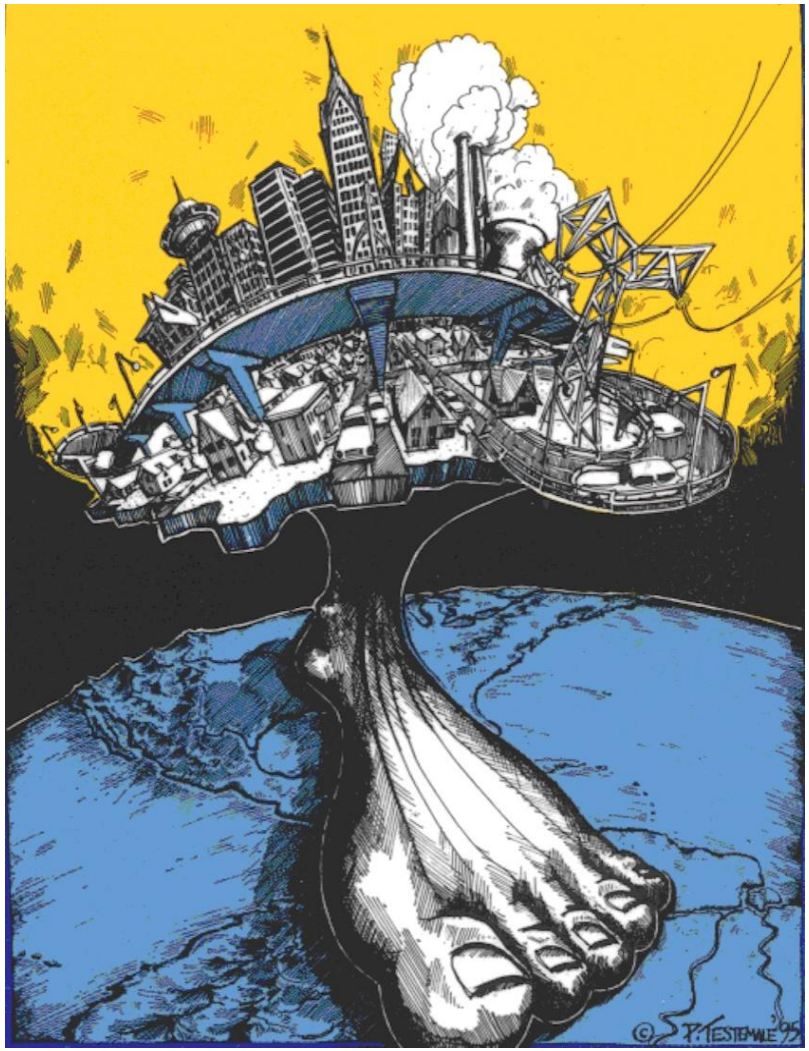
Problem: Agriculture dissipates soil

- Over 600 million hectares (40%) of the world's cropland is degraded or severely degraded.
- Half the world's topsoil has been lost—at current average rates of depletion we have less than 60 years supply.
- The depletion rate typically varies from 10 to 40 the regeneration rate.
- A cumulative 300 million hectares (21%) of cultivated land—enough to feed almost all of Europe—has been so severely degraded "as to destroy its productive functions."
- We hardly notice because we are rich, can "always import food from somewhere else", and fossil fuels and fertilizers can substitute for soils.

The human ecological footprint: How to measure overshoot

- The 'ecological footprint' of a specified population is ***the area of land and water ecosystems required, on a continuous basis, to produce the bio-resources that the population consumes, and to assimilate the (carbon) wastes that the population produces, wherever on Earth the relevant land/water may be located and whatever the population's state of technological development.***
- NB: Eco-footprints are exclusive areas—*we are competing with each other for Earth's limited bio-capacity*.
- This is a partial explanation for much civil unrest and outright war in the Mid-East.

