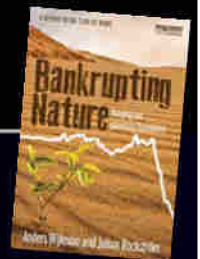
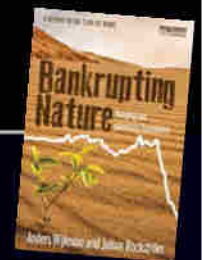
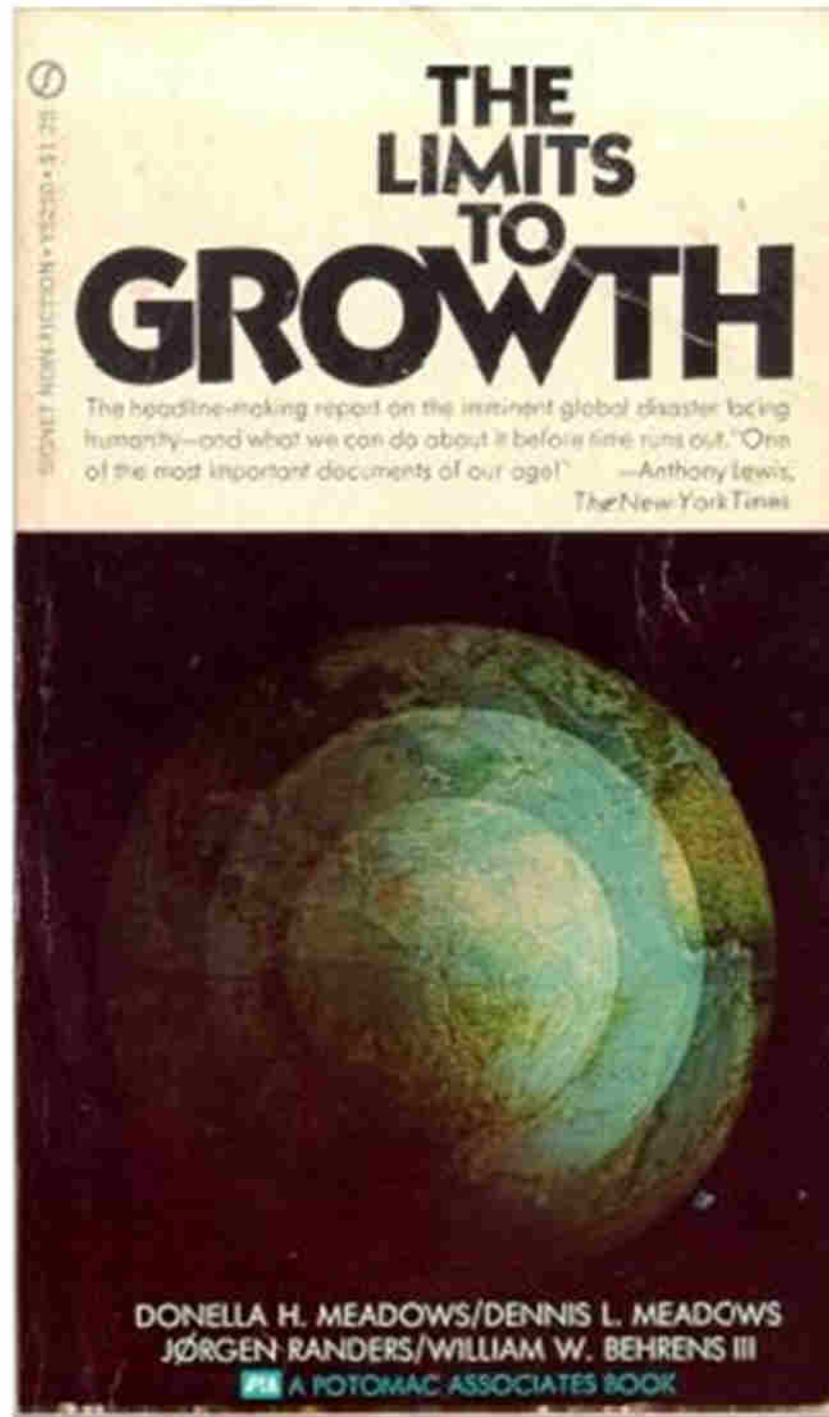


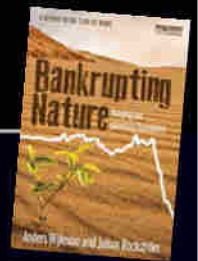
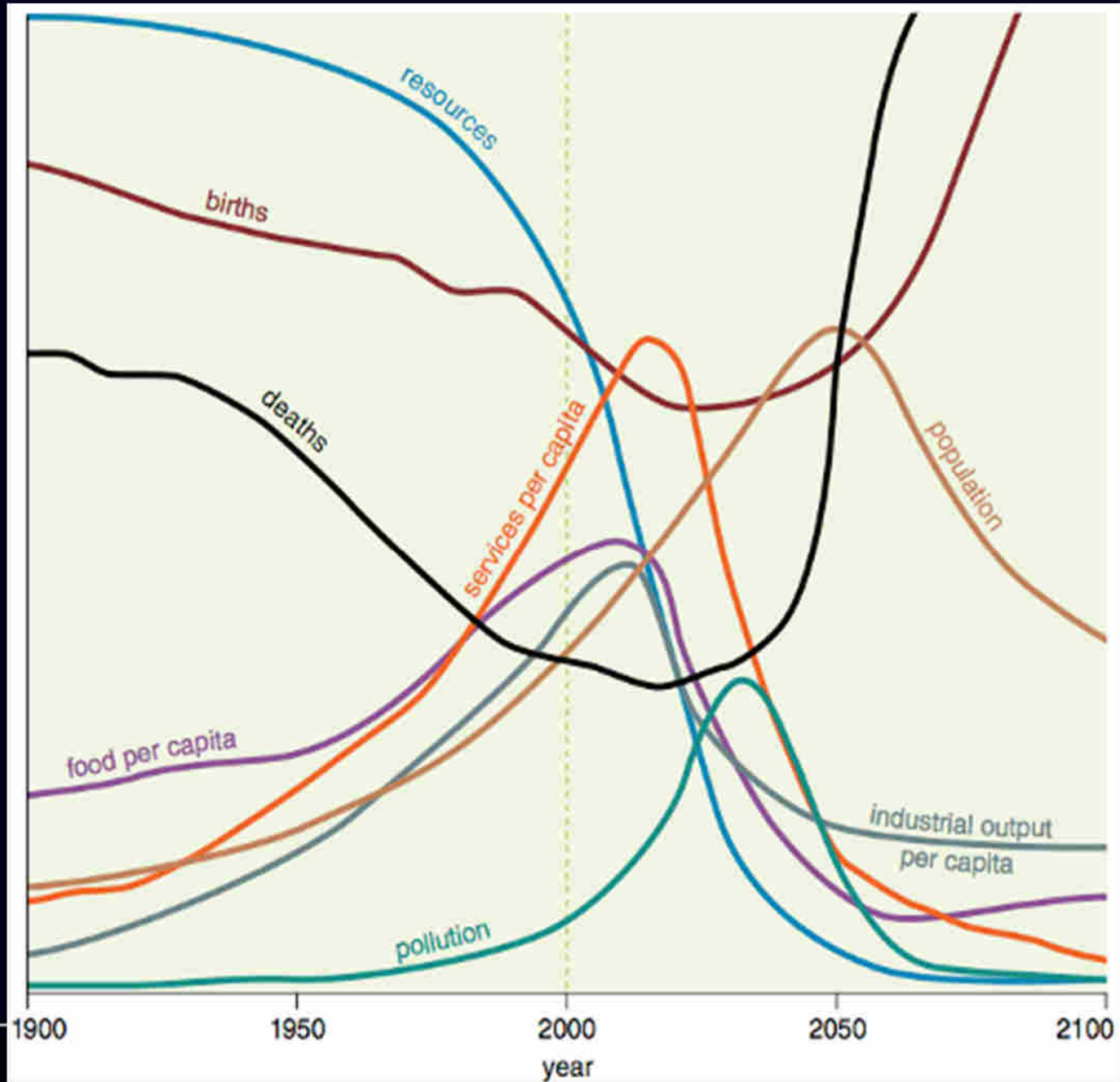
"How do we avoid bankrupting nature?"

