

The State of Sustainability Science

A Presentation for the Stockholm Seminar

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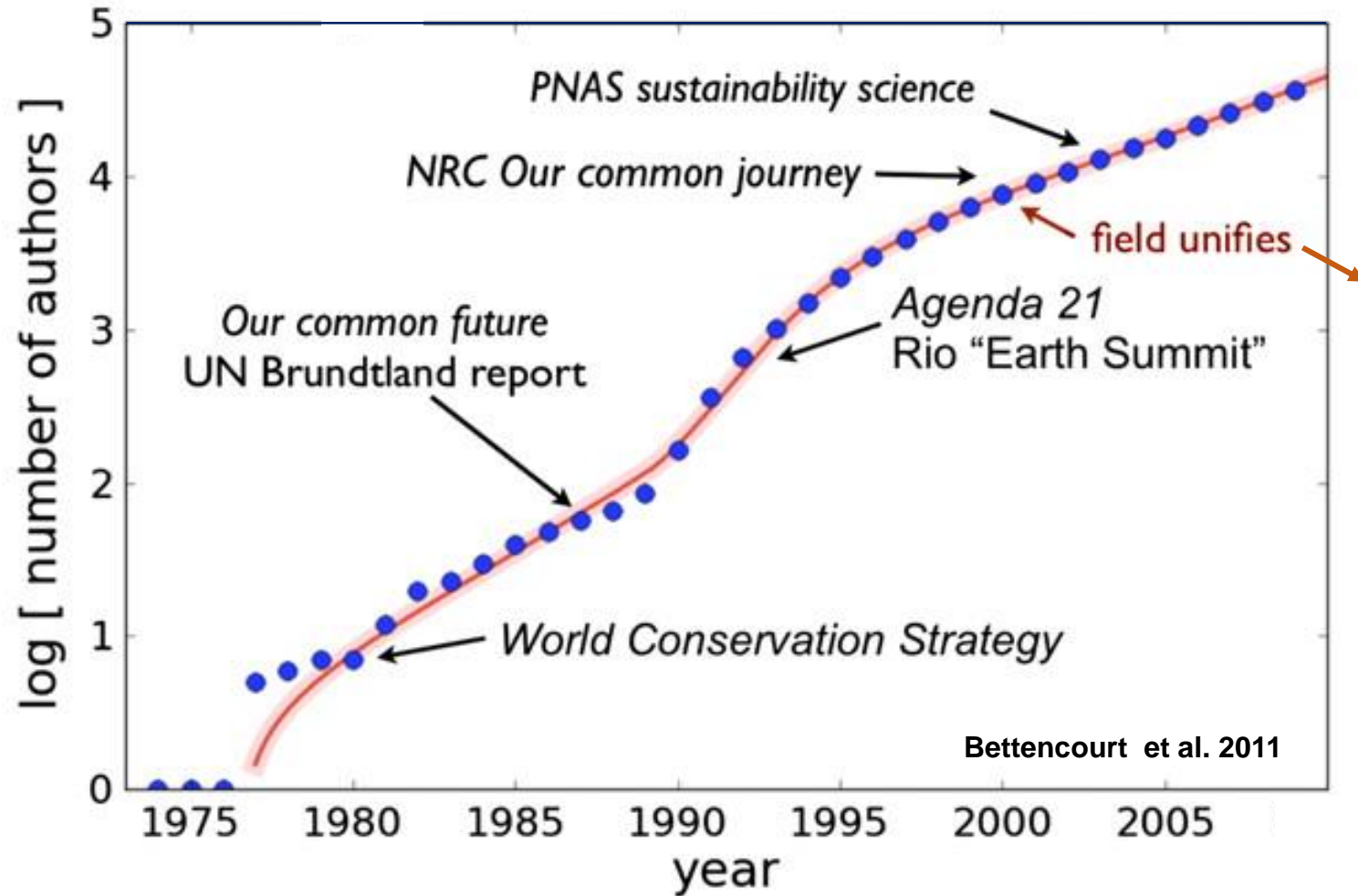
An intergenerational perspective....



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Science of Sustainable Development



Friberg's Herrgård, 2001

Sustainability Science today...

- 1) An *emerging field* of ‘use-inspired’ research and innovation, like agricultural, health science;
- 2) *Defined* by the practical problems it addresses, i.e. the problems of sustainable development;
- 3) *Conducted* by drawing from and integrating basic research on human-environment systems from the natural, social, medical and engineering sciences;
- 4) *Committed* to linking knowledge with action through the design, implementation & adaptation of improved practices, technologies and policies.
- 5) *Building* a presence in research literature, degree programs, a next generation of sustainability scientists, (some) career tracks.