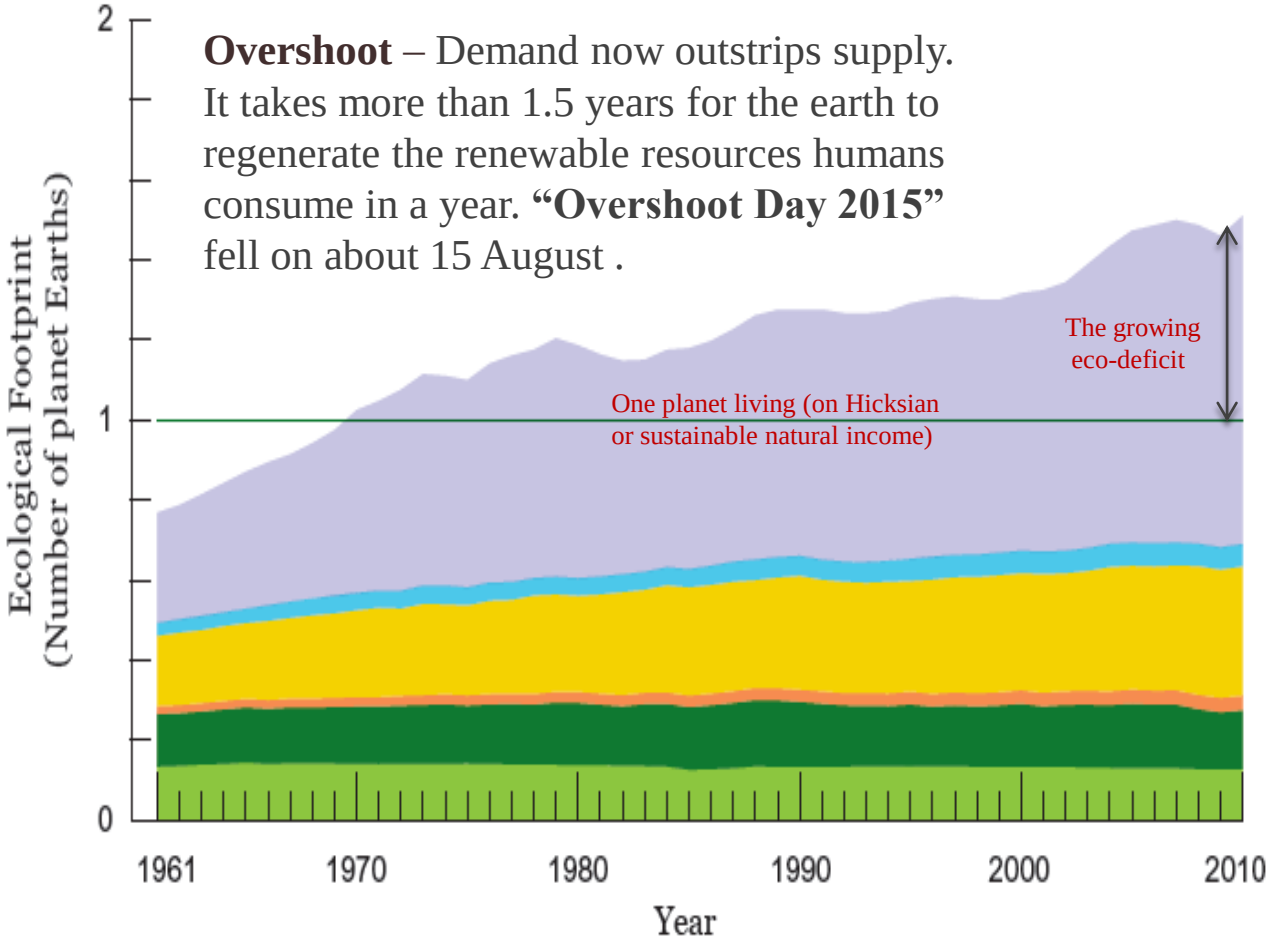
Eco-Footprints Vary with Income



- Average per capita EFs in high-income countries range between four and ten global average hectares (gha)
- The poorest people live on a third of a gha.
- There are only about 1.6 gha per person on earth.
- Wealthy Europeans and North Americans use 3-4+ times their equitable share of global biocapacity.

Consumption now exceeds Hicksian 'natural income' globally

Overshoot – Demand now outstrips supply. It takes more than 1.5 years for the earth to regenerate the renewable resources humans consume in a year. **"Overshoot Day 2015"** fell on about 15 August .



Currently, the largest single component of the Ecological Footprint is the carbon component (53 per cent) (Global Footprint Network, 2014).