- **Comments by Anders Wijkman, co-president of the Club of Rome in Luxembourg March 26, 2014.**

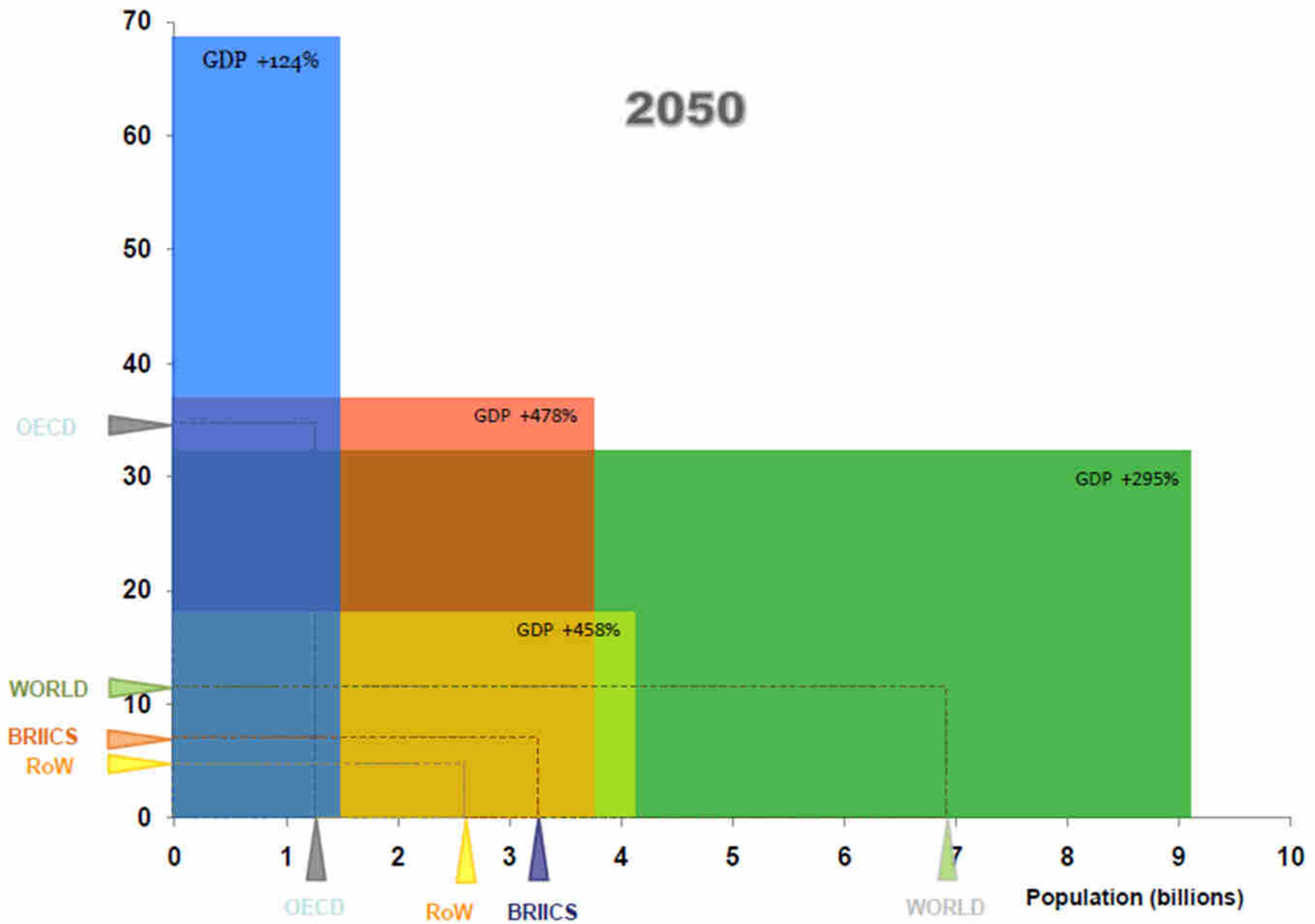


1972





GDP per capita ('000 USD)

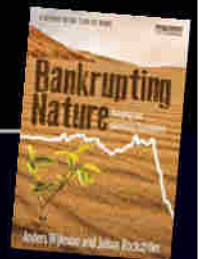


Source: OECD (2012), *OECD Environmental Outlook to 2050*, Baseline projection using ENV-Linkages model

But the Economy is already on a collision course with Nature

- Overuse of Nature is serious; demonstrated by Climate Change, Overuse of many vital Ecosystems, the transgressing of Planetary Boundaries and looming resource constraints
- So continued growth positive from the point of view of poverty reduction – but will it last? Will it be sustainable?
- We don't seem to realize the power of exponential growth.....
- 3 Billion more middle-income takers in 2030 – how can Nature sustain the increase in demand?

- Conclusion: We need a different logic

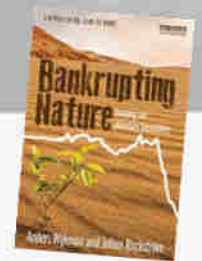


The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?