“A field of ‘use inspired’ research?”

Pasteur’s Quadrant

Considerations of use?

No

Yes

Research
inspired by...
Quest for
fundamental
understanding
?

No

“Soaking
and
poking”

Applied
research
(Edison)

Yes

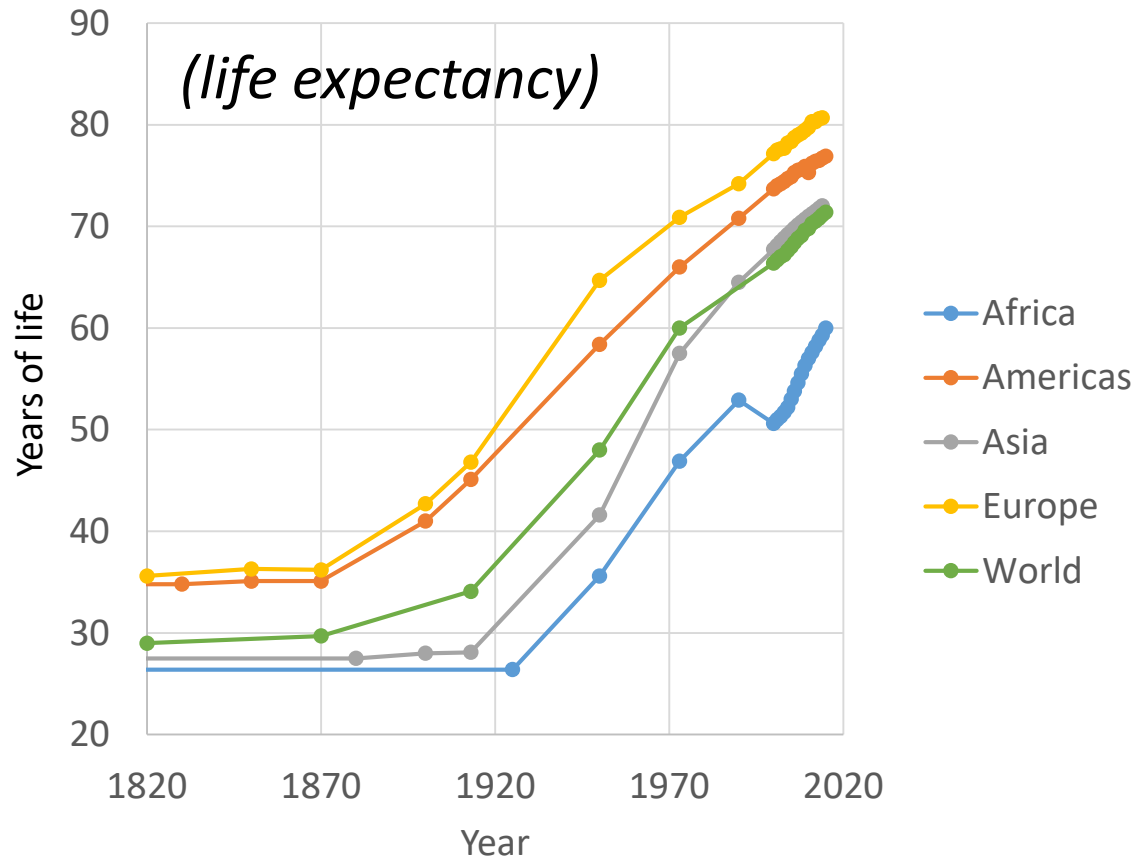
Basic
research
(Bohr)

