Social-ecological systems insights for sustainable development





Odirilwe Selomane
Stockholm Resilience Centre, Sweden
Council for Scientific and Industrial Research, South Africa

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GRAID
At Stockholm Resilience Centre

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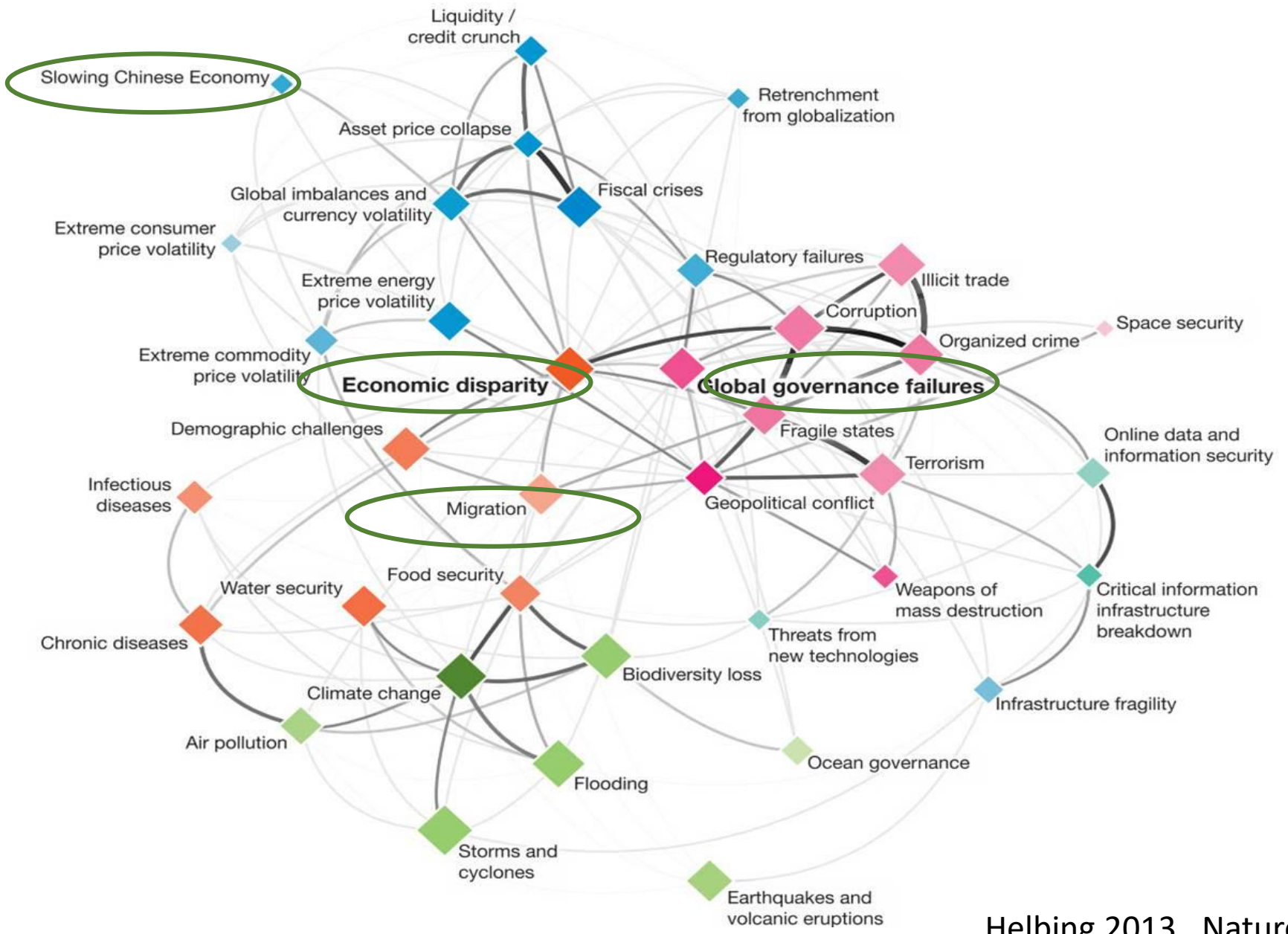
Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship

Stockholm University

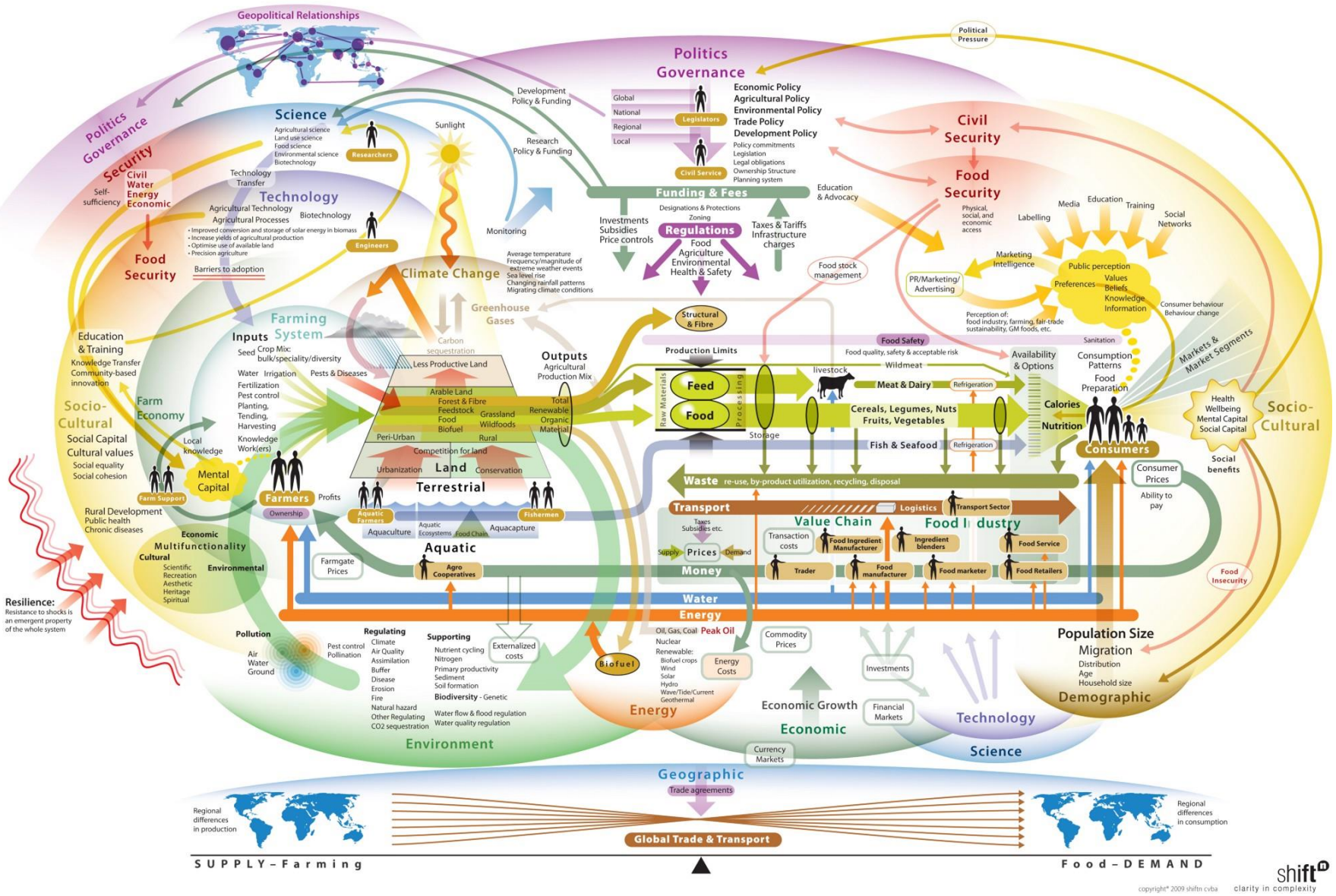
Global hyper connectivity

Global interconnected risks



Helbing 2013, Nature

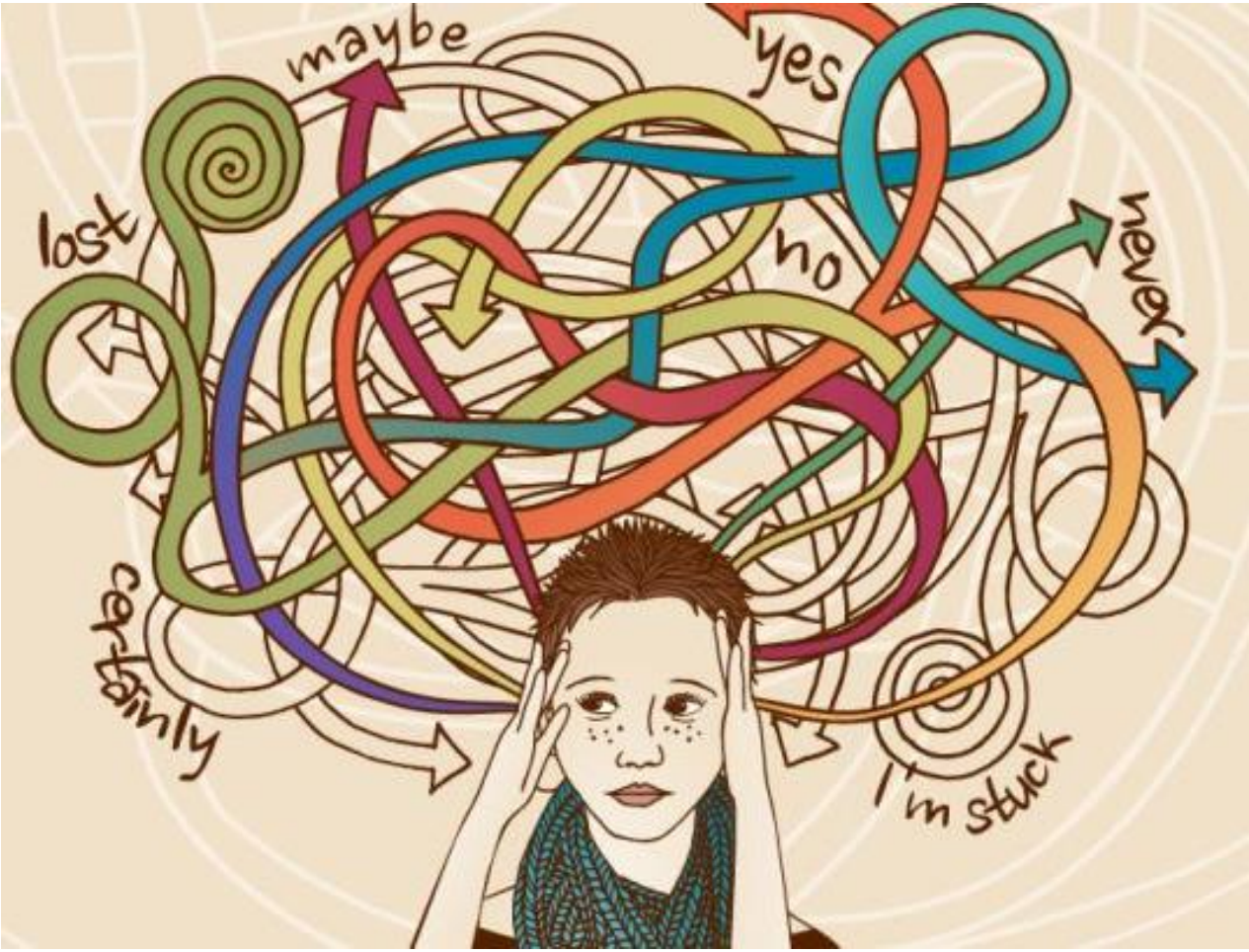
The global food system



Belchior et al. 2016.

