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Deriving targets for global resource use for planetary boundaries – material, water and land

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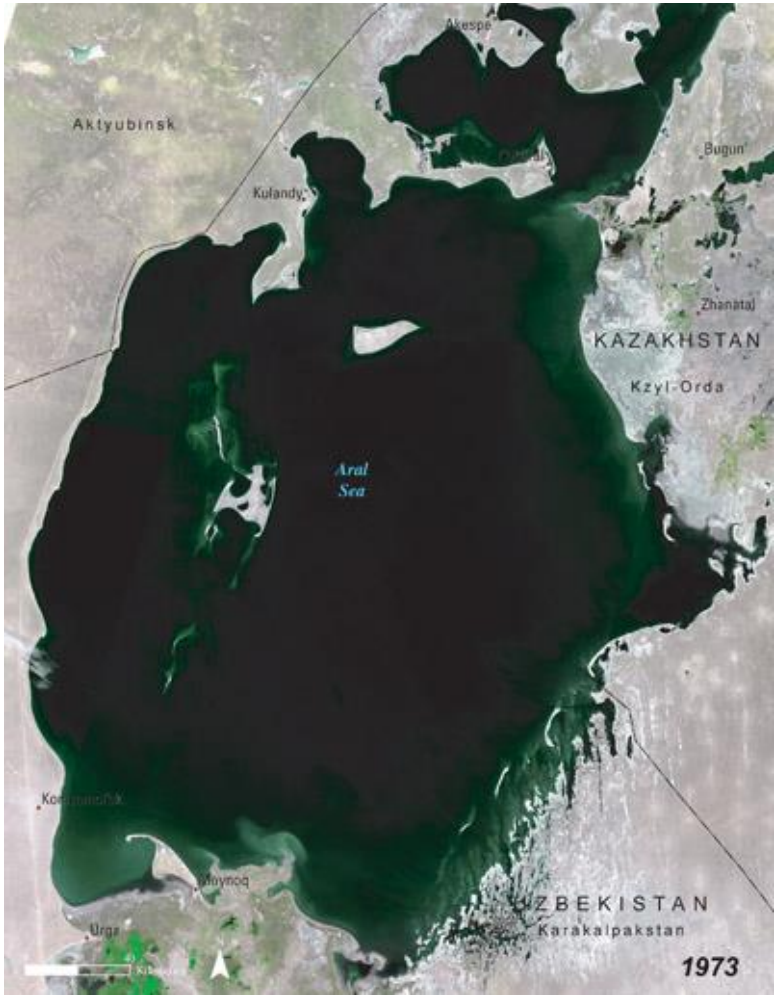
The Challenge:

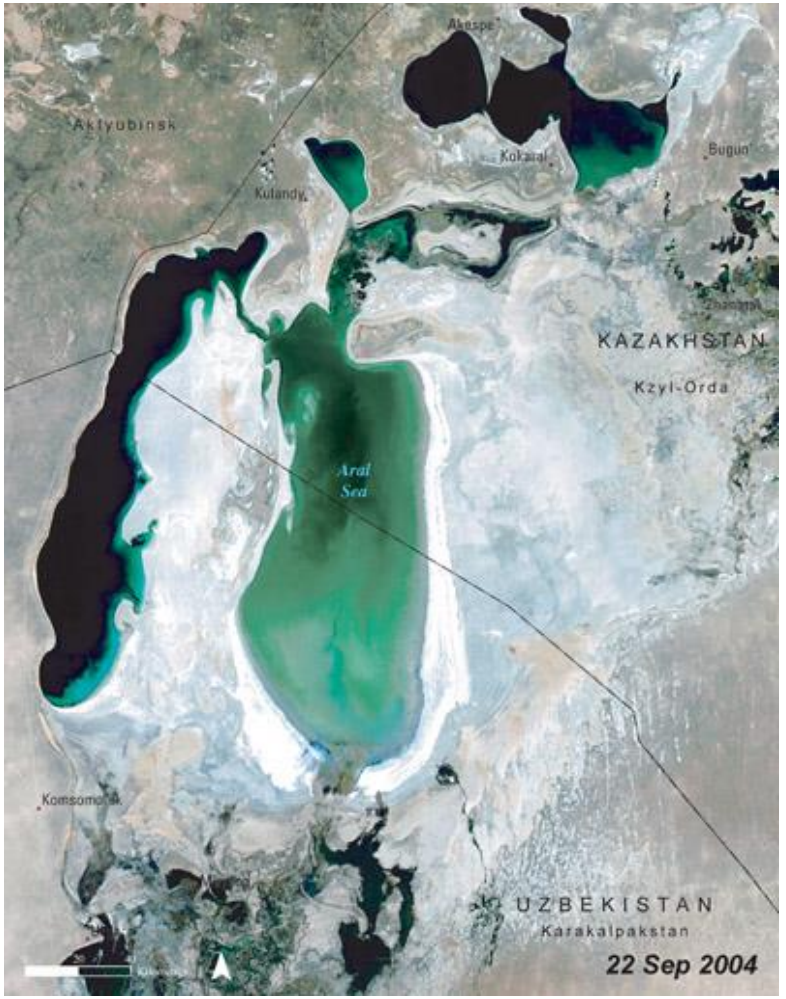
Why we need targets

Biodiversity Loss

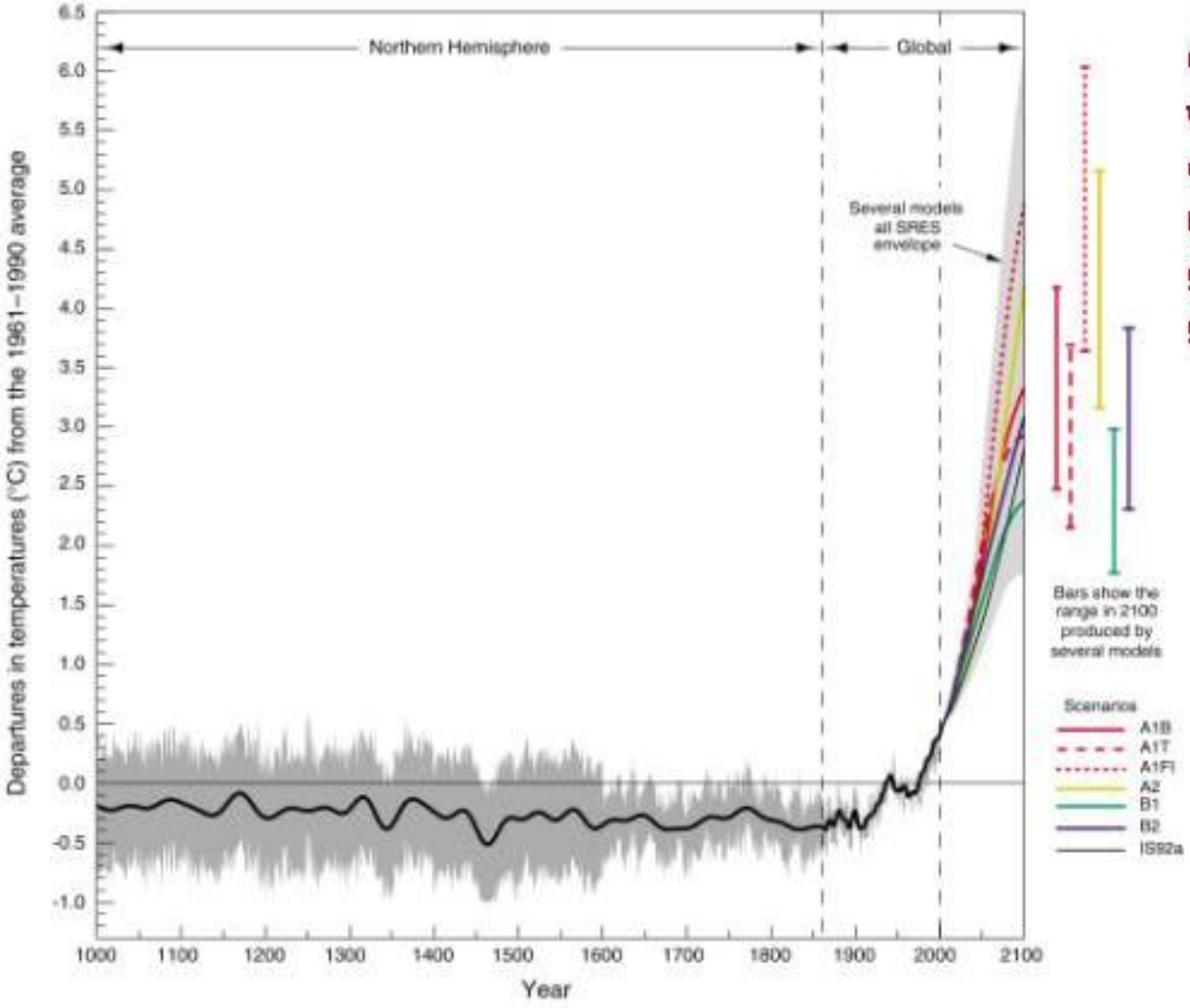
Desertification

Danger to freshwater reserves





Climate Change

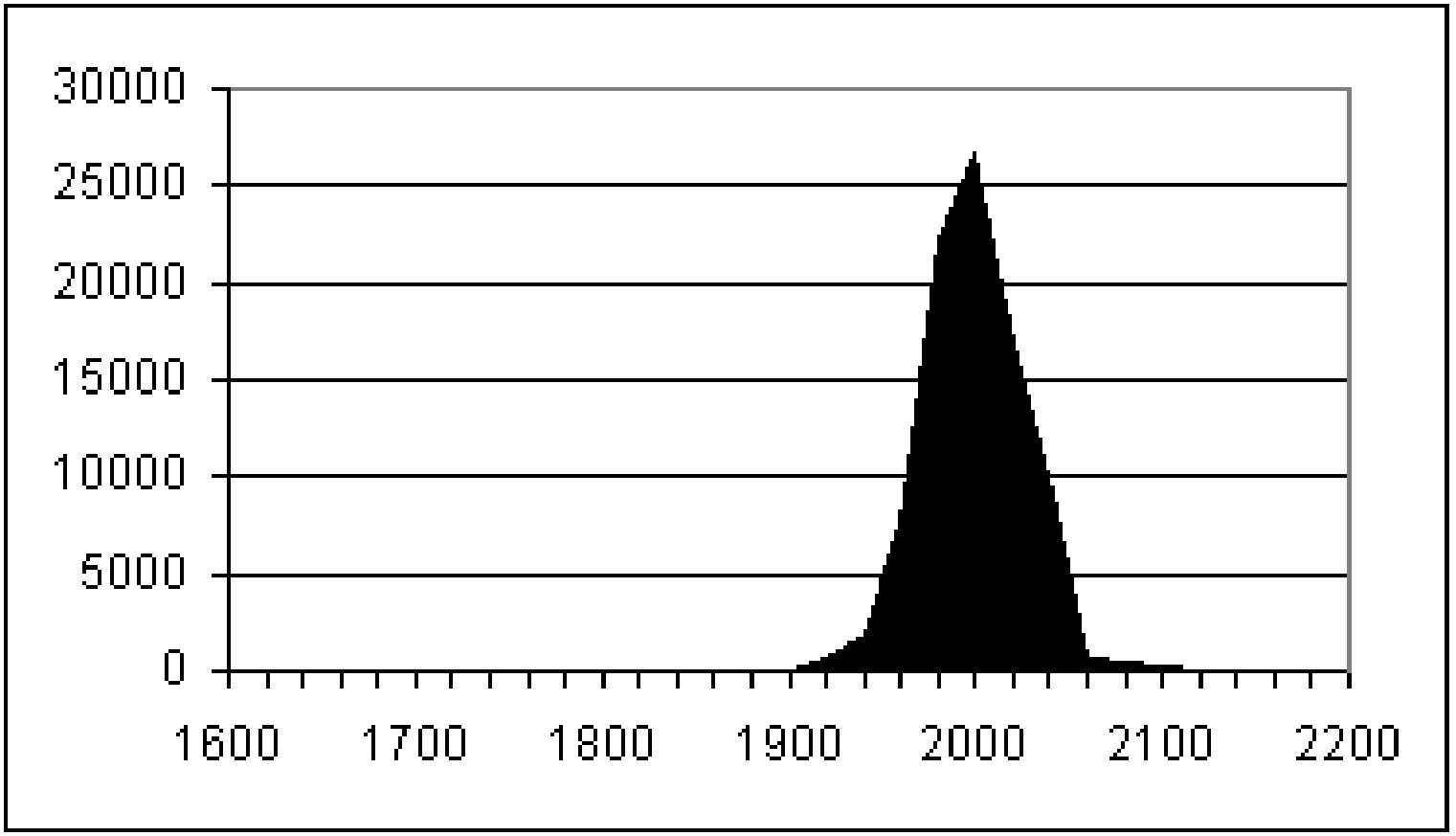


Global temperature will rise from 1.4-5.8°C over this century unless greenhouse gas emissions are greatly reduced

Source: IPCC Third Assessment Report, WG1