Key to eco-footprint Components

- Carbon
- Fishing grounds
- Cropland
- Built-up land
- Forest products
- Grazing products

The Global Picture

58% overshoot

global biocapacity:
12.0 billion hectares

Economic growth today is being financed by the liquidation of essential, non-substitutable self-producing natural capital and the erosion of global life support systems. We are in violation of Hicksian sustainability.

current human eco-footprint:
19.0 billion hectares

Most densely-populated and high-income countries run eco-deficits

- **Germany** (Population: 81 million; EF = 4.5 gha/cap)
  - physical area: 35.7 million ha
  - eco-footprint (demand): 364 million gha
  - biocapacity (supply): 153 gha
  - physical overshoot factor: 10
  - biocapacity overshoot factor: 2.4
- I.e., Germany uses 2.4 times as much biocapacity as is available domestically. The country could satisfy only 42% of present demand for ecosystems services on its own soil.
- Is it good policy in a era of global change to become increasingly dependent on potentially unreliable external sources of vital supplies?

Cities are all eco-deficit

- **Berlin** (approx EF = 4.5 gha/cap)
  - population: 3.5 million
  - area: 89,185 ha
  - eco-footprint: 15.7 million gha
  - physical overshoot factor: 176
- Cities are incomplete (heterotrophic) ecosystems.
- The area of ecosystems required to supply food and fibre to Berliners and assimilate their carbon wastes – is 176 times larger than the city's physical footprint and is scattered all over the planet.
- This is fairly typical—densely populated high income cities have eco-footprints hundreds to a thousand or more times the size of their political or built-up areas.

'Today's city is the most vulnerable social structure ever conceived by man' (Martin Oppenheimer).

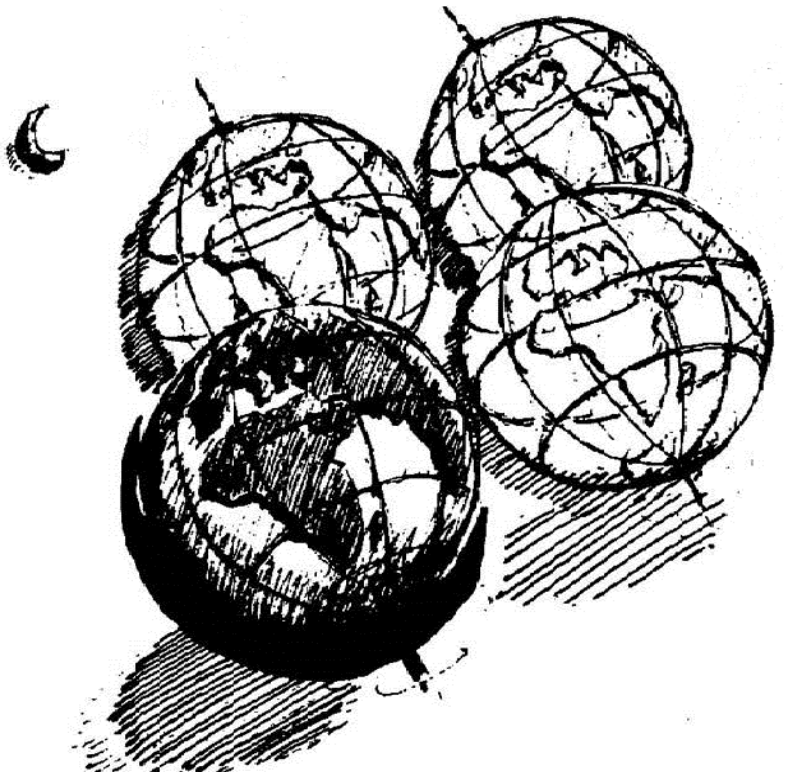
Cities will be increasingly threatened by the degradation and depletion of the ecosphere:

- Climate change (e.g., rising sea levels).
- Land degradation and soils depletion (e.g., peak phosphorus).
- Energy and material resource shortages.
- Resultant geopolitical instability.

Nevertheless, urban populations are projected to increase by more than 2.5 billion in the first half of this century. This is equivalent to the *entire human population* in 1950.

Continuous material growth for all to first-world standards is *ecologically* impossible

- If everyone on Earth lived at the same material standards as Europeans or North Americans, we would require up to three additional Earth-like planets.
- Regrettably, good planets are hard to find.
- Meanwhile, Globalization and trade enable the rich legally to acquire the 'underutilized' biocapacity of poor countries.
- Is this a form of neo-colonialism?