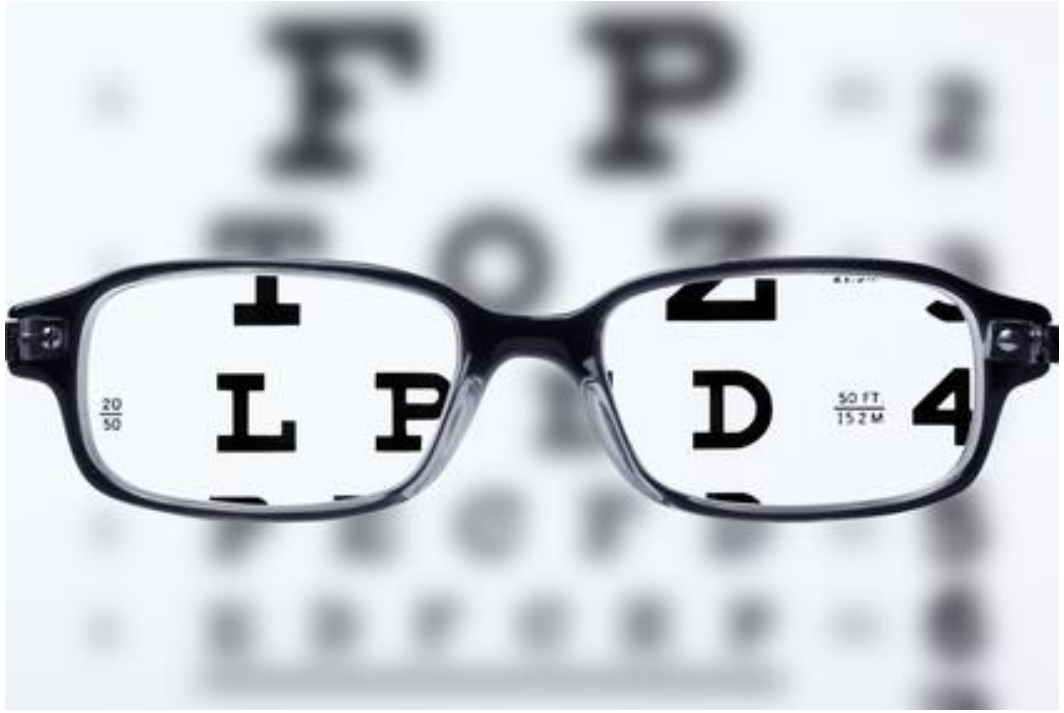
Complex = insoluble

do nothing

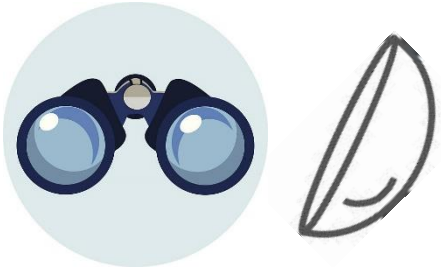


Complex = soluble

But need new lenses

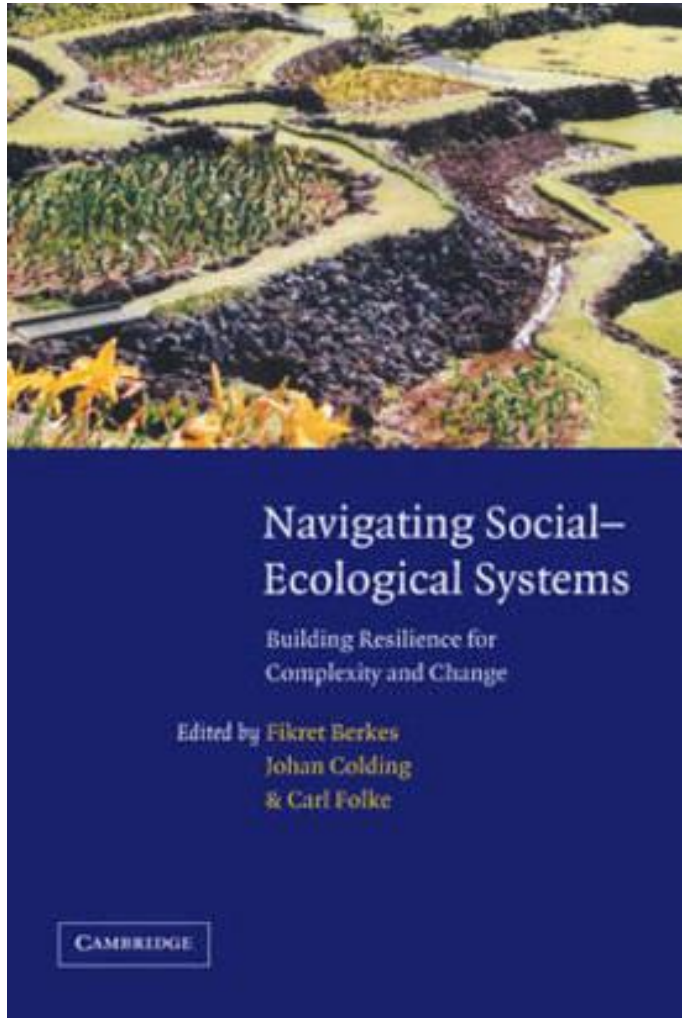


Complexity lenses



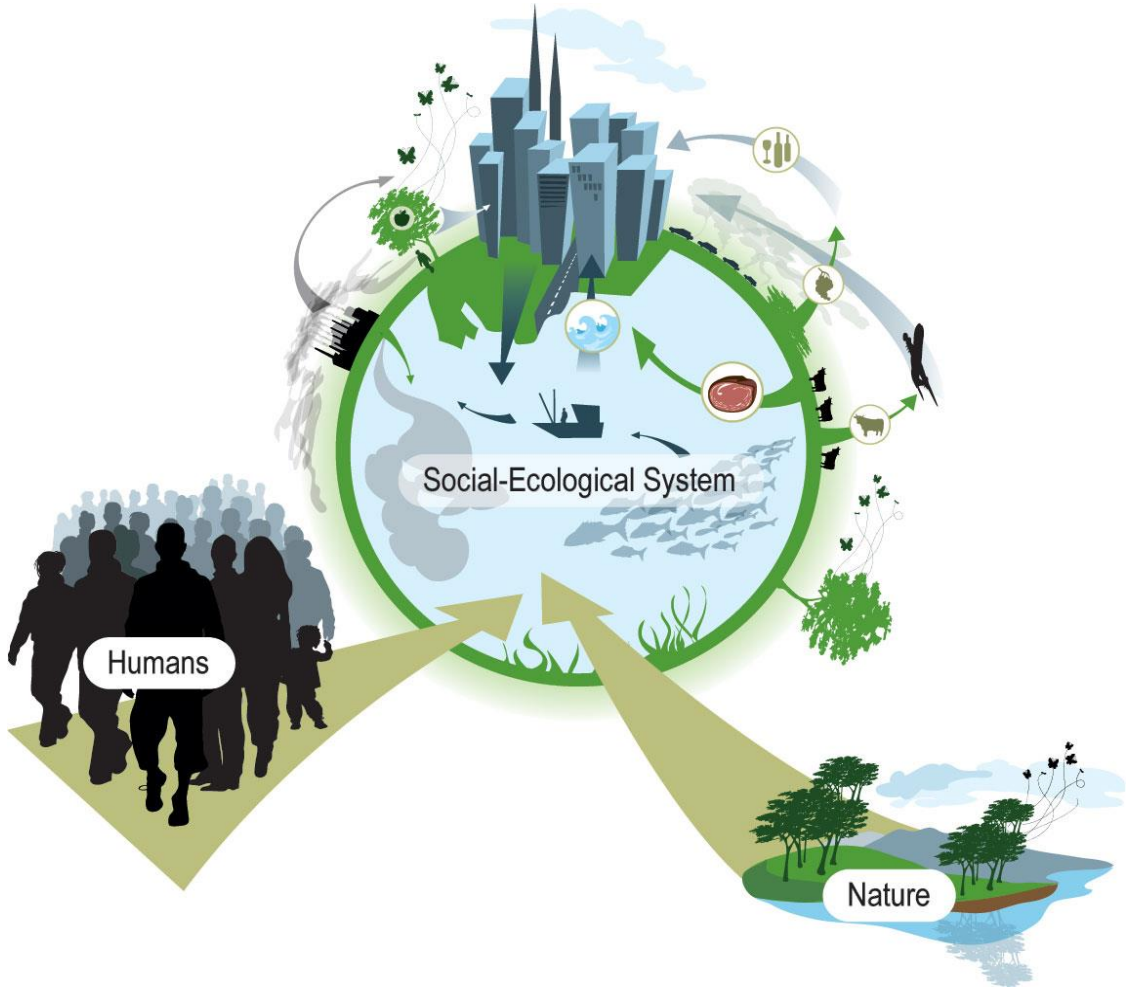
Complex social-ecological systems lens

Complex adaptive systems (CAS) are comprised of many individual, diverse components that interact, forming networks which self-organise, learn, and adapts over time (Levin 2002; Duit & Galaz 2008; Schoon & van der Leeuw 2015).