Peak Oil

Oil production in a ‚deep historical perspective'
(millions of barrels per year)



Source: Douthwaite, 2006

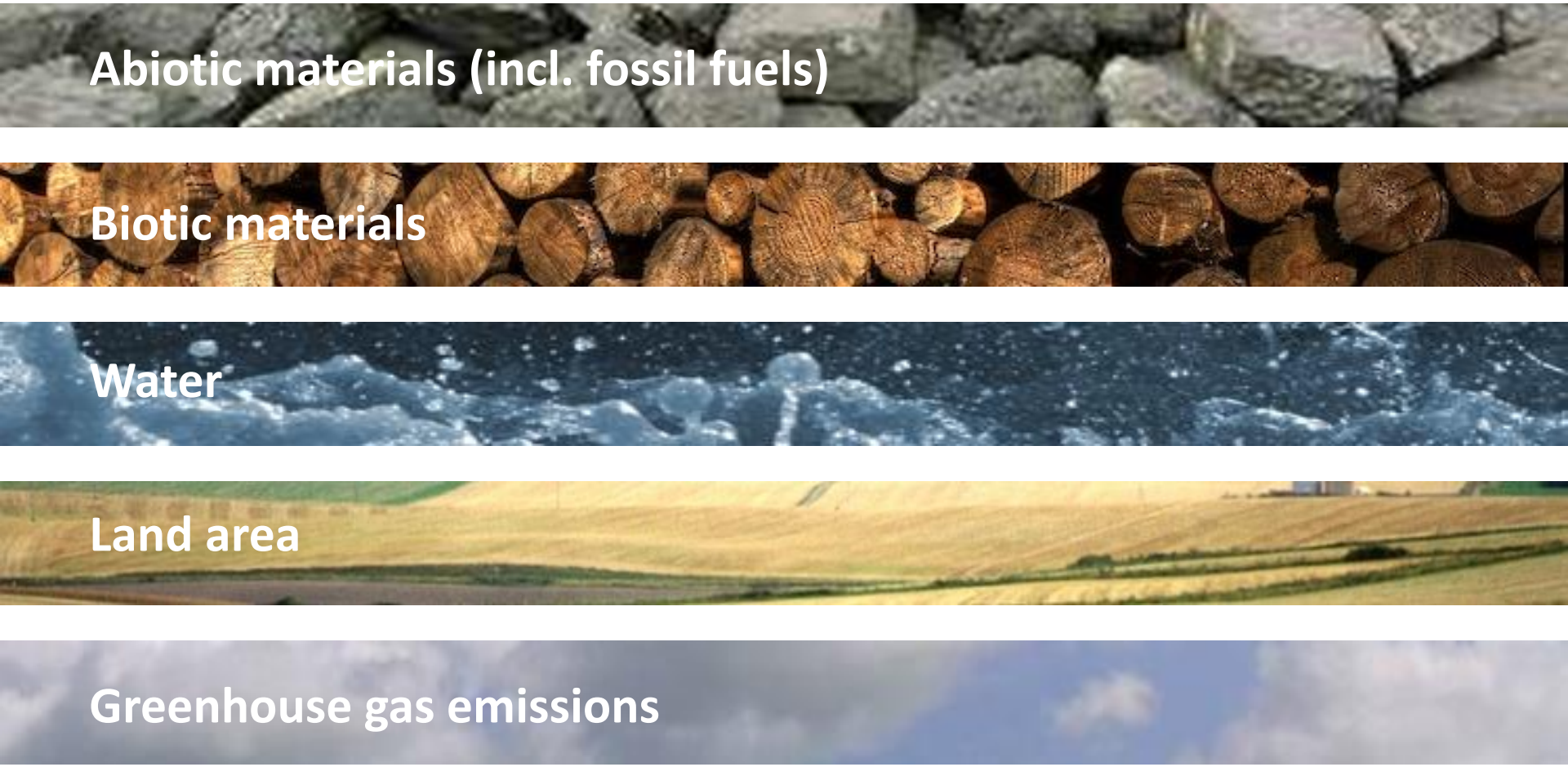
Global environmental problems


…caused by **extensive resource use** related to production and use of products.

Mitigate environmental problems by **reducing resource use in absolute terms**.