*Use-inspired
research
(Pasteur)*

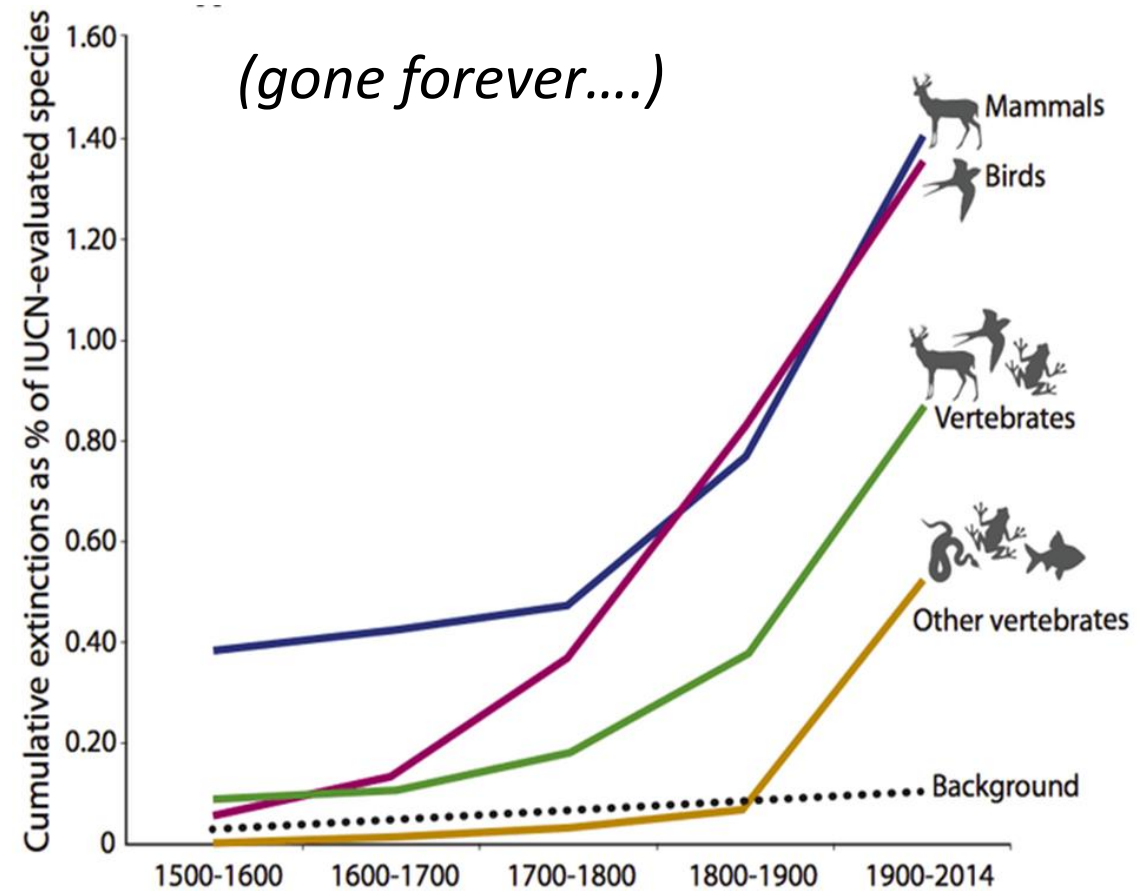
(redrawn from Stokes, 1997)

Defined by the practical problems it addresses?

The “Great Escape”

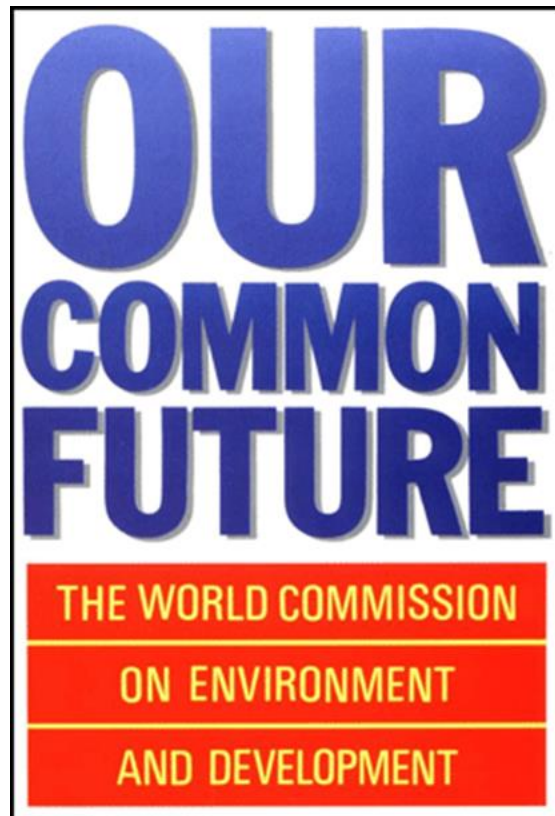


“The Great Extinction”



“Defined by the practical problems it addresses”?

Sustainable Development



Goals for sustainability development?

- “Human well-being” is emerging as a unifying social goal for sustainable development
 - Multidimensional: relative importance of the particular constituents of well-being vary across time, place and people
 - But with a common commitment to equity, within and between generations
- Development is sustainable when its success in enhancing *our* well being here and now does not come at the expense of *others'* well-being elsewhere or later.
- Sustainable development is thus a radically redistributive project, inseparable from politics.