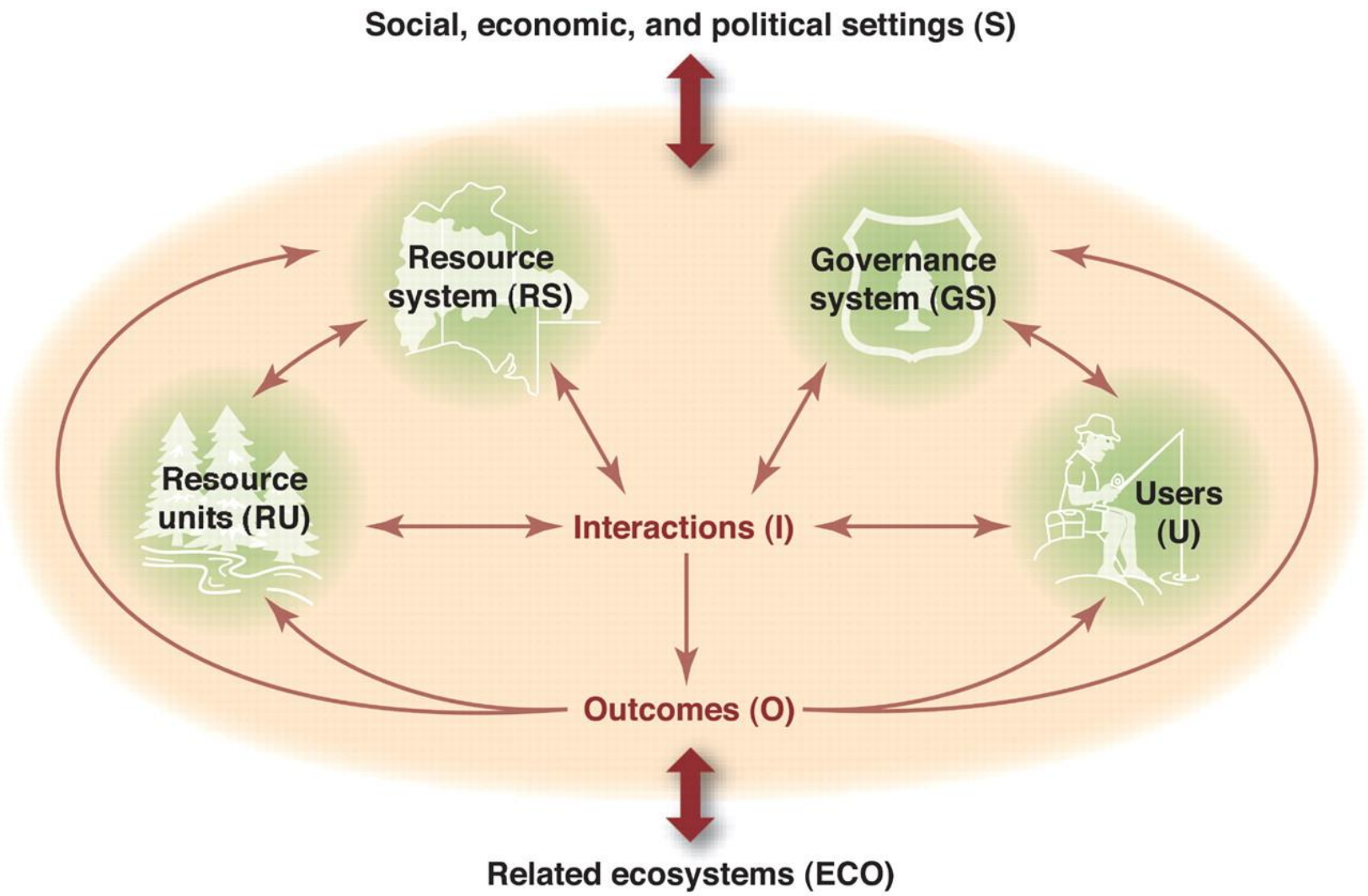


Complex social-ecological systems lens

Social-ecological systems (SES) are **CAS** which adopt an intertwined approach of *humans-in-nature*, emphasising the embedded and interdependent relationship of society and ecosystems and the long history (and future) of the two shaping, and being shaped by one another (Folke et al. 2016).