The competition for ‘soil’ is getting worse: Food security and ‘land grabs’

- The competition for food, fibre and biofuels has so far been waged largely through global commodity markets, giving an advantage to high-income countries.
- However, land scarcity, rising global food prices, drought-induced food export restrictions, etc., have weakened confidence in markets and spawned the desperate (or opportunistic) phenomenon of ‘land-grabbing’.
- Various over-populated, import dependent countries—China, Saudi Arabia, Libya, South Korea, the US — are acquiring large tracts of productive land, mainly in poor developing countries (especially in Africa) to sustain populations back home (or as investments!).
- 36 million hectares (almost equivalent to the area of Japan) have been purchased or leased by foreign interests since the beginning of the century alone and an additional 15 million hectares are under negotiation.

Where are we headed?

In coming years, the human enterprise will likely contract. As an intelligent, moral species, capable of acting on the evidence and planning ahead, we can choose between:

- Business as usual – risking a chaotic implosion *imposed by nature* followed by geopolitical turmoil and resource wars or:
- A well-planned, orderly and cooperative descent toward a socially just sustainability for all.

‘One-planet living’ is not merely a preference, it is an absolute

Implications:

- The per capita eco-footprints of urban dwellers in typical high-income cities ranges between four and eight global average hectares (gha); an equitable share of Earth’s biocapacity (a ‘fair Earth-share’) is 1.6 gha. Therefore:
- To achieve one-planet living, high-income cities should plan for a 60% - 80% reduction in energy-material throughput.
- This is technologically achievable and could lead to higher quality of life.

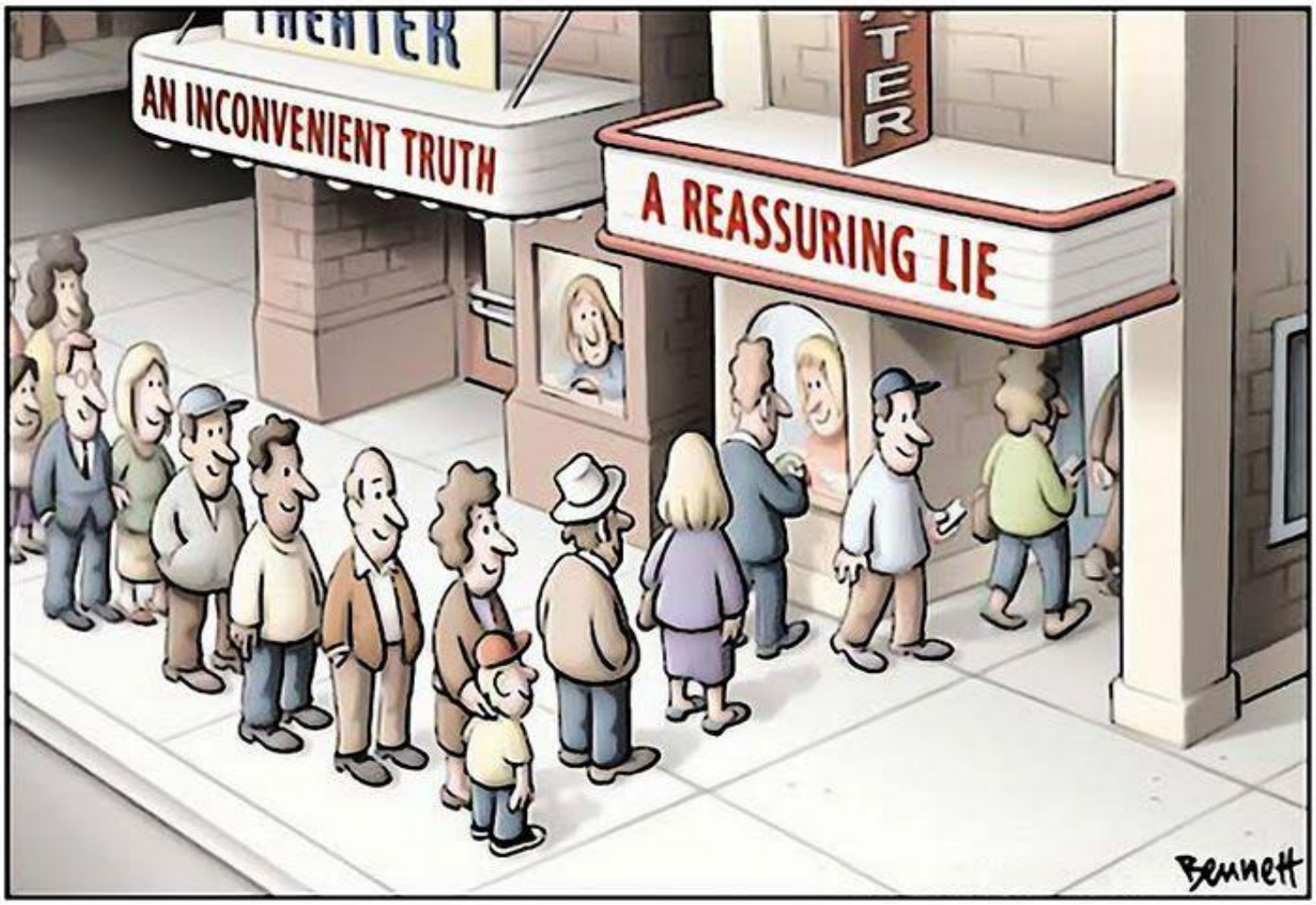
Motivation and rationale?
It's in everyone's long-term interest