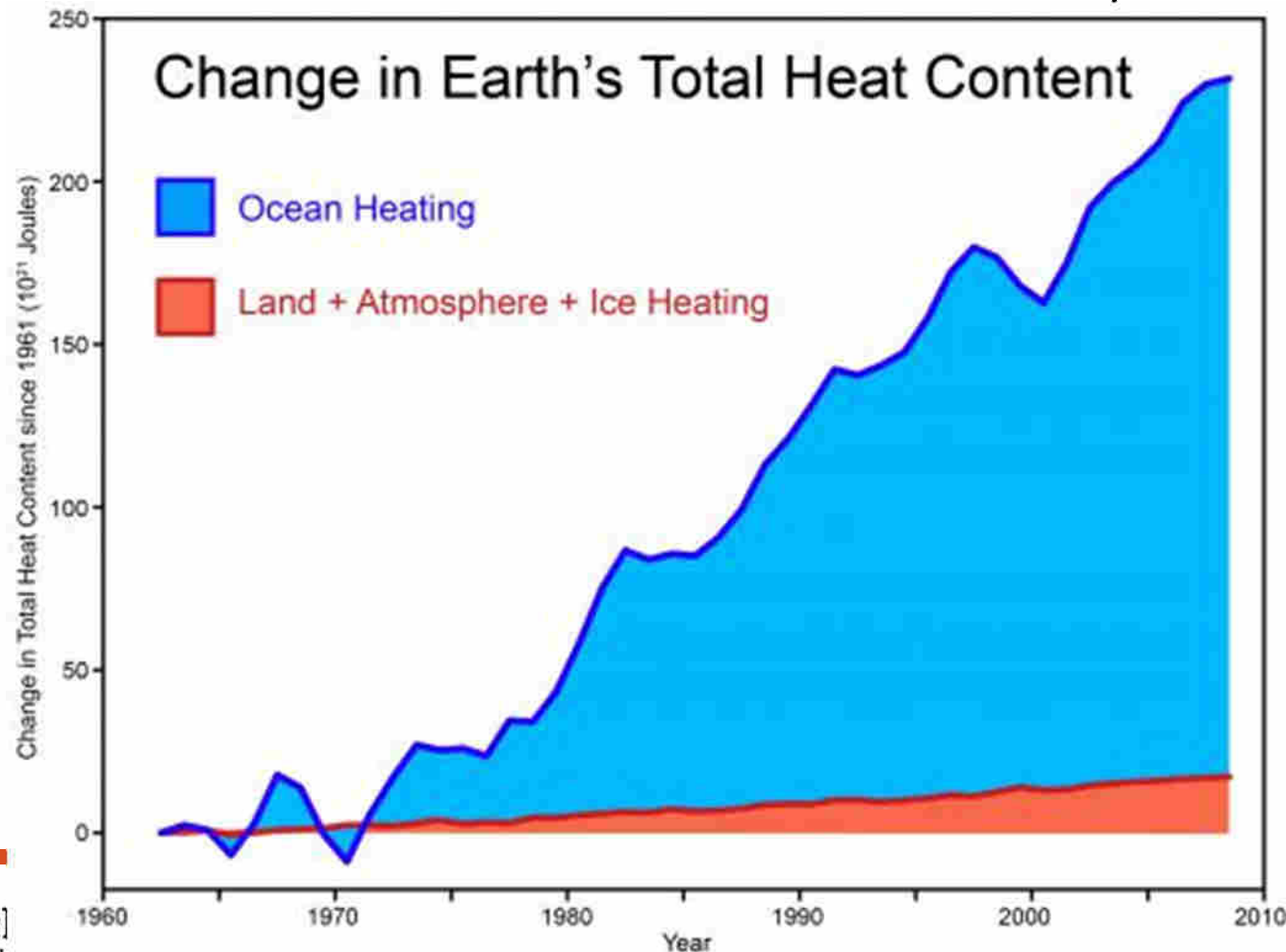
IPCC 5th AR

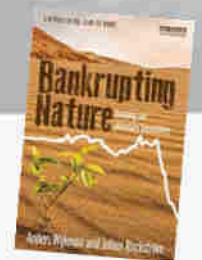
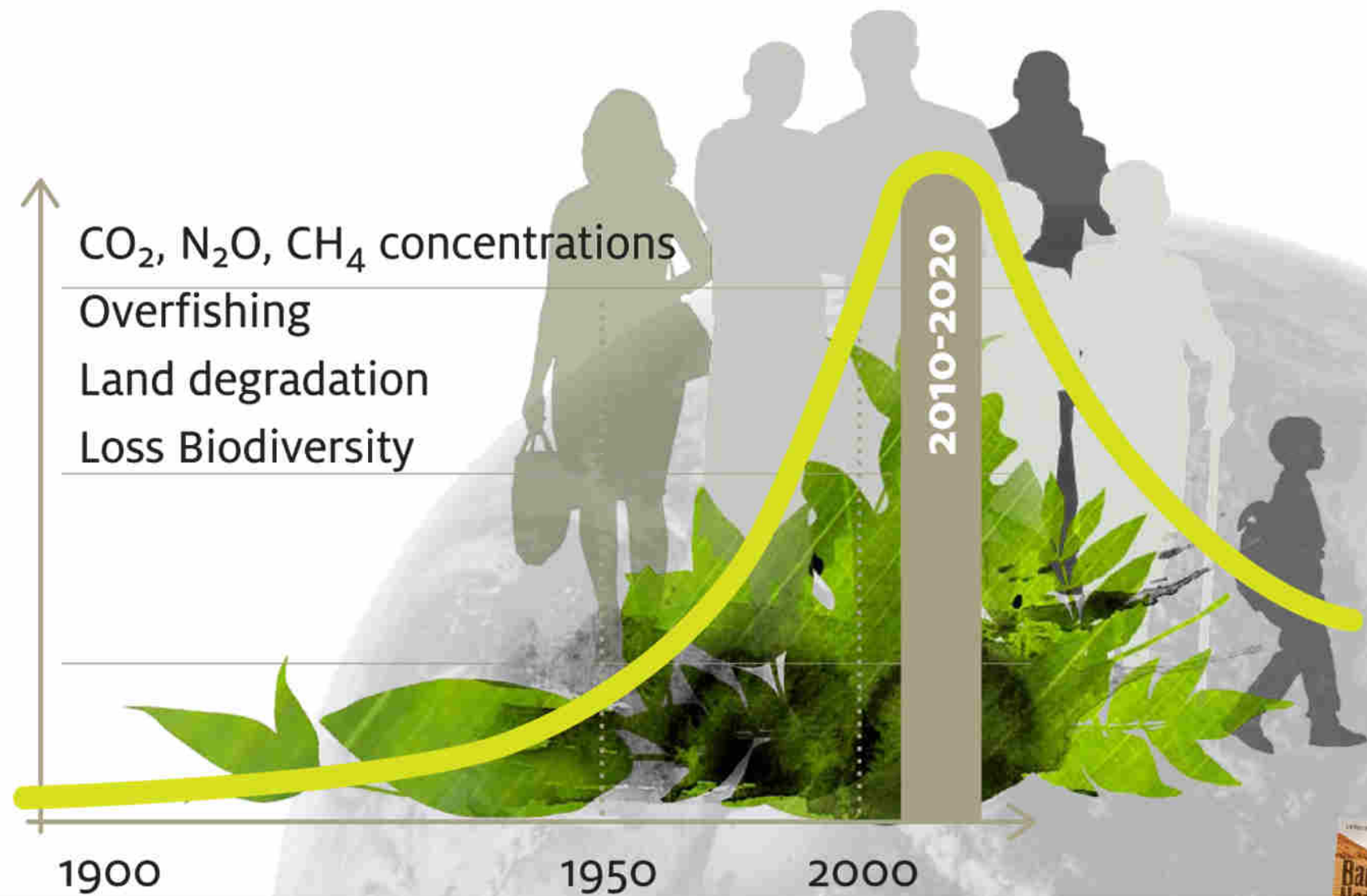
- GHG emissions are increasing more rapidly than ever
- We are on track for more than a doubling – leading to a temp increase of 3-4 °C; Risk panorama includes probability that warming may be as high as 6°C
- The atmosphere and the oceans have become warmer
- Both glaciers and sea ice have been significantly reduced; Sea levels have increased
- Around 30 % of CO₂ emissions have been absorbed by the oceans – leading to acidification and dire consequences for marine life
- Extreme weather events are likely to occur more frequently
- Food production is at serious risk