Create Your Better Life Index

Rate the topics according to their importance to you:

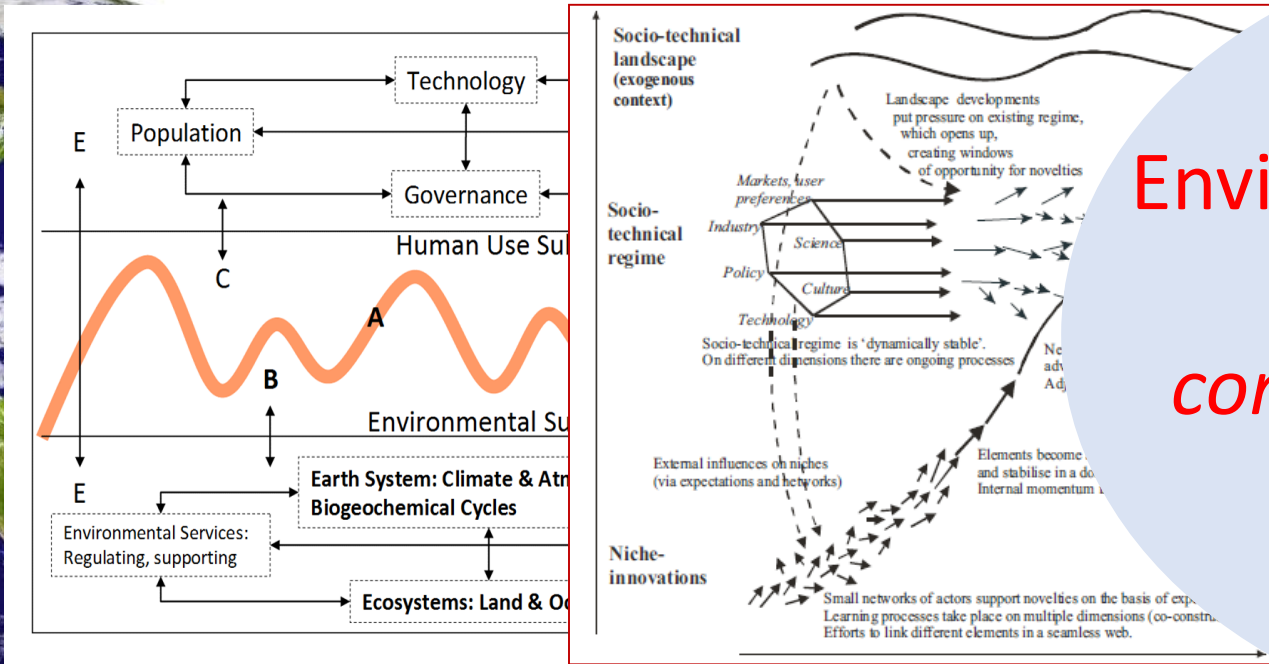
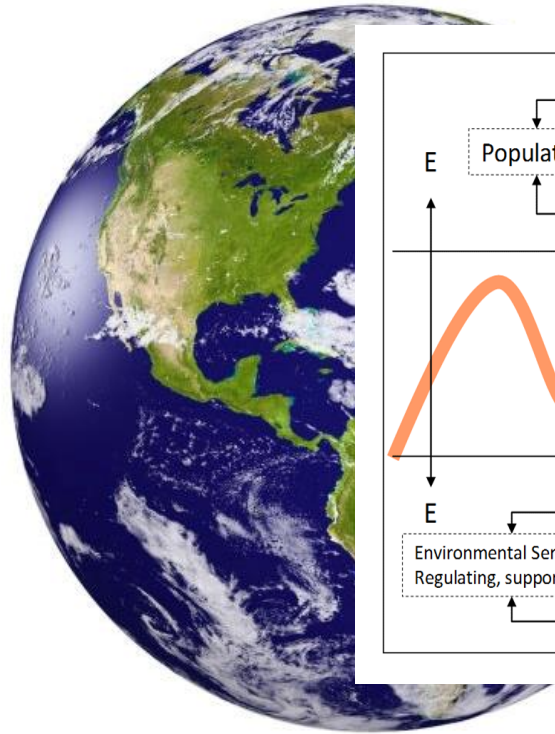
A screenshot of the OECD Better Life Index creation interface. It shows a list of ten topics, each with a corresponding icon and a slider control. The sliders are positioned to indicate their relative importance. At the bottom, there are "Reset" and "Help" buttons.