- No city, region or country can achieve sustainability on its own.
- Individual and national interests have converged with humanity's common interests. That is:
- Sustainability is a collective problem that demands collective solutions.

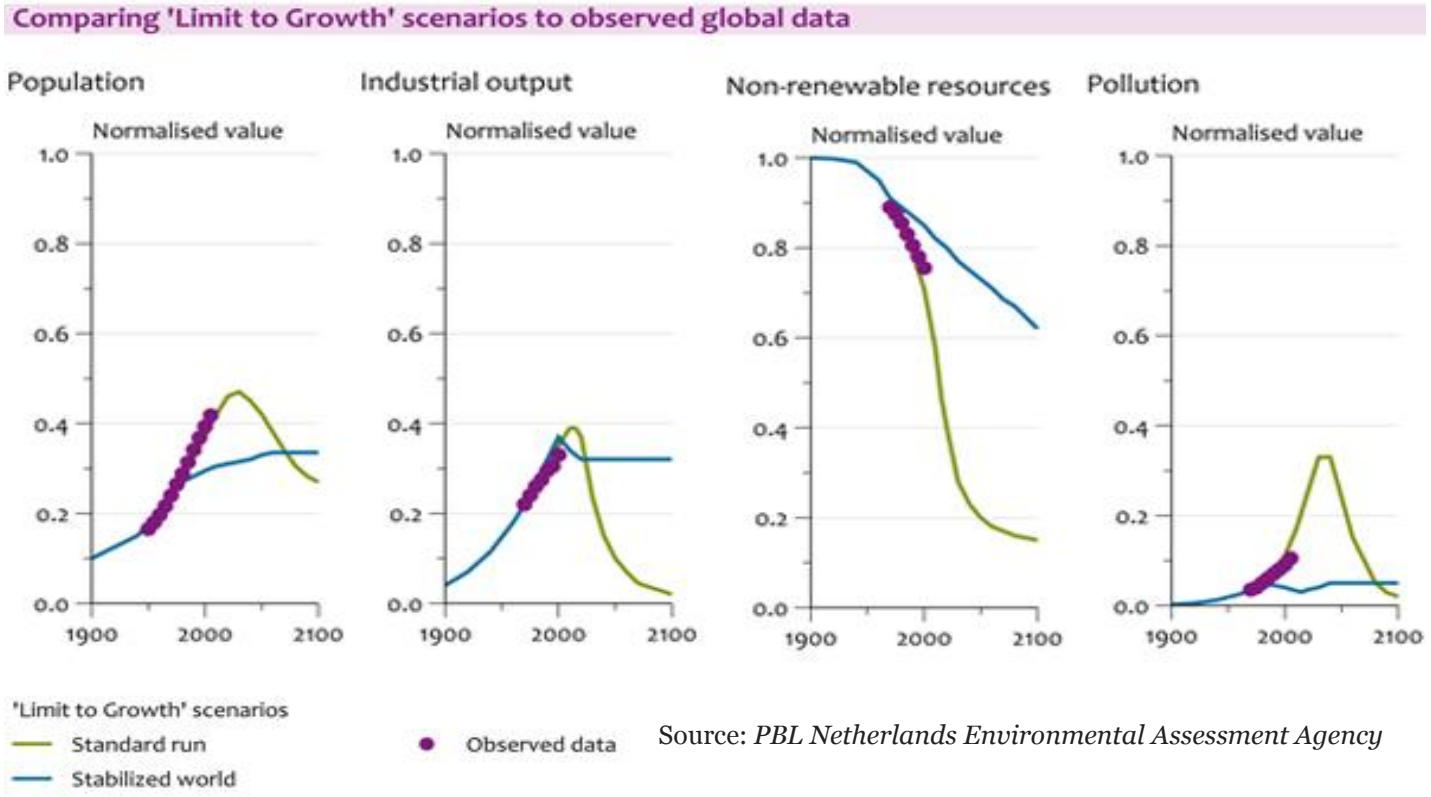
Problem: A world in denial

- "The masses have never thirsted after truth. They turn aside from evidence that is not to their taste, preferring to deify error…"
  (Gustave le Bon 1896).
- Wooden-headedness... plays a remarkably large role in government. It consists in assessing a situation in terms of preconceived fixed notions [i.e., ideology] while ignoring any contrary signs. It is acting according to wish while not allowing oneself to be deflected by the facts" (Tuchman 1984).
- "For us to maintain our way of living, we must… tell lies to each other, and especially to ourselves… [the lies] are necessary because without them many deplorable acts would become impossibilities"