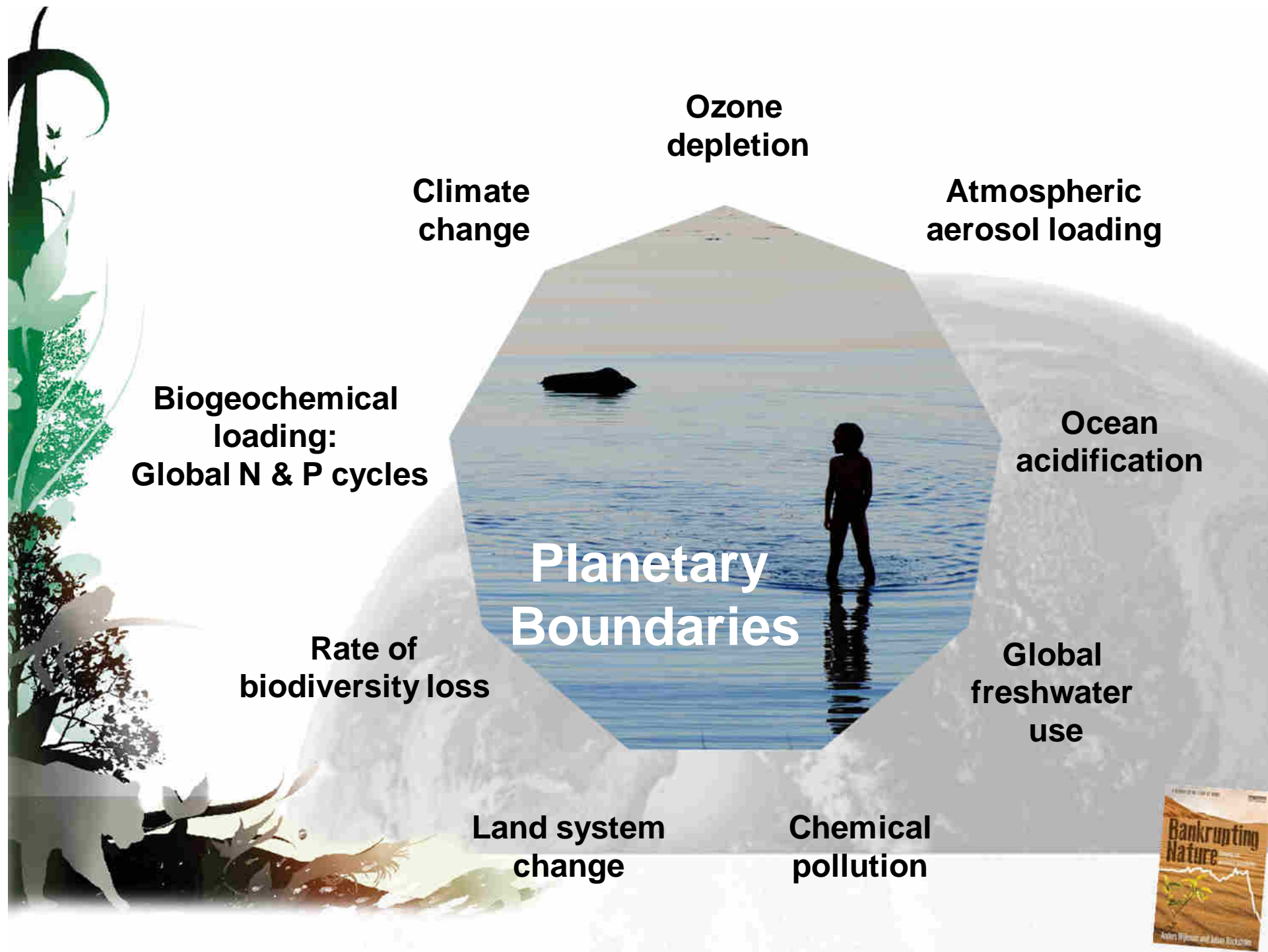


Global Warming did not stop in 1998

- as many deniers claim







Multiple Interacting driving forces pushing systems towards tipping points

Natural Fire regimes
Biomass burning
Palm-oil expansion
El Nino

El Nino goes from regenerative to destructive force
Breaking millennia long Fire-El Nino relationship for Dipterocarp trees