Topic	Relative Importance (Slider Position)
Housing	High
Income	Medium-High
Jobs	Medium-High
Community	Low
Education	Medium
Environment	High
Civic Engagement	Low
Health	Medium
Life Satisfaction	Medium
Safety	Low
Work-Life Balance	Medium

What is the role of sustainability science?

- “Inform agitation” for the radical transformation of “business as usual” that will be needed to secure sustainable development
- Requires raising our ambitions from treatment of individual “diseases” stemming from human-environment interactions to the promotion of overall “wellness...”
- *Unit of analysis* for sustainability science should thus be long term, large scale trajectories of development
- Work of sustainability science should be to help society...
 - *Assess the sustainability of recent development trajectories*
 - *Diagnose the causes of unsustainable development trajectories*
 - *Prescribe interventions to promote transitions from unsustainable to sustainable development trajectories*

What are the principal contributions of the various “earth system” frameworks used to organize sustainability science research?



→ Interactions of Environment/Development as a complex adaptive system driven by innovation

What must be sustained to achieve the goals of sustainable development?

- A central question for sustainability science...
- ... on which natural scientists of the early “sustainability science” community had virtually nothing coherent to say
- ... but on which resource economists, led by work at the Beijer Institute, began to build what has become the core theoretical foundation for the field:
- The idea that the ultimate foundations on which people now and in the future can build their own versions of well being is their stock of “capital assets” ...

What are we trying to sustain?

Goals of SD

→ Interactions of Environment/Development as a *complex adaptive system* driven by *innovation*

Asset Stocks



INCLUSIVE HUMAN WELLBEING
across places, generations



“INCLUSIVE WEALTH”
of relevant capital asset stocks should not decline

What stocks of capital assets constitute the foundations (think “determinants” or “state variables”) of sustainable development?



Capital Assets of Inclusive Wealth

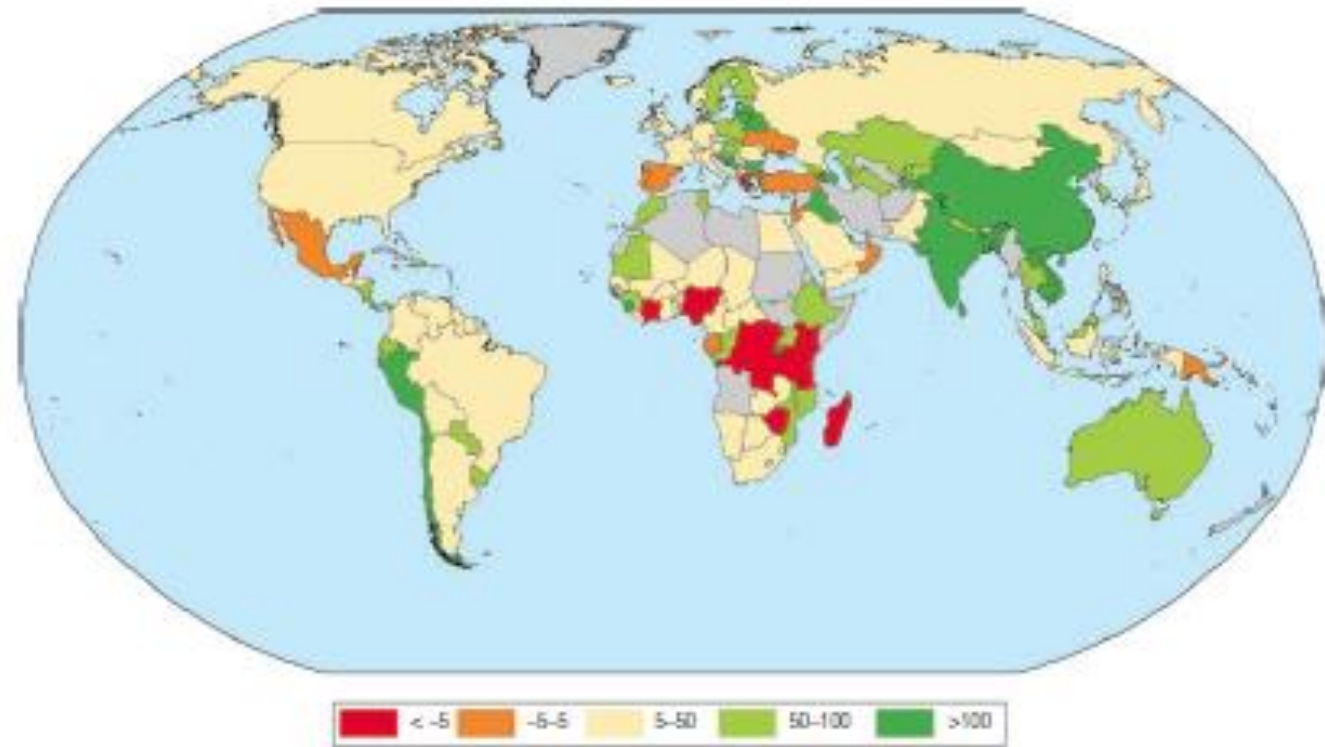
N-Biota
N- PhysChem Env
N-Minerals
N-Geography

