

Planetary Boundaries as potential measurable aspects in a global model

What aspects?

- Physical climate – ppm CO₂, Wm⁻²
- Physicochemical processes
 - aerosols
 - ocean pH
- ‘Human’ processes
 - Land use change
 - Water abstraction
 - Chemical pollution (ozone depletion)
- Biogeochemical processes – N and P cycles
- Ecological processes – biodiversity loss

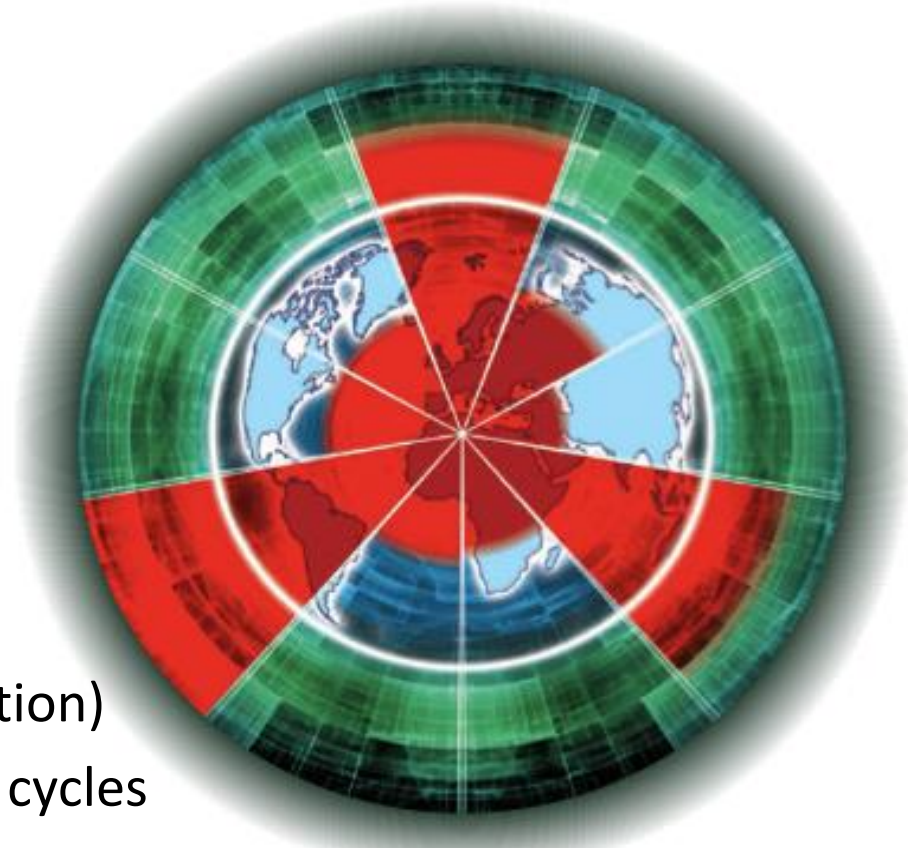


Image: © Edward Elgar 2014

A global model of what?

- Risks to social systems (LAWM)
- Consequences of resource use (WORLD)
- Risks of biophysical thresholds (ESCIMO?)
- Consequences of “system perturbation” (???)

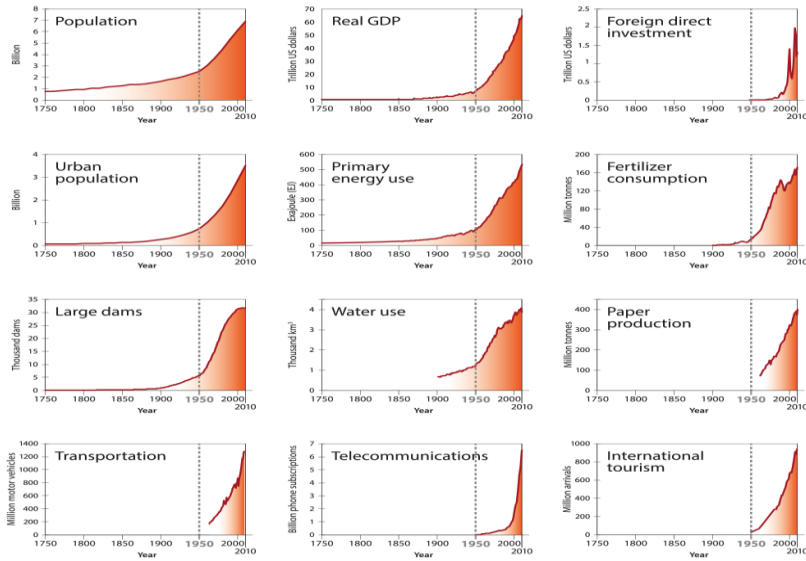
Limits to Growth:

“With the model we are seeking to understand the causes of these trends, their interrelationships, and their implications as much as one hundred years in the future.”

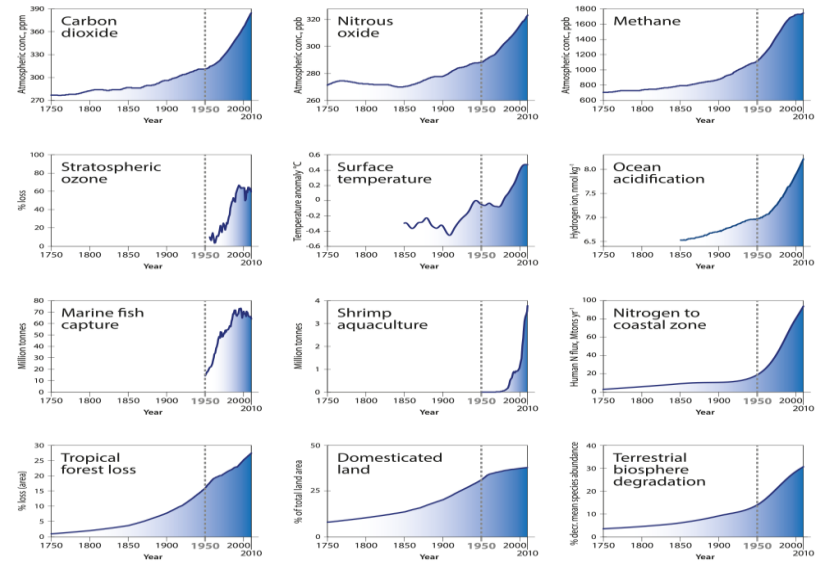
The linear Anthropocene:

Steffen and co-authors (2015) 'The trajectory of the Anthropocene: the Great Acceleration'; published in *The Anthropocene Review*

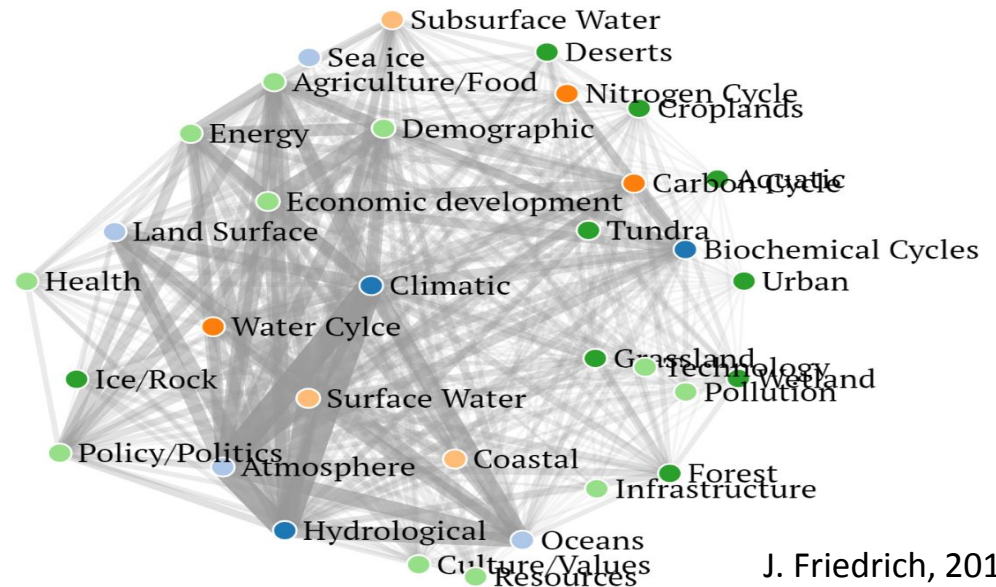
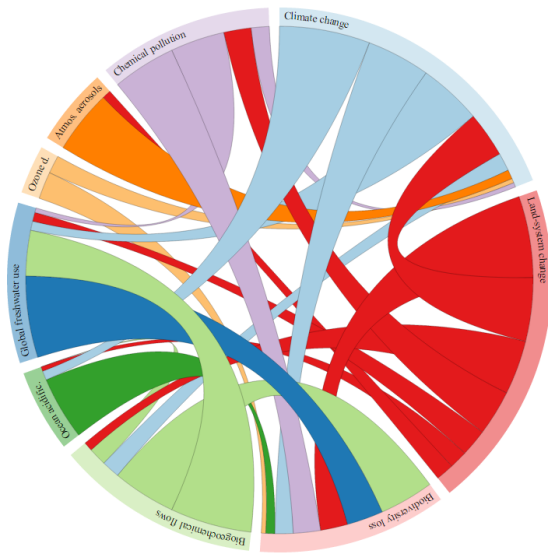
Socio-economic trends