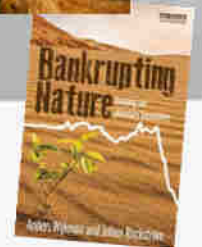




Photo Mattias Klum

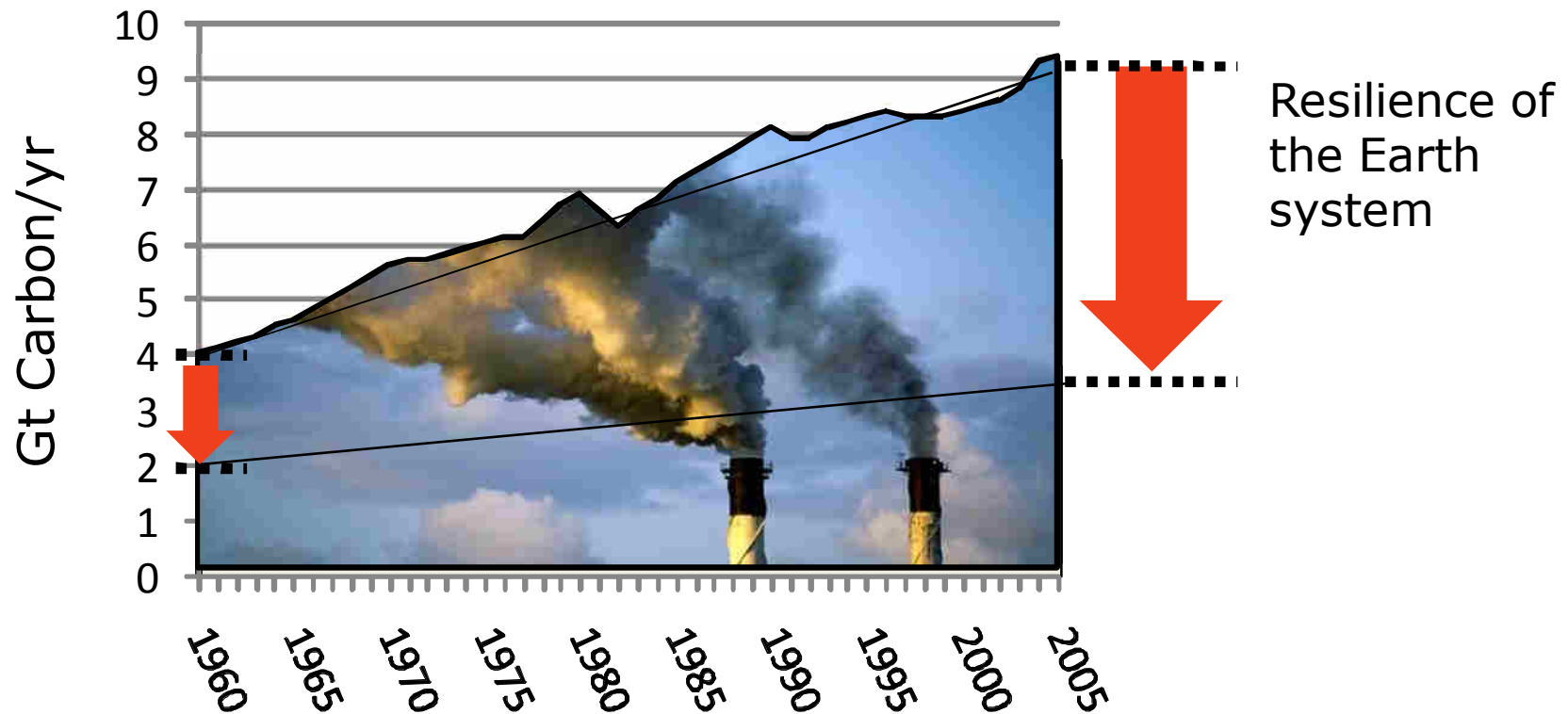




Photo: Matthias Klum



Interactions among Planetary Boundaries



Adapted from Canadell et al., 2007

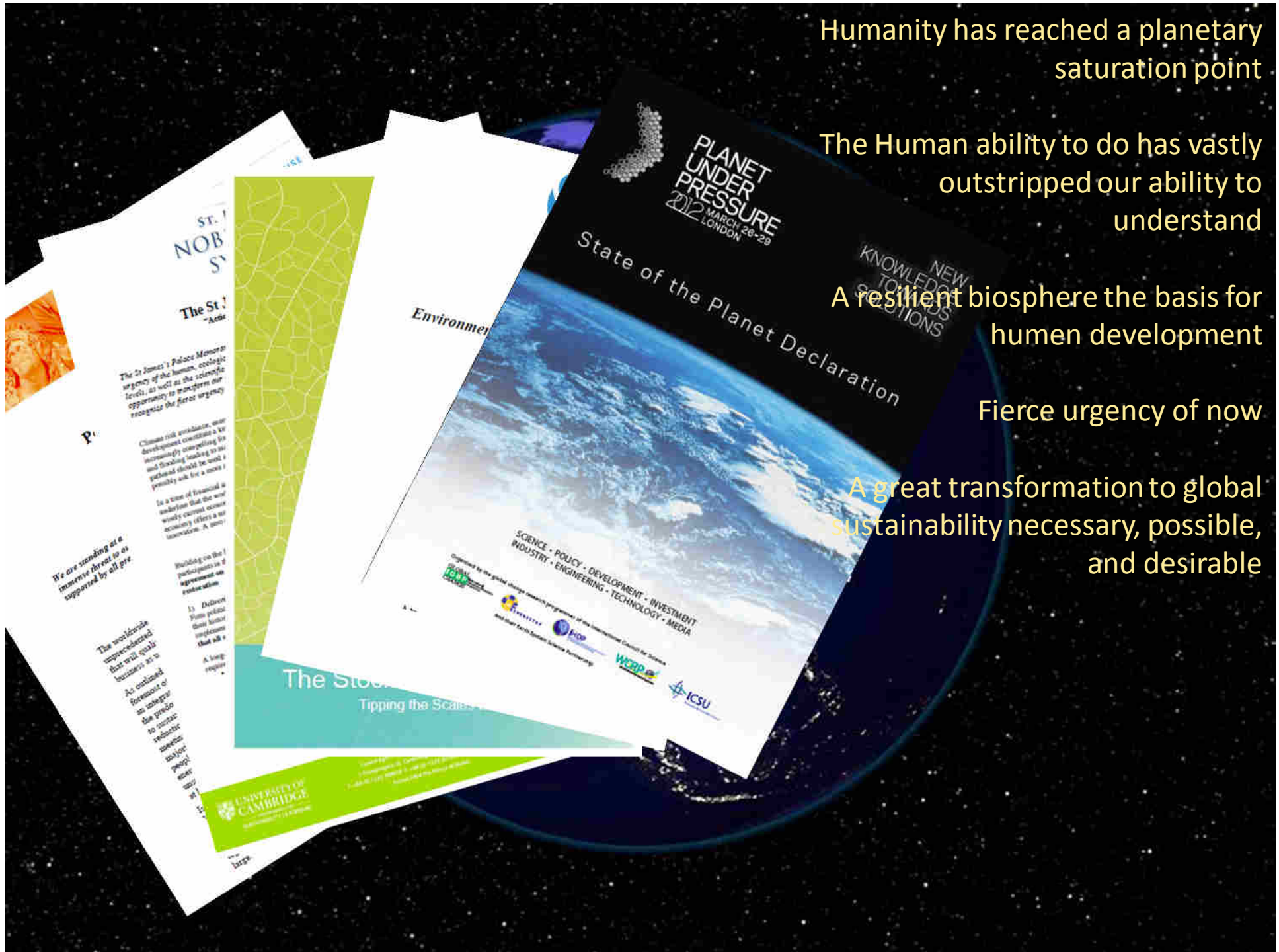
Humanity has reached a planetary saturation point

The Human ability to do has vastly outstripped our ability to understand

A resilient biosphere the basis for human development

Fierce urgency of now

A great transformation to global sustainability necessary, possible, and desirable





Stockholm Resilience Centre
Research for Governance of Social-Ecological Systems



A centre with:



Energy critical issue from a climate point of view – but, as well, from the point of view of development

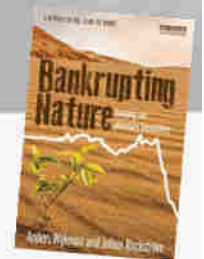
- The high standard of living in OECD countries primarily result of cheap oil
- The era of cheap oil is over - HOW will it affect growth and development?
- Some economists – like M Kumhoff and J Hamilton – claim oil prices above 140 US/barrel will bring growth to a halt
- Crude oil production has peaked; HYPE around shale oil and shale gas - bubble or for real?
- Only way forward is renewables + efficiency; but fossil fuels will play a role for many decades
- Energy transition takes time and will be difficult
- If energy prices too high economy will slow down: investments in energy transition will not happen
- **Investments today in renewables and efficiency are far too low**



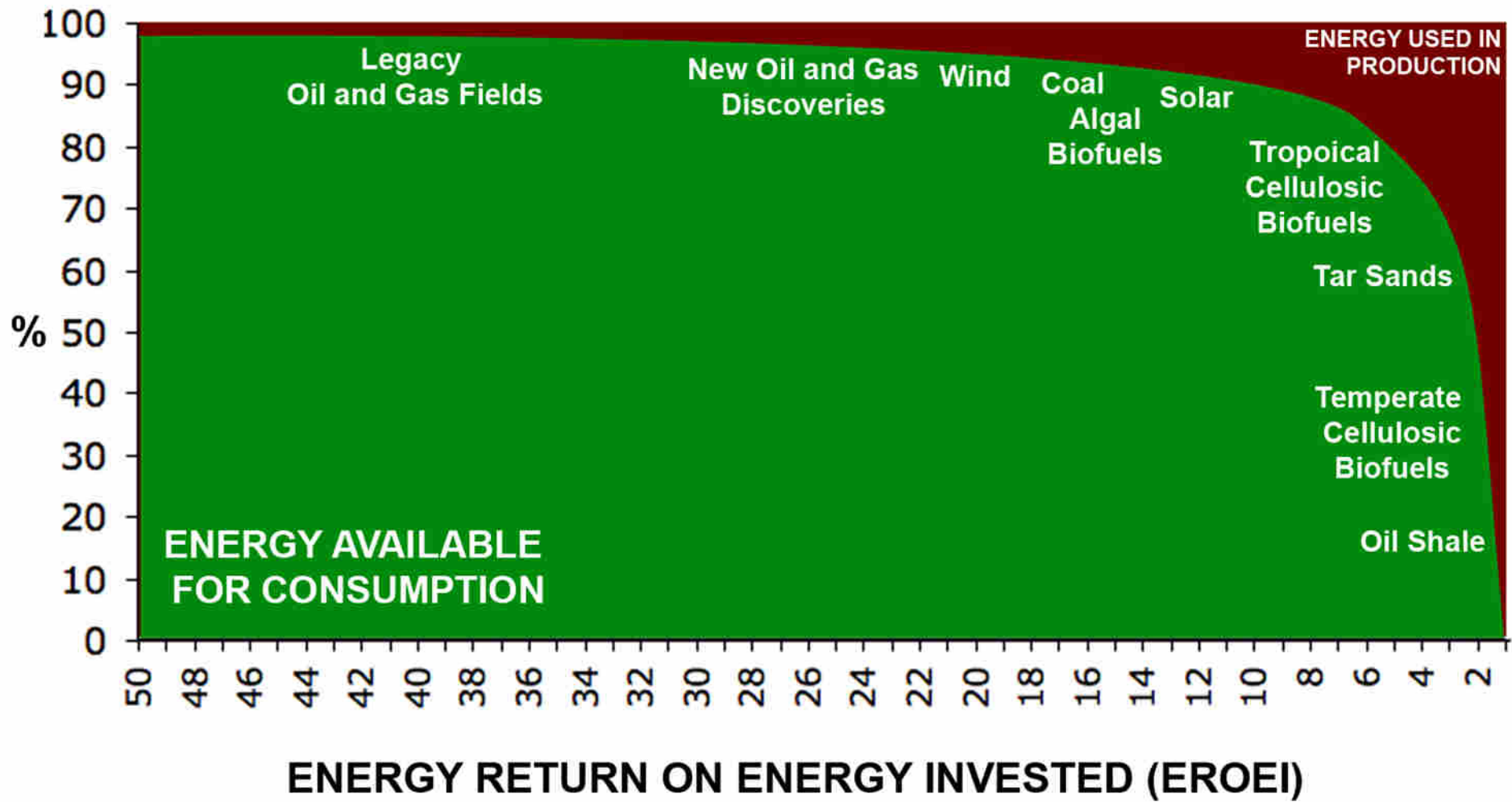
What energy alternatives we invest in is of great importance