Complex interactions in SES



Ostrom 2009, Science

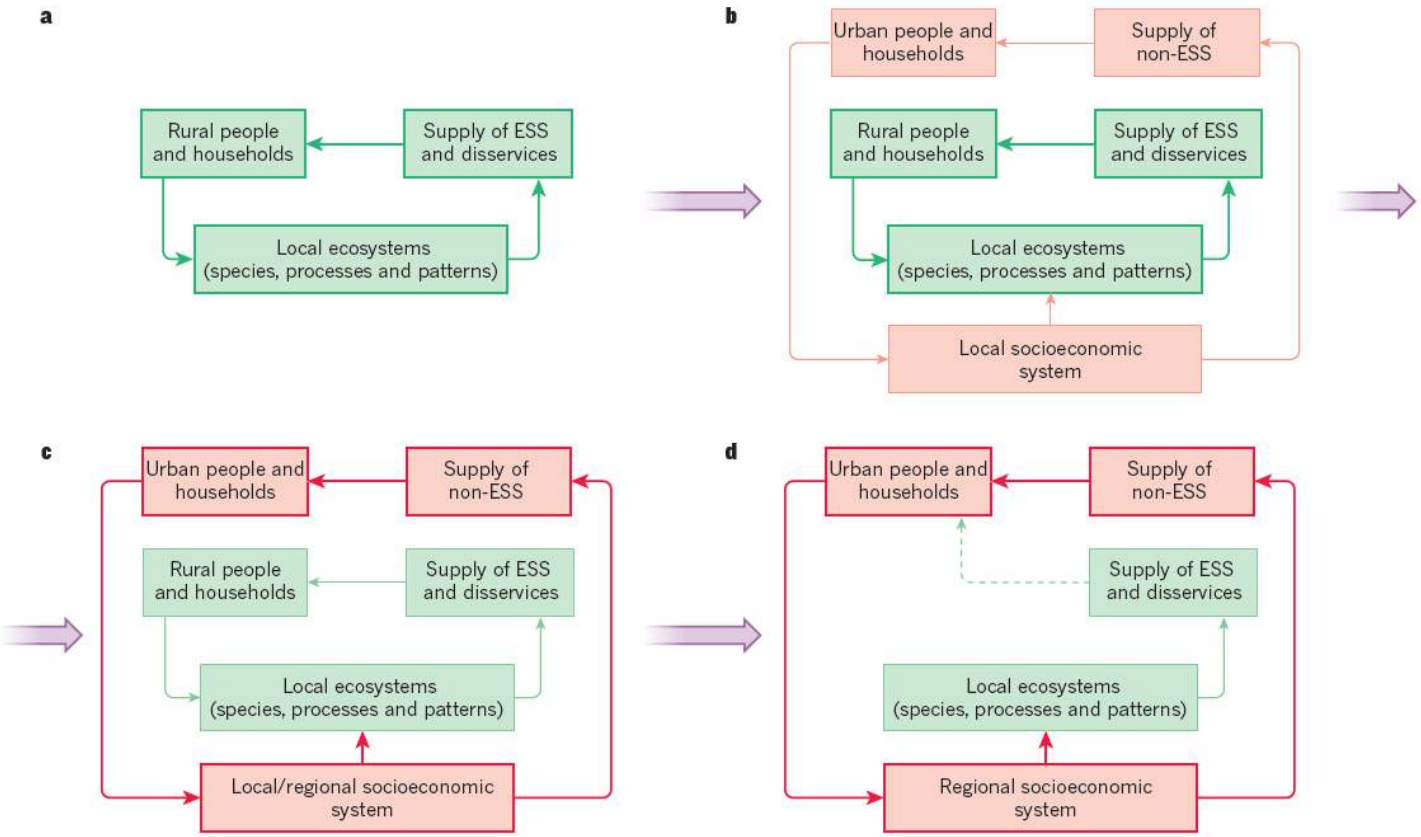
Elements of complex social-ecological systems lens

1. Interactions and feedbacks
2. Cross-scale dynamics
3. Diversity
4. Non-linearity
5. Emergence
6. …

Reyers & Selomane (2018)

Interactions and feedbacks: between social and ecological systems (evolve)

"Green loop"



"Red loop"

Cumming et al 2014, Nature

Cross-scale dynamics: linking social and ecological systems across vertical and horizontal scales