Earth system trends



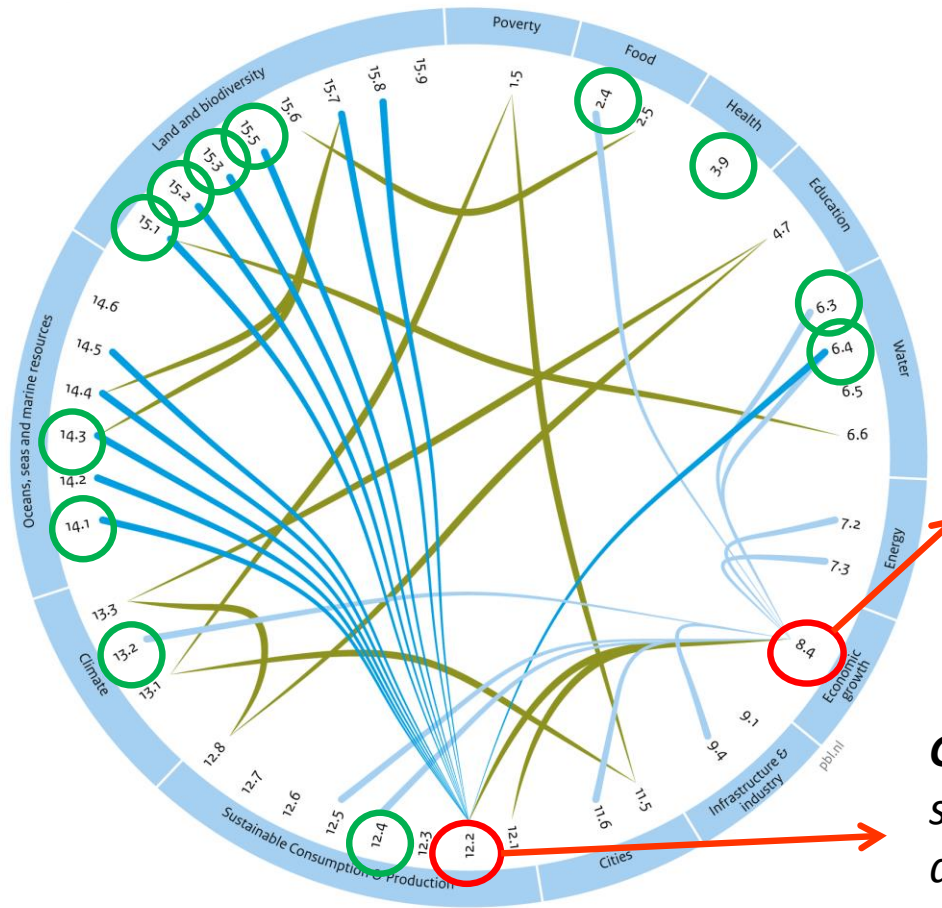
<http://www.slideshare.net/IGBPsecretariat/great-acceleration-2015>