Resource use plus Carbon



Overall objective

Resource use categories

Greenhouse gas emissions

Epistemological challanges

Knowledge *and* awareness gaps

immediate impacts of extraction
– input perspective, plus impacts of the materials as outputs (solid waste, emissions to air, grey water)
– output perspective

complexity of ecosystems:
reactions to material extraction lead to
combined effects of materials flows
(including inputs and outputs)

Suggestion for a comprehensive approach

Defining a “safe operating space” (SOS):

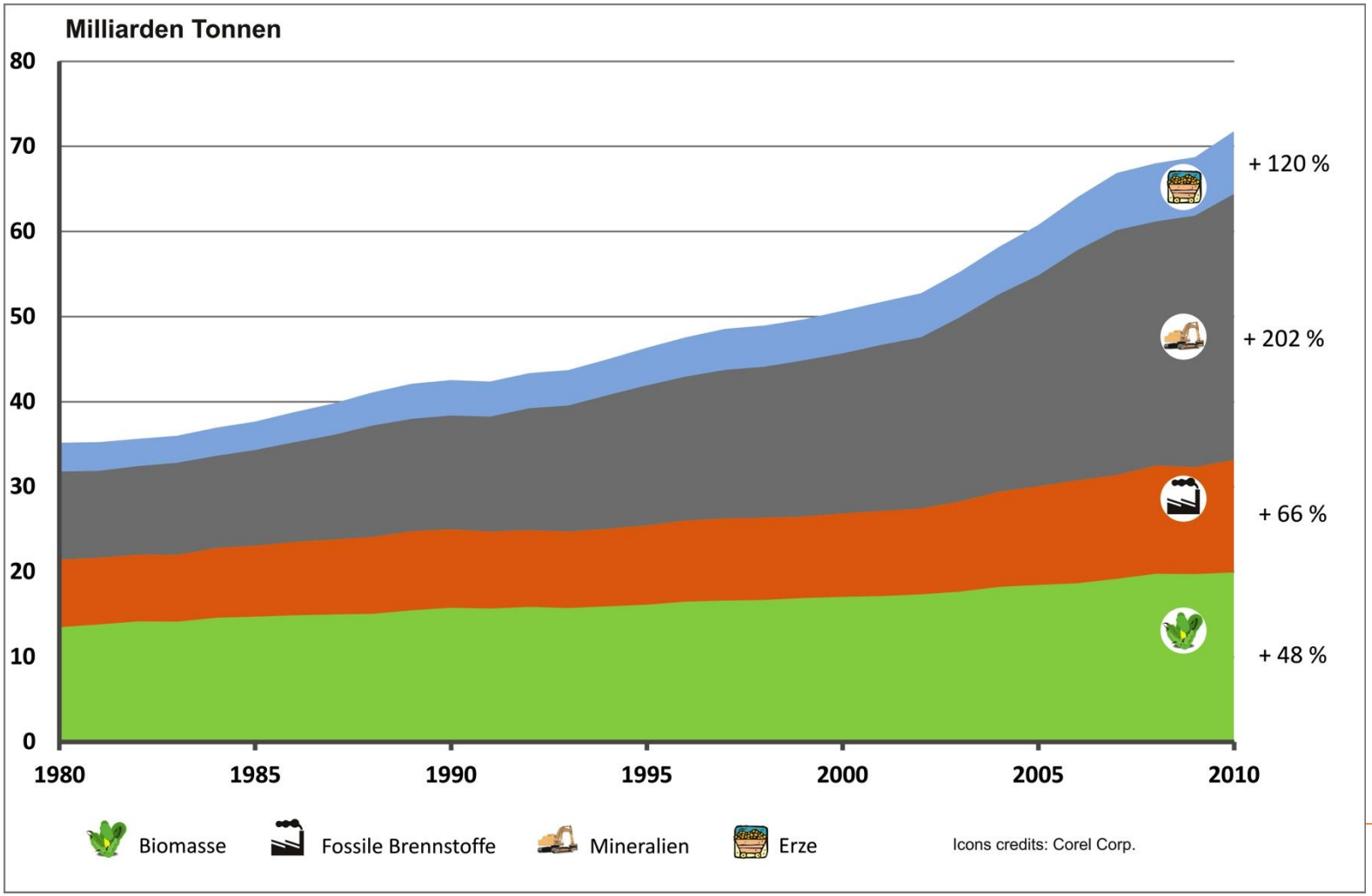
framework within which the functioning

of the Earth system and its ecological sub-systems

as well as societies is not at jeopardy

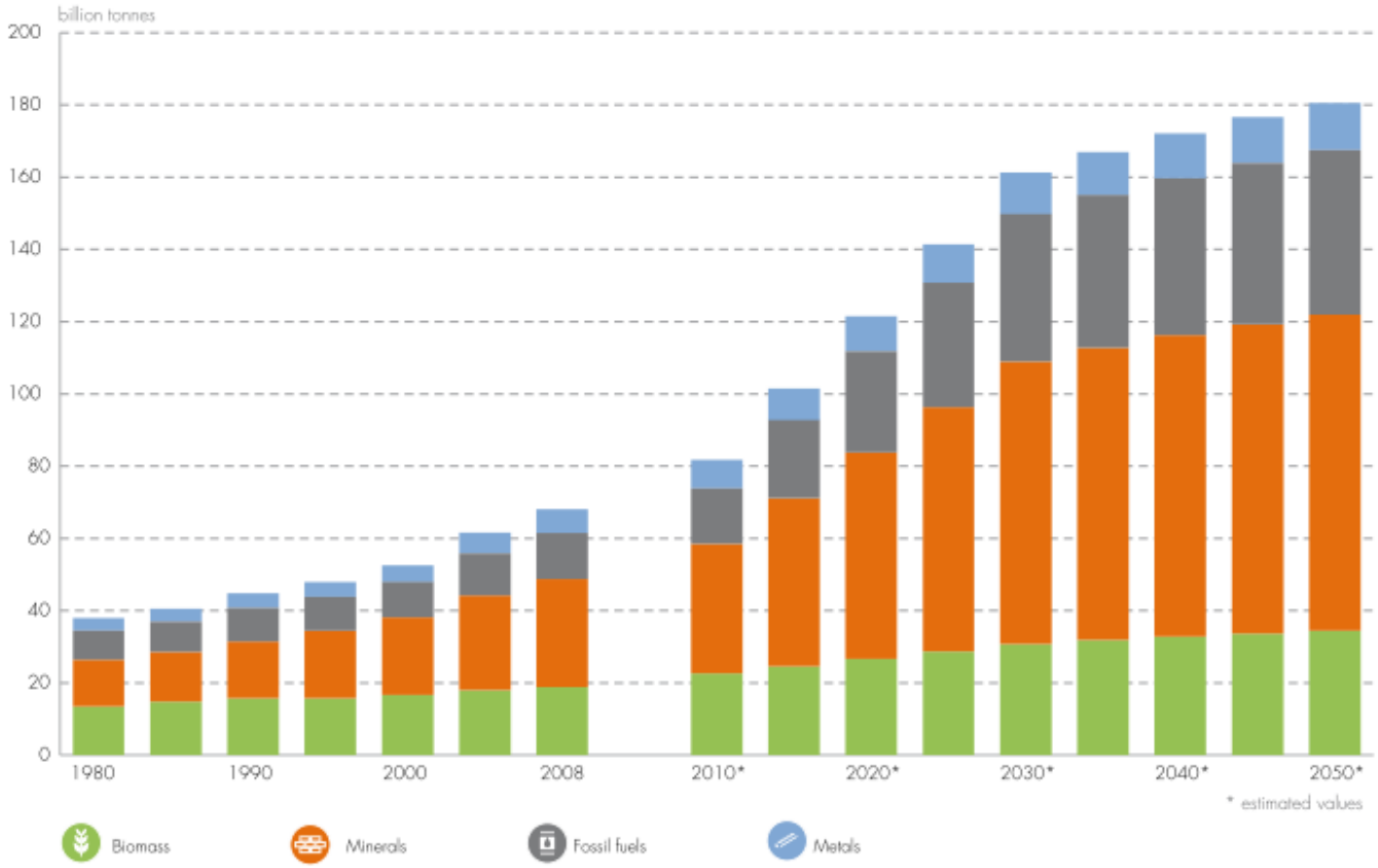
→ precautionary approach

Steady growth of resource use



Source: SERI

Suggestion for a comprehensive approach



Global material consumption 1980-2008 and estimations until 2050 (Dittrich et al. 2012)

The Research

The IntRESS project

IntRESS exploring options for global resource use

Basic Facts

- **Project for:** German Federal Environment Agency (UBA)
- **Funded by:** the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
- **Research ID (FKZ):** 3712 93 10
- **Project duration:** October 2012 to January 2016