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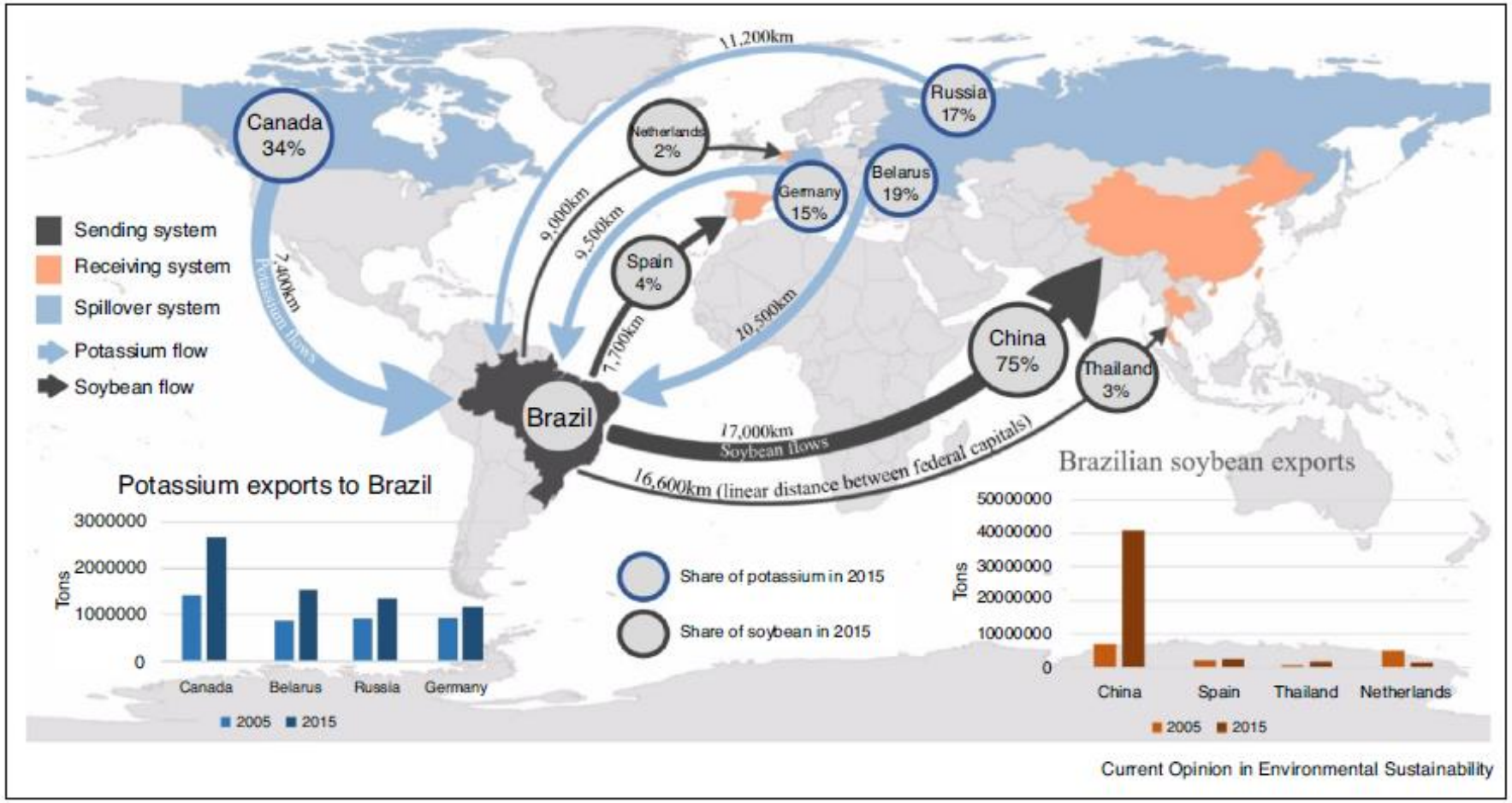
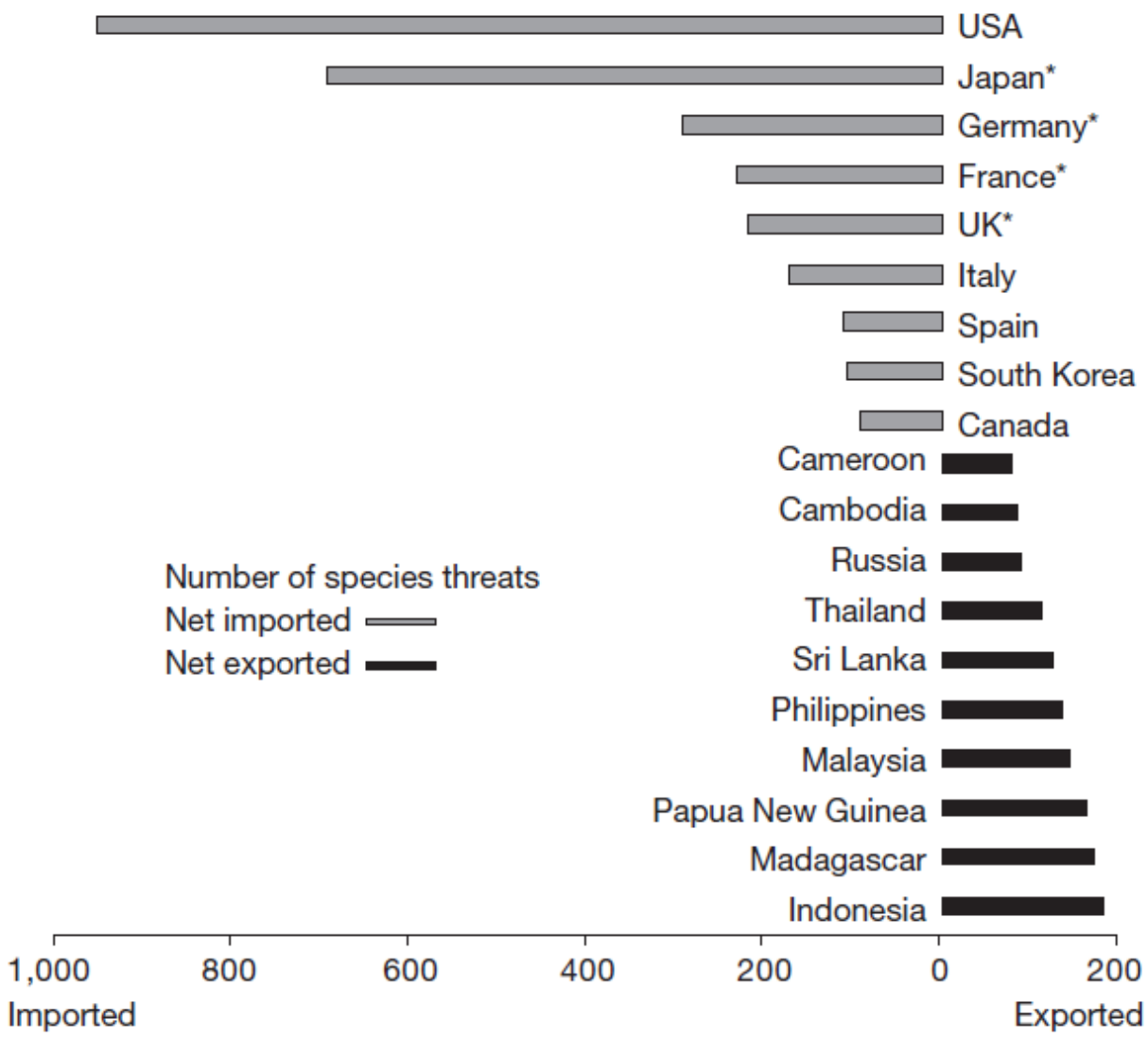


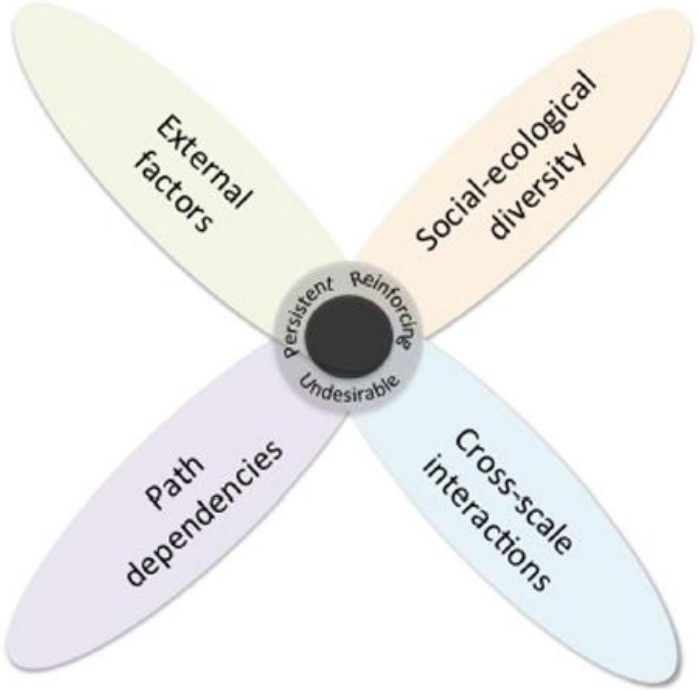
Liu et al 2018, CoSust

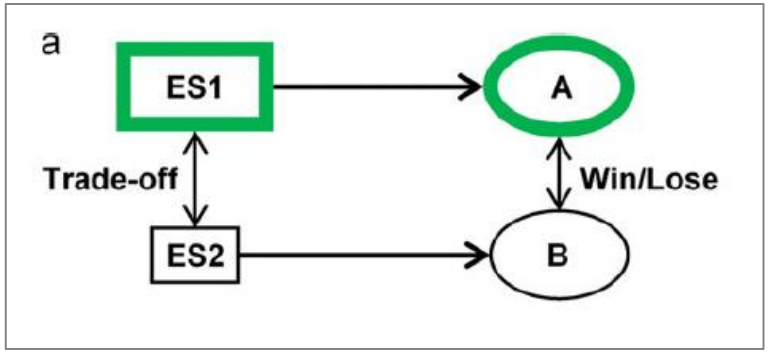
Cross-scale dynamics: outsourcing impacts

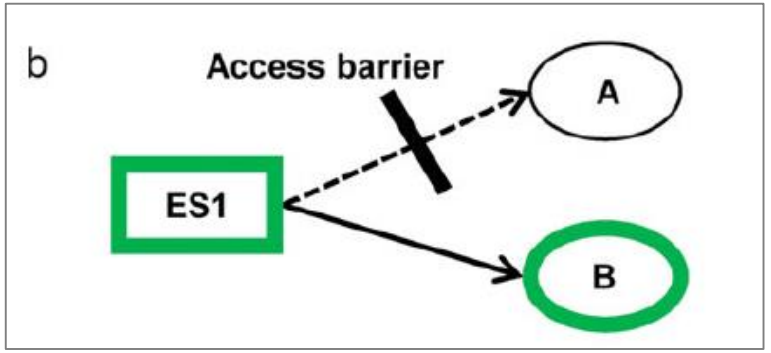


Lenzen et al 2012, Nature

Diversity: variety, disaggregation, multi-dimension







Haider al 2018, World Dev.

Daw et al 2011, Env. Cons.

Non-linearity: the disproportionality of inputs and outputs, thresholds, unexpected outcomes

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