A-Human
A-Manufactured
A-Social
A-Knowledge

How is current development doing with respect to sustaining the asset stocks essential for future human well-being?



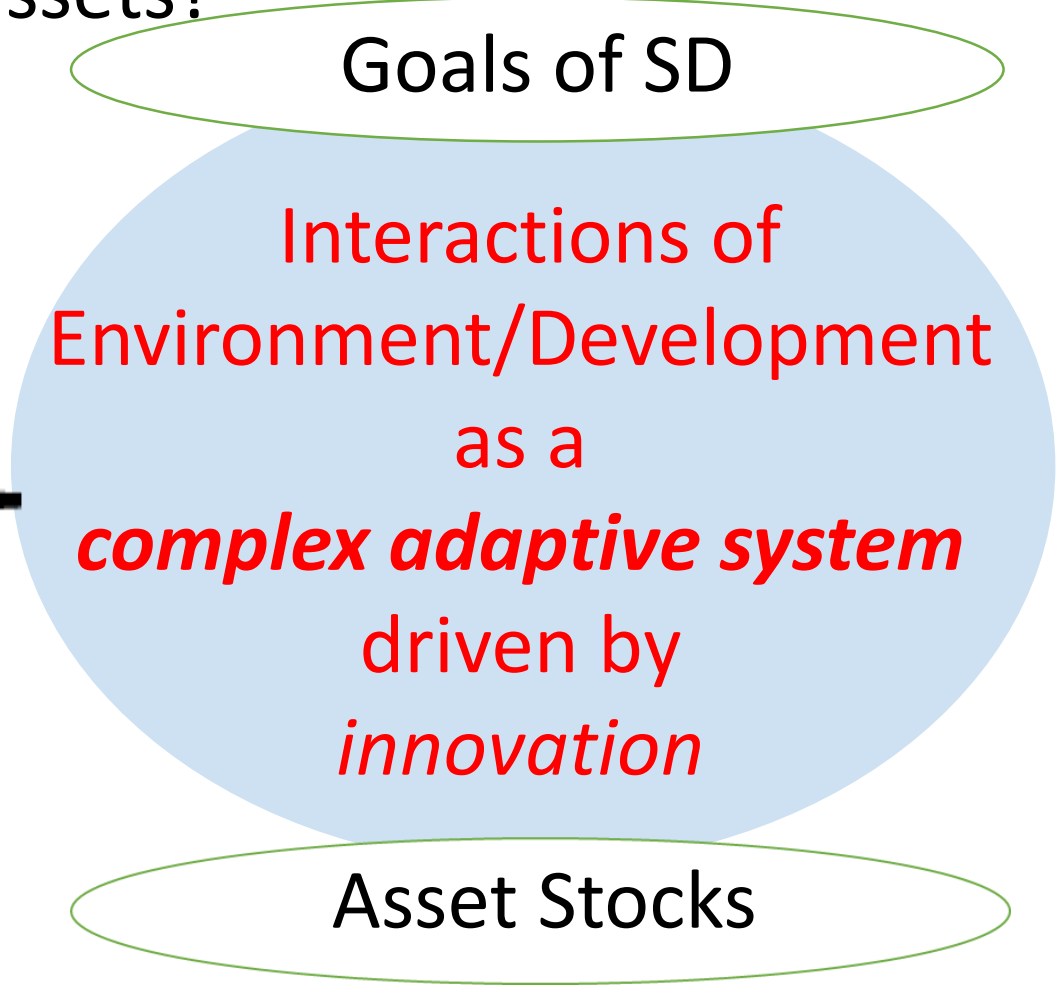
MAP 2.1 Percent Growth in Total Wealth Per Capita, 1995–2014



→ Most assets still left out, major challenges in “shadow price” valuation

What properties of the earth system are most significant for future efforts to create human well-being while sustaining essential capital assets?