- **EROEI will be crucial**
- **For many decades EROEI was very high – 50:1 to 100:1 (crude oil in the early years)**
- **Today crude oil < 20:1**
- **Tar sands 5:1**
- **Ethanol from corn 1:1**
- **Wind 10:1 to 15:1**
- **Solar 10:1**
- **Nuclear ?**

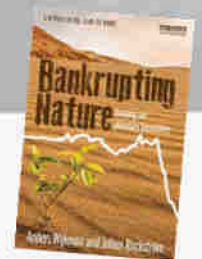
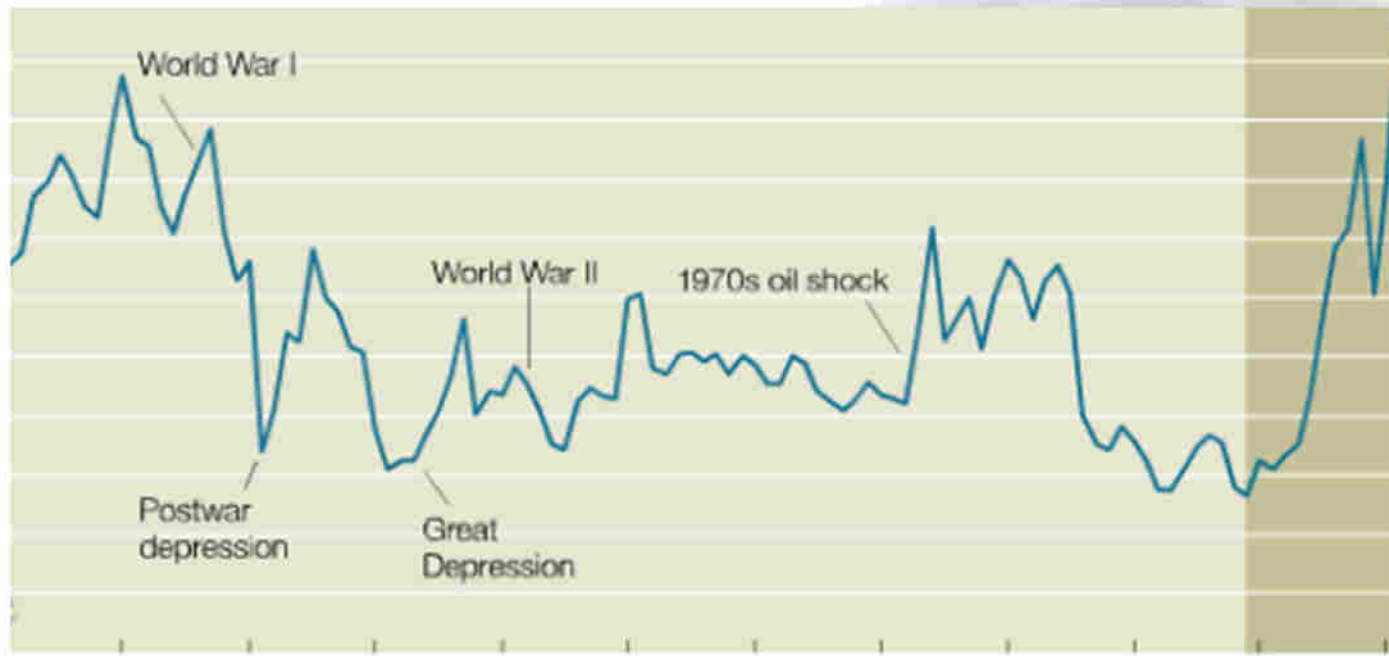
A society like ours needs > 10:1



THE NET ENERGY CLIFF



On resource prices, what we experienced was a long decline and since a decade a sharp increase



Mining requires energy



So we are in a double bind

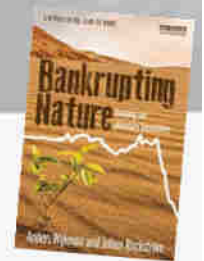
- We need cheap energy – up till now mainly through fossil fuels – to secure welfare; not least to fight poverty in the South
- But – according to Potsdam Institute and Carbon Tracker - we cannot use more than 1/4 of proven fossil reserves
- If we use more, the 2° degree target can not be met
- But climate negotiations has very little traction – they remind mostly of a trench war
- The role of the US crucial – but if they can't agree on domestic issues, why expect agreement on global?
- Investments currently in energy alternatives are 1/4 of what they should be
- CCS technology is getting very limited attention
- Add to that the issue of "stranded assets"

**WE DESPERATELY NEED A GLOBAL STRATEGY BOTH
ON CLIMATE AND ENERGY**



How did we get here:

- **Growing populations and economies**
 - **Little concern for Nature**
- **"From a small economy on a big planet to a big economy on a small planet"**
 - **A lot of denial**
 - **Short-termism**
 - **"Conventional growth will fix it"**
- **Those recognizing the dilemma of growth do not know WHAT the transition looks like**
- **Externalities not acted upon– lack of political will**
 - **Shortcomings in conventional economics**



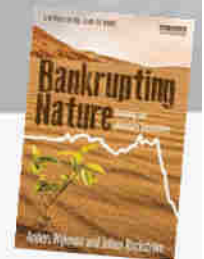
Dilemma of growth not recognised

- **There are limits to conventional growth and energy and material throughput; most people won't discuss it**
- **Welfare ultimately depends on Nature**
- **However, negative growth is no solution either – that would result in economic, financial and social collapse;**
- **To dodge the issue as most people do is irresponsible**
- **Many things should grow, but overall throughput must be curbed – i.e. we need a new development model**
- **Conventional economics has some answers but a lot of changes needed in economic policy framework**