  (Jensen 2000).

Worse, the current generation has been socially engineered to ignore reality



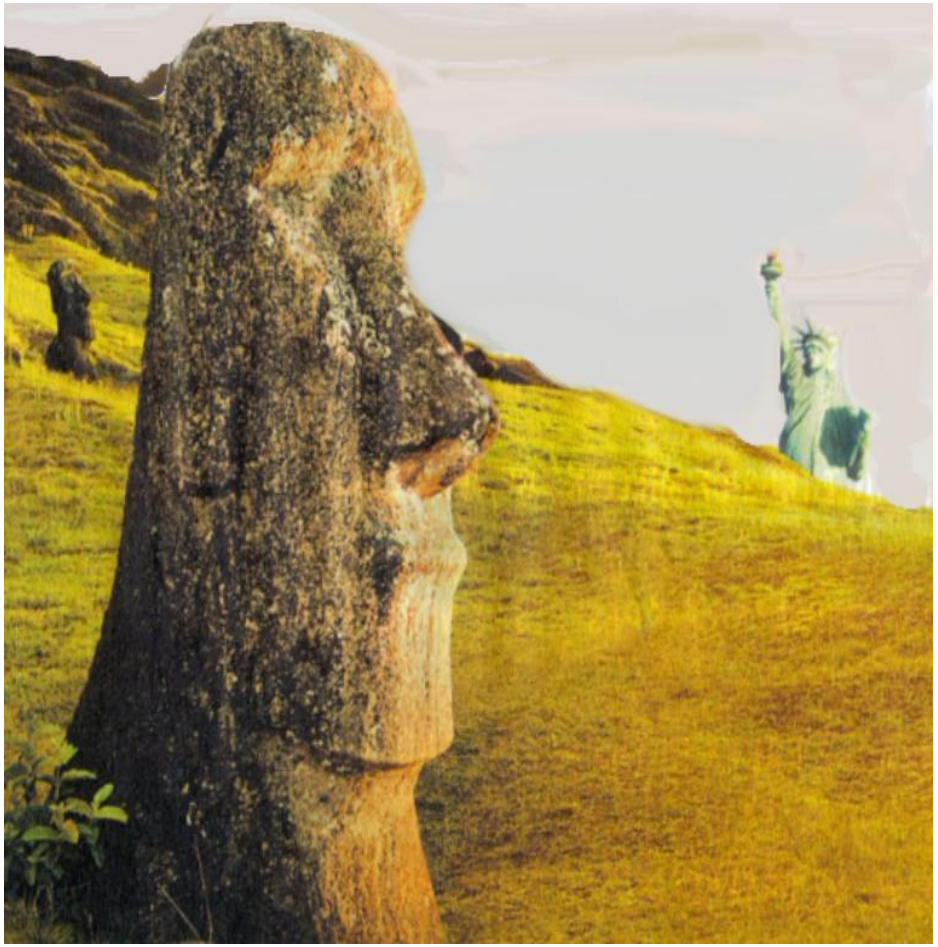
Globally, it's still 'business as usual' – on course for collapse



Source: *PBL Netherlands Environmental Assessment Agency*

Failure to act for the common good will ultimately lead to **civil insurrection, geopolitical chaos, resource wars and ecological implosion**.

It wouldn't be the first time!



- "...what is perhaps most intriguing in the evolution of human societies is the regularity with which the pattern of increasing complexity is interrupted by collapse..." (Tainter 1995).
- The modern tragedy is that humanity could, in theory, break from the pattern but, as yet, *the world shows little sign of getting serious about sustainability.*