IntRESS

exploring options for global resource use

1. We elaborate scientifically-derived suggestions for global resource targets

➡ Scientific analysis and expert discussion

2. We identify and analyze international options, processes and instruments for the implementation of a international sustainable resource use policy (“Windows of Opportunities”)

➡ Scientific analysis and stakeholder discussion

Umwelt Bundesamt

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

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IntRESS exploring options for global resource use

Objectives

- Derive **targets for sustainable resource use**

  categories of materials, water and land use

- Taking into account the **limited ecological capacities** of the global ecosystems

  (planetary boundaries)

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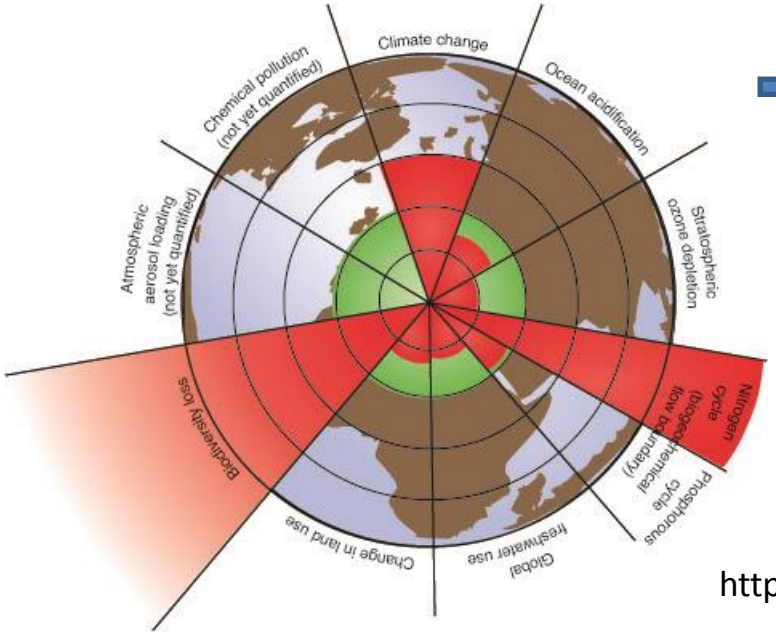
The Starting Point

Planetary boundaries and save operating space

Planetary Boundaries

Johan Rockström et al. (2009): Nine Earth system processes of crucial importance to prevent unacceptable environmental change on a global scale. These boundaries define the "safe operating space" for humanity with respect to the Earth system.