Obvious shortcomings in mainstream economics

- Natural capital and ecosystem services have no value
- The notion that different types of capital are easily substitutable – but “we can’t eat money”
- The view that economic decisions are always reversible
- The notion that resource scarcity can be effectively addressed by increasing prices and innovation
- The failure to address non-linear phenomena
- The way future values are discounted
- A financial sector that does not care what it invests in as long as short-term profits can be maximized
- Shareholder value the only thing that counts



The Green economy discourse - a paradigm change

Current economy

GDP growth: more economic activity
the aim

Short-termism

Maximisation of return

Shareholder value

Extraction of natural resources

Linear production systems

Short-life products for sale

Efficiency measured in monetary
terms (CBA)

Green, inclusive economy

'Beyond GDP': prosperity the aim

Long-termism

Safeguarding of long-term incomes

Stakeholder value: benefit to society

Management of natural resources

Circular production systems

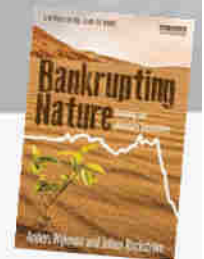
Long-life services

Multidimensional efficiency (e.g. multi-
criterion analysis, MCA)

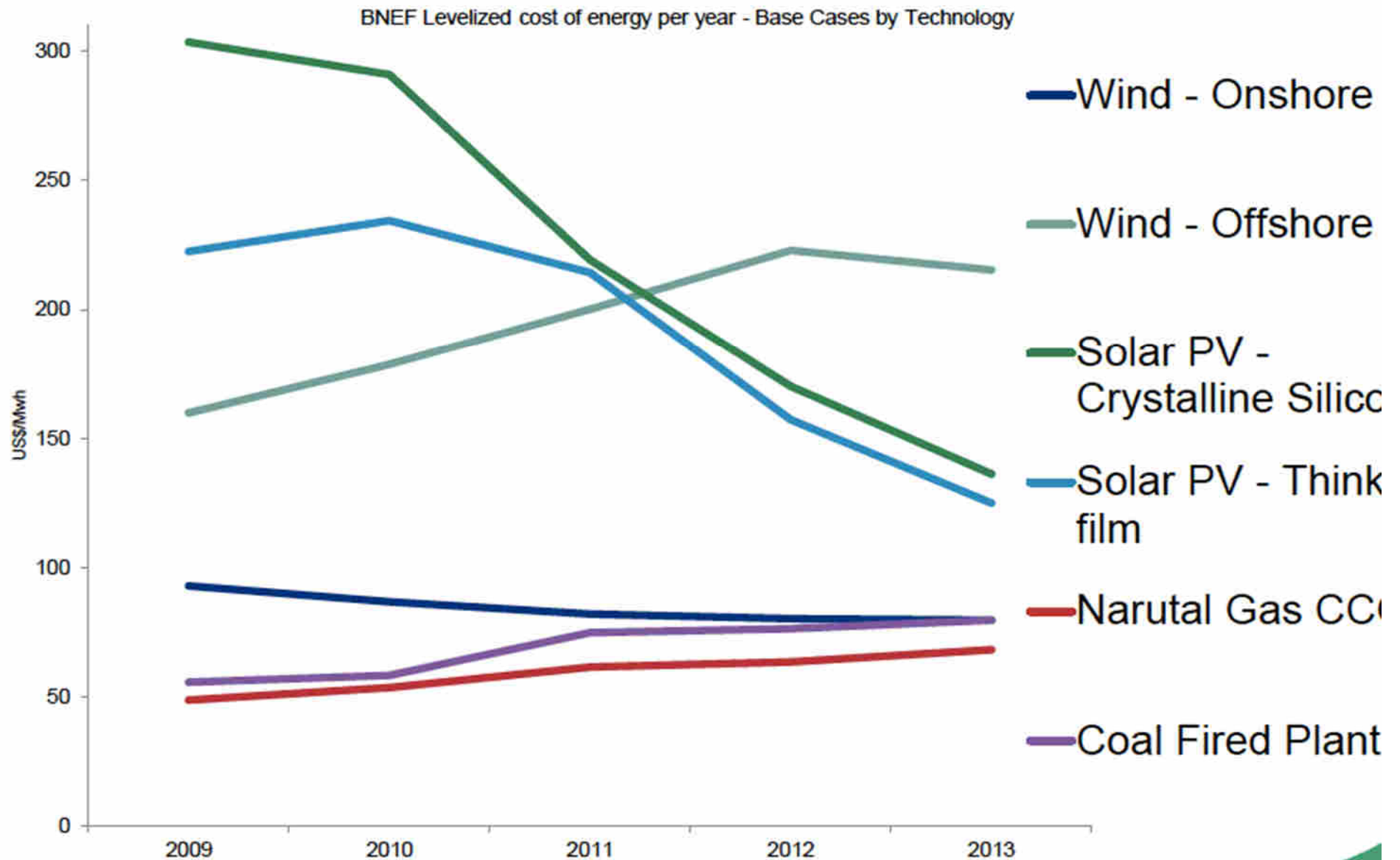


Vital signs

- World Energy Demand can be met by Solar, Wind and Water
- Solar energy costs are falling rapidly
- Solar and Wind installed capacity exceeds 400 GW:s – but pace slowing down because of ”shale revolution”
- Resource efficiency - incl energy - potential is huge – but untapped
- The digital revolution
- Ultra-light materials
- Near zero-energy buildings
- Build in wood
- Green chemistry
- The circular economy; From cradle to cradle; Biomimicry
- **But transition too slow**



FÖRNYELSEBAR ENERGI



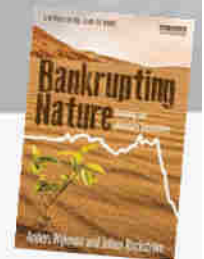


***In Japan, one solar roof-top is
installed every 2 minutes!***



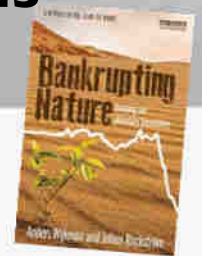
On the negative side

- Global investments in clean energy suffers setback - fr 318 Billion US in 2011 to 254 Billion US in 2013
- Investments in fossil fuel exploration > 700 Billion US in 2013 – a consequence partly of the “shale revolution”
- Support schemes for renewables weakened
- Energy efficiency still poorly recognized
- US policies still passive
- EU policies – uncertainty about 2030 and beyond