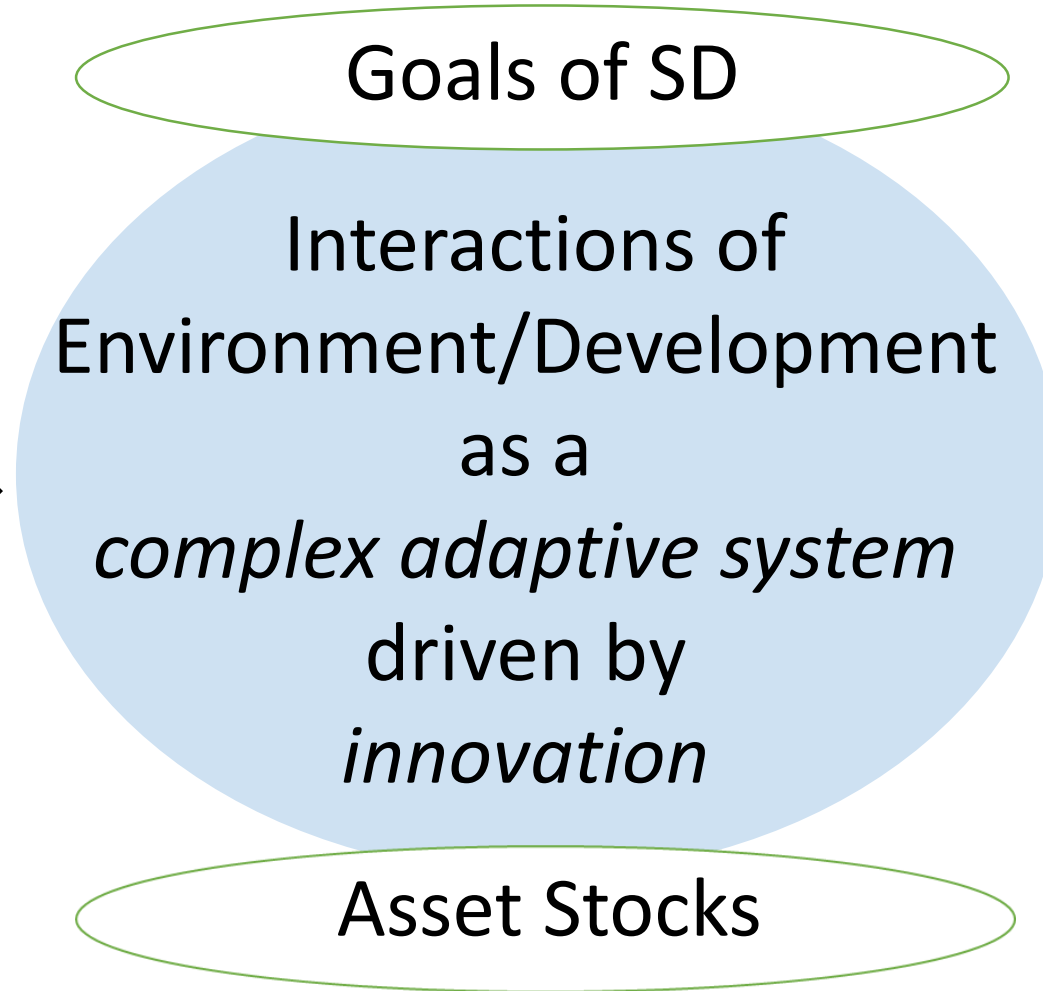
- ***Space**: heterogeneity, cross-scale & network linkages
- ***Time**: semi-stable regimes, path dependence, thresholds... but mostly regional not “planetary”
- ***Coping capacity**: Resilience, differential vulnerability, adaptation, novelty generation
- ***Inequality** in access to assets & benefits flowing from them → centrality of power...



Power and agency: **Who is running the earth system*?**

- Natural inequalities amplified by positive returns to scale...
- System is being run by & for a very few...
- Not for the poor, marginalized, or future generations
- Sustainability requires proactive, governance.