➡ Three of these boundaries have been passed already.

http://www.stockholmresilience.org

Rockström et al.: the concept of Safe Operating Space (SOS)

defining SOS: framework within which the functioning of the Earth system and its ecological sub-systems as well as societies is not at jeopardy

Transgession of two planetary boundaries already in 1970s and 1980s: N-cycle and climate boundary

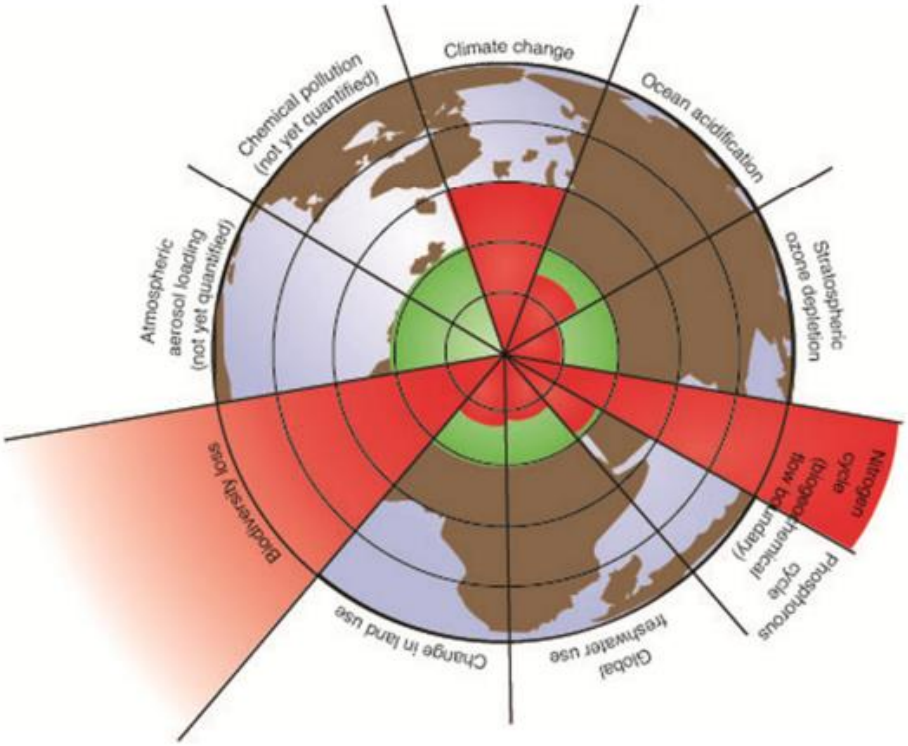
Biodiversity loss: boundary passed at local and regional scales

Critics claim that thresholds cannot be determined exactly,

⇒But: resource use is a crucial driver

⇒**therefore the precautionary principle should be applied**

Rockström‘s Planetary boundaries for water and land



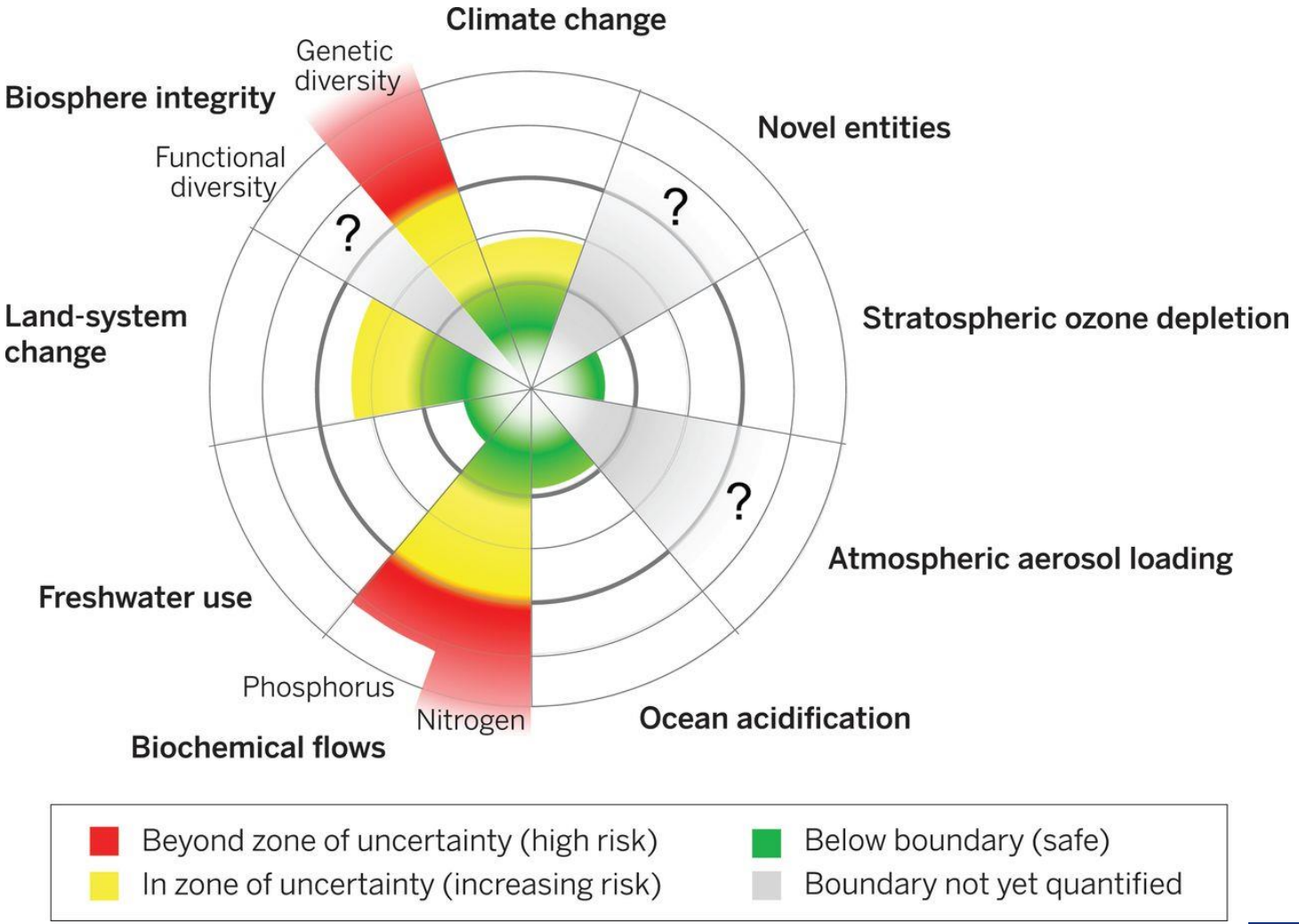
Planetary Boundary	Control variable and target
Land use	Land surface converted to cropland: 15 percent
Freshwater	Global human consumption of water: 4000 km^3/year