Muddles in models

J. Friedrich, 2013

Sustainable Development Goals – Links among the environment-related targets



Goal 8

- resource efficiency in consumption and production;
- decoupling of economic growth and development from resource use and environmental degradation

Goal 12

sustainable management and efficient use of natural resources

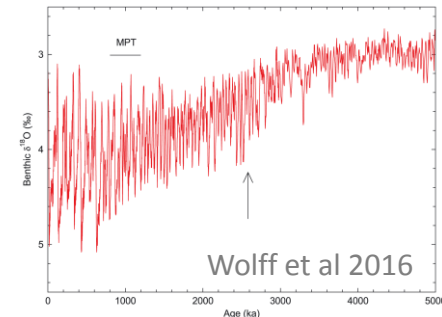
Targets with overlapping scope
Sub-targets under an overarching target

○ Planetary boundary related targets

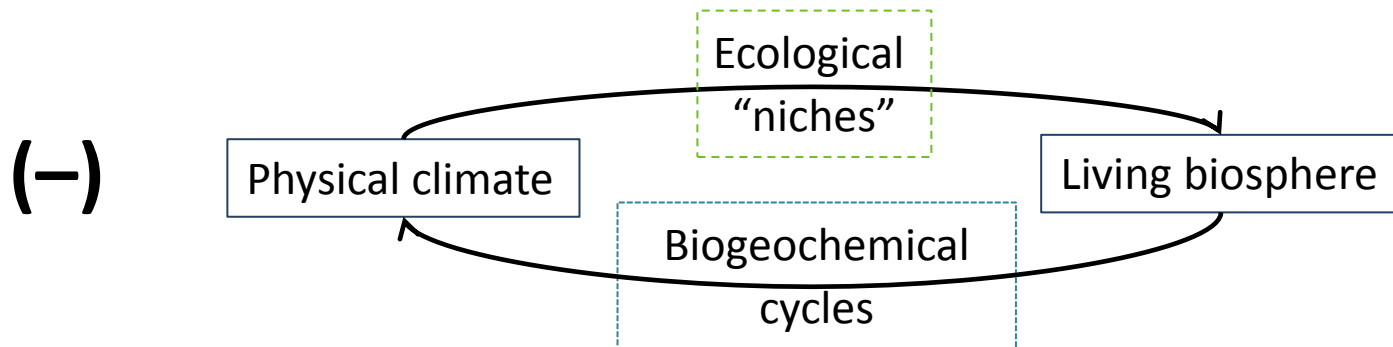
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What is the planetary boundaries system?

- “Holocene-like state”
- Compartmentalised biophysical “processes”
- Invisible, undifferentiated human – unclear drivers



5 Ma Earth history
Glacial cycles since 2.6Ma
Strong since mid-Pleistocene



Characteristics?

- Precise and transparent representation of assumptions
- Full technical documentation
- Open to inspection and criticism by all

“There is more to integration, however, than combining algorithmic techniques. *There is also the issue of problem formulation.*”

Hooker, Hybrid modelling, 2011,

WORLD

What if present consumption trends continue?

- Population
- Food production
- Industrialisation
- Pollution
- Resource consumption

LAWM

What is the material viability of a world free of misery of poverty ?

- Production*
- Energy
- Pollution
- Non-renewable resource

** nutrition, shelter, education, capital goods, other consumer goods*

Other information:

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European Union and Sustainable Development: Challenges and Prospects

19-21 October 2016, Clermont-Ferrand, France

https://www.univ-bpclermont.fr/IMG/pdf/call_for_paper-_EUSD_-_OR2D.pdf

3rd LOOPS workshop, October 2016 – date to be finalised...

Towards co-evolutionary modeling of global society-environment interactions

PIK, SRC, Southampton University, and partners

(old) <https://www.pik-potsdam.de/members/donges/loops-2014-workshop>

Thank you!

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