Power and agency

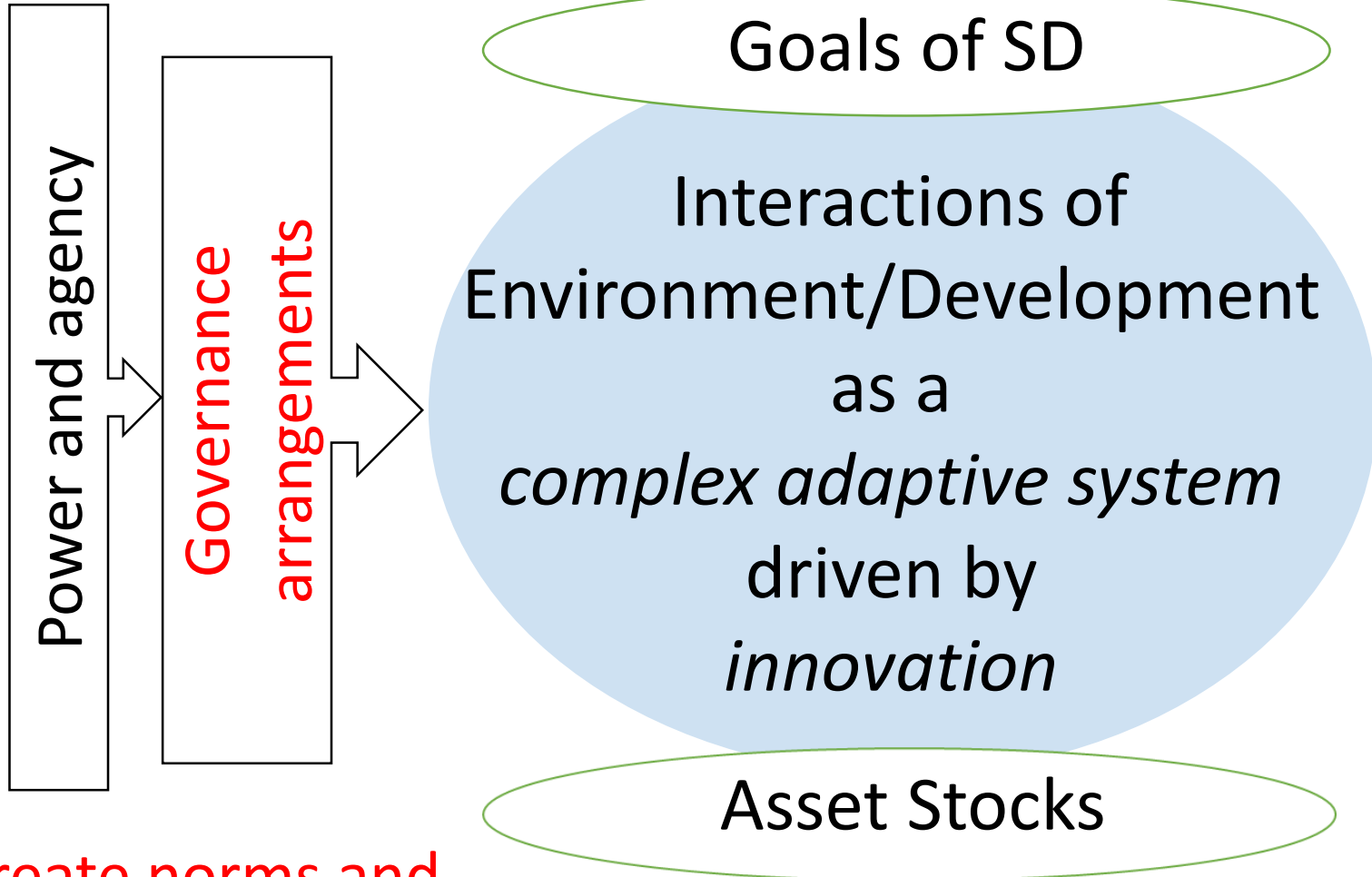


**INCLUSIVE
HUMAN
WELLBEING**

**INCLUSIVE
WEALTH**

Governance arrangements: How do governance arrangements affect the prospects for sustainability?

- Progress on cooperation for CPRs and externalities
- Less on protecting powerless, unborn...
- Challenge to create norms and institutions for sustainability stewardship



INCLUSIVE HUMAN WELLBEING

INCLUSIVE WEALTH

Future prospects: What can sustainability science say about which interventions are most likely to promote transitions toward sustainability?

- Forecasts / Social cost-benefit analyses implicit in asset theory problematic given earth system's complex adaptive character (see debates on Social Cost of Carbon, IPCC scenarios)
- But “future as algorithm” approach of the complex systems community is still weak on policy guidance
- Prospects for improvement *may* be on combining high (global, national) level stewardship norms and incentives while fostering local capacity for innovation.

→ While we have learned a lot, much remains to be done. The orders of the day are surely both *persistence and humility*...

Questions, Comments and Suggestions Welcome!



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