Rockström et al‘s (2009) planetary boundaries and resource use

Relation between Rockström et al.’s planetary boundaries and material use

Planetary Boundary (Rockström et al.)	Drivers and/or pressures of material use
Climate change	GHG Emissions due to combustion of fossil energy material
Stratospheric ozone depletion	Emissions of ozone-depleting substances (such as CFCs and halons)
Ocean acidification	Emissions of chemical substances (such as nitric acid or sulphuric acid)
Biogeochemical flows: inference with P and N cycles	Phosphor influx due to agricultural activities; Biomass extraction
Rate of biodiversity loss	GHG Emissions due to combustion of fossil energy material; Biomass extraction
Chemical pollution	Emissions of chemical substances based on abiotic raw materials
Atmospheric aerosol loading	Emissions of aerosols due to burning of fossil energy materials and biomass

Current status of the control variables for seven of the planetary boundaries in 2015



Will Steffen et al. Science 2015;347:1259855

Published by AAAS

Steffen et al.'s (2015) planetary boundaries and resource use (preliminary considerations)

Planetary Boundary (Steffen et al.)	Drivers and/or pressures of material use
Freshwater use	See IntREES water target suggestions
Land-system change	See IntRESS land target suggestions
Climate change	GHG Emissions due to combustion of fossil energy material; Biomass extraction (reelation to IntRESS materials and land targets)
Biosphere Integrity	Materials and land use have impacts on biosphere integrity (see IntRESS materials and land targets)
Ocean acidification	Emissions of chemical substances (relation to IntRESS materials targets)
Stratospheric ozone depletion	Emissions of chemical substances based on abiotic raw materials (relation to IntRESS materials targets)
Atmospheric aerosol loading	Emissions of aerosols due to burning of fossil energy materials and biomass (relation to IntRESS materials targets)
Novel entities	Must be in some way be related to material use

Suggested answers:

Targets for materials (, water and land)

Our suggestion for a “safe operating space” (SOS)

The question: when was the planet still “save”?
(given the mentioned epistimolgical challenges)

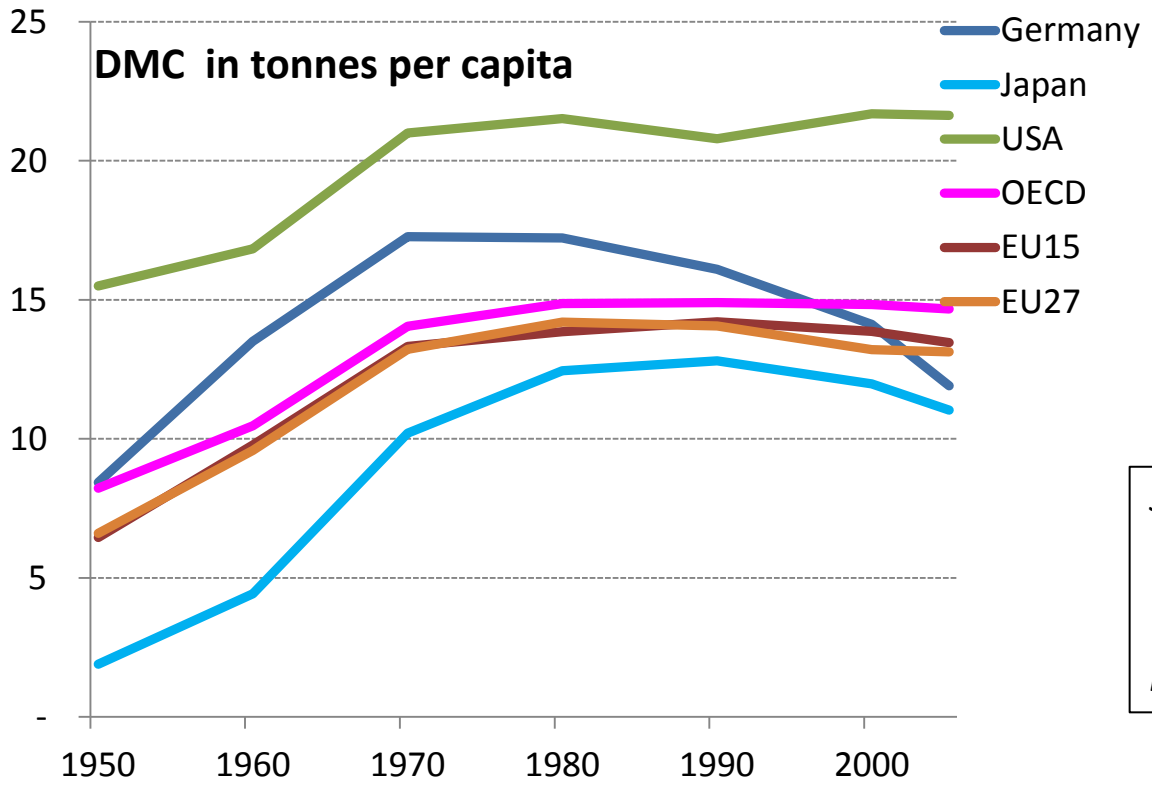
Our suggested answer
(for various reasons / literature review):