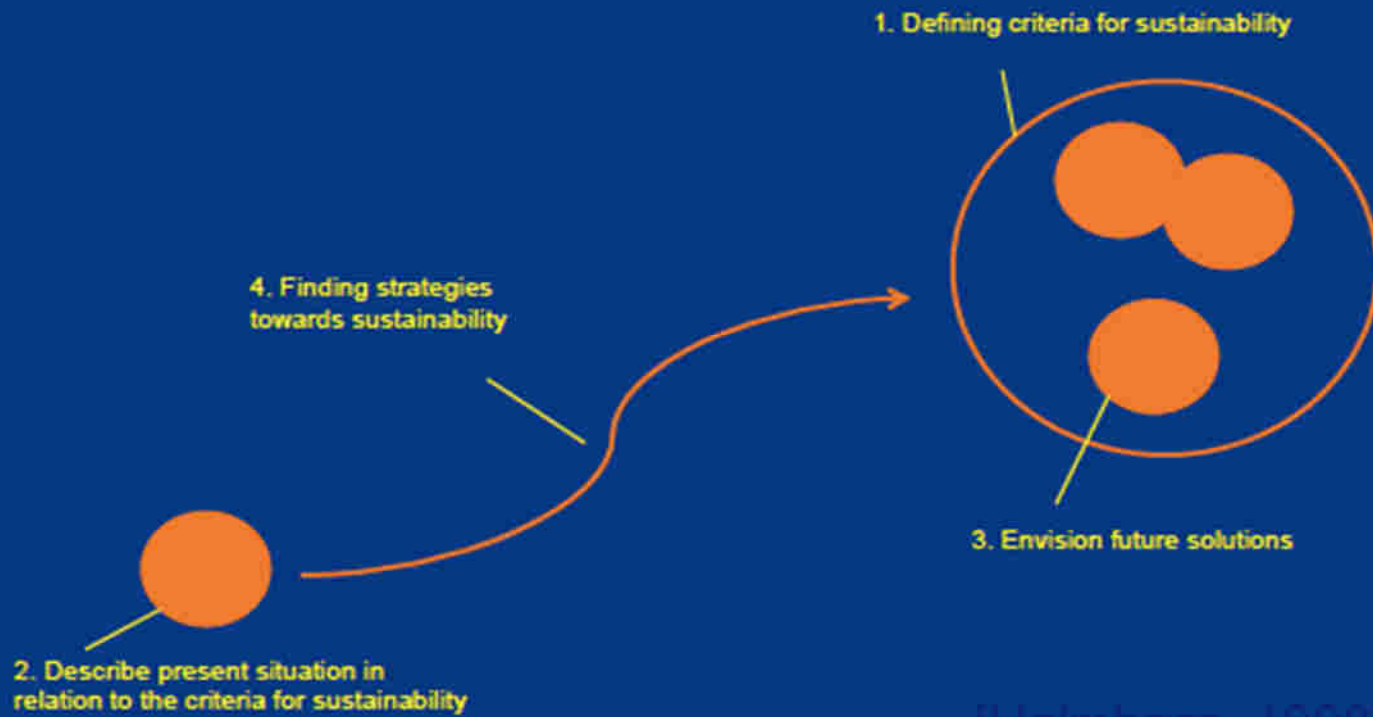


How to move forward?

- We need a vision for a sustainable society
- How much is lagom – sufficiency ?
- What is Quality of Life? Values!
- From Quantative to Quality Growth
- Launch of major reform of economics
- Analyze carefully the necessary transition
- Back-casting can be a useful tool
- Merge the agendas of finance, economy, employment, climate change, pollution and resource depletion and constraints
- The financial crisis is not about money alone – it is as much about energy and natural resources



Backcasting



[Holmberg, 1998]



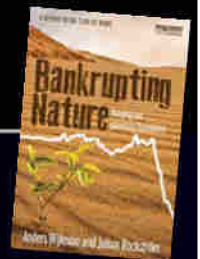
We need transformative solutions

- But focus today – if any – is on incremental change
- This will not do – We need technology leapfrogging and behavioral change
- Entrypoint should be: **Everything that is produced ought to meet the sustainability requirements for a world with > 9 Billion people**
- A Circular Economy represents transformative change. It would reduce energy and material demand and throughput by at least 50 %.
- A Circular Economy would require a radically reformed economic policy framework – and, in particular, other incentive structures – and new Business models
- The Public Sector ought to take the lead for transformative change



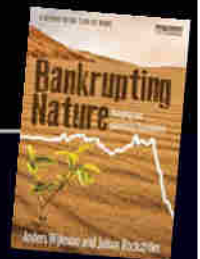
Strategy for Sustainability

- Priority to transdisciplinary science and education
- Bring in neuro science as well as behavioral science
- Reform economic and finance policy frameworks
- **Replace Economic Growth w specific welfare goals instead**
- Assign a value to Natural Capital
- Carbon tax + crash program in renewables and efficiency
- Circular Economy – a Performance Economy - tax resource use; no tax on labor
- Public Procurement proactive role in transformation
- Rethink Company Laws
- Strengthen Global Governance – start with EU + Asia
- Stabilise population
- A proactive Research Agenda



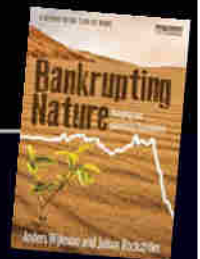
Possible action on energy transition

- **Quadruple clean energy investments – > 1000 Billion US/annum**
- **Add to that increased investments in efficiency**
- **Stable support schemes**
- **Increased funding for Energy R&D, not least market introduction**
- **Financial markets to be reformed; today 10-15 % of investments are still in fossil fuels against 2 % in clean energy**
- **Fund managers, not least pension funds, take stranded asset seriously**
- **Put pressure on pension funds to divest from coal and unconventional oil**
- **Change compensation schemes in financial institutions**
- **Multiply the issuing of green bonds**
- **Introduce a global carbon tax**
- **A global support system for feed-in tariffs in developing countries**



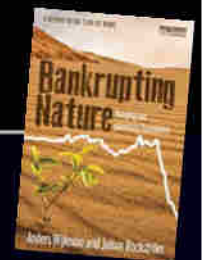
Move towards a circular economy

- Products designed to last longer
- Reuse, recycling and reconditioning of materials
- Service economy for maintenance and repair = jobs
- Requires new business models for HQ service and performance
- Promoted by tax reform; raising taxes on use of virgin materials while lowering taxes on labour
- Means less pressure on resources – both finite and renewables
- Will lead to significantly lower GHG emissions + new jobs
- The EU Commission Roadmap for a Resource-Efficient Europe!



Key figures about recycling:

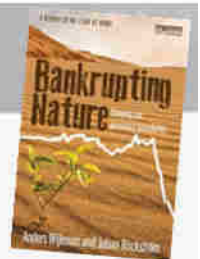
ENERGY SAVINGS THROUGH RECYCLING	
Aluminium	95%
Copper	85%
Lead	65%
Zinc	60%
Paper	64%
Plastics	80%



Functional sales do happen in B2B

- Rolls Royce leases jet engines
- Interface leases carpets
- Michelin leases tyres for trucks
- Xerox offers copying services
- Resource and energy use + CO2 emissions have decreased significantly. The companies have benefitted financially.

Now is time to move into the area of B2C – cars, appliances, electronic equipment, kitchens, furniture, textiles etc





December, 2009



March, 2010



October, 2010

Bold efficiency thinking is at the heart of *Factor Five*



**More ambitious even:
Building the Blue Economy**

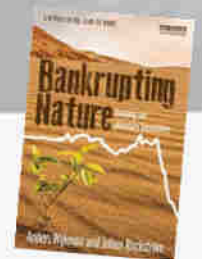
10 years, 100 innovations, 100 million jobs



The Blue Economy



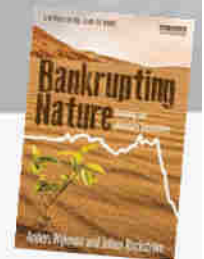
- by Gunter Pauli. From over 2.000 innovations, he selected 100 that are published on a weekly basis at www.blue.economy



To conclude:

A combination of technology and innovation, resource productivity (decoupling) and cultural change – stressing non-material aspects of life – is the hope we have

Labour productivity has increased twentyfold since 1850. It is not utopian to think of **resource productivity** increasing tenfold in 50 years! For that to happen, policy frameworks and Business Models must change - giving real priority to renewable energy, resource efficiency as well as sustainable land use



Time to reconnect to the Biosphere