1970

(for purely environmental reasons –
socio-economic arguments to be discussed later)

Suggestions for a comprehensive approach (MATERIAL)

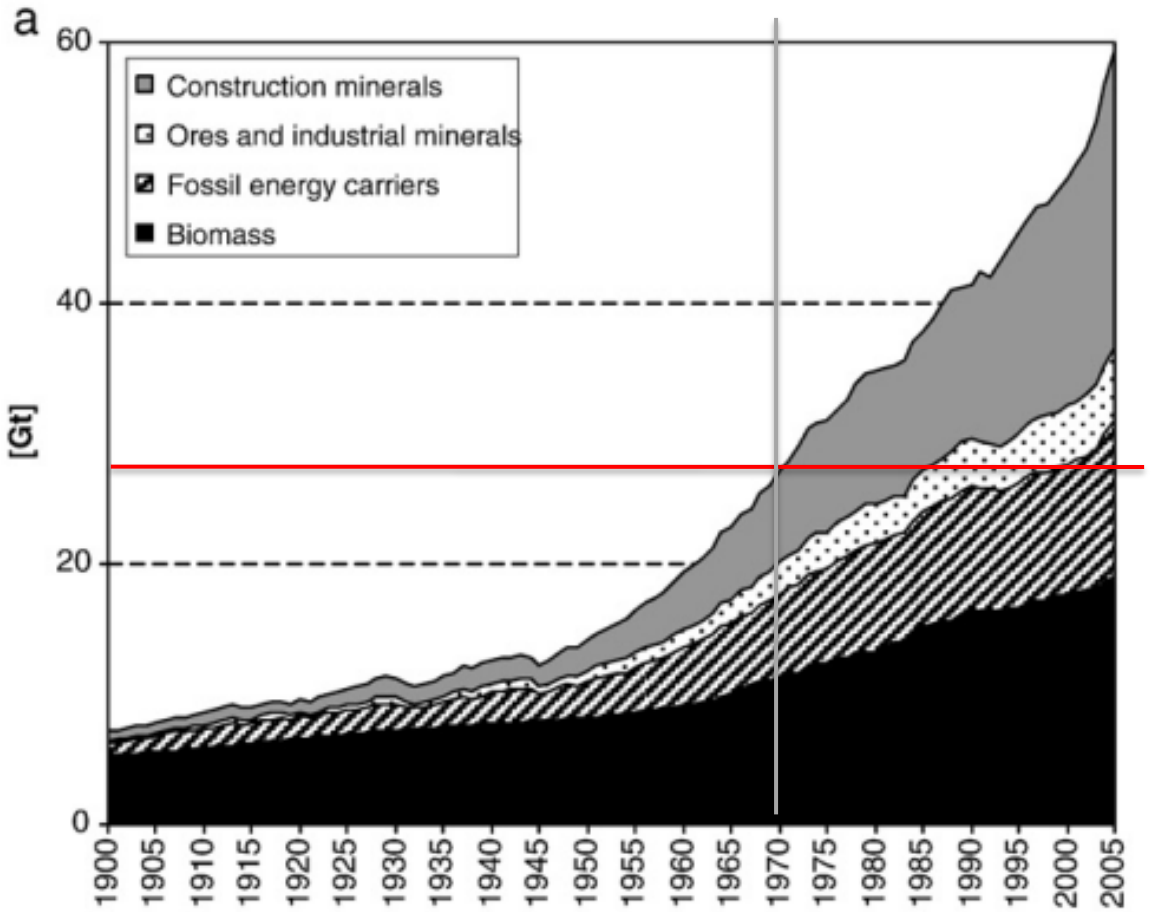
Fischer-Kowalski/Wiedenhofer (2014). The 1970s-Syndrome: stagnation of resource use in high income countries



Source: Fischer-Kowalski/ Wiedenhofer.Presentation at WWWFOREUROPE, 17.12.2014

Based on SEC database

Suggestions for a comprehensive approach (MATERIAL)



1970: 27.3 bn tonnes estimated DMC

Materials use (DMC = DE) by material types in the period 1900 to 2005: total materials use in Giga tons (Gt) per year (Krausmann et al. 2009)

Our proposal for global target derivation on MATERIALS use

1970 as base year for target: 30 bn tonnes used extraction

assumption: unused extraction adds another 40-50% to used extraction

global total material consumption: 45 bn tonnes

- Differentiate used and unused extraction
- Formulate sub-targets for disaggregated abiotic materials
- Derive targets for biotic and abiotic material extraction separately

Suggested target values for MATERIALS use

- Global target: Total material consumption limited to 45 bn tonnes
- Per-capita target: 5 tonnes based on TMC,

to be complemented by socio-economic indicators

- Further sub-targets: separate sub-target for sand and gravel

THIS IMPLIES

a factor of 2 reduction of global TMC from today

a factor 4 reduction of global TMC

relative to estimates of 180 bn t TMC by 2050

a factor 10 reduction for industrialized countries

relative targets: 5.6 tonnes per capita TMC (at estimated population of 9 billion)

How to get there? (MATERIAL)

Infrastructure: no net additions to stock

Extraction vs. recycling:

Mid-term:
balancing use of primary and secondary materials

Long-term:
no extraction of primary materials
(for some materials, such as aluminium)

Our proposal for global target derivation and suggested targets on WATER and LAND use

To come (summer/autumn 2015).

IntRESS exploring options for global resource use

Next steps

- **Finalisation** of materials and land papers (summer 2015)
- Horizontal paper and **workshop** (8th October 2015, Berlin) combining the categories and integration of socio-economic aspects (SAVE THE DATE!)
- **Presentation** and discussion at WRF Davos (12-14 October)
- **Final report:** 1st half of 2016

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Thank you very much for your attention

Vielen Dank für Ihre Aufmerksamkeit!

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und Verena Stricks

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12. Juni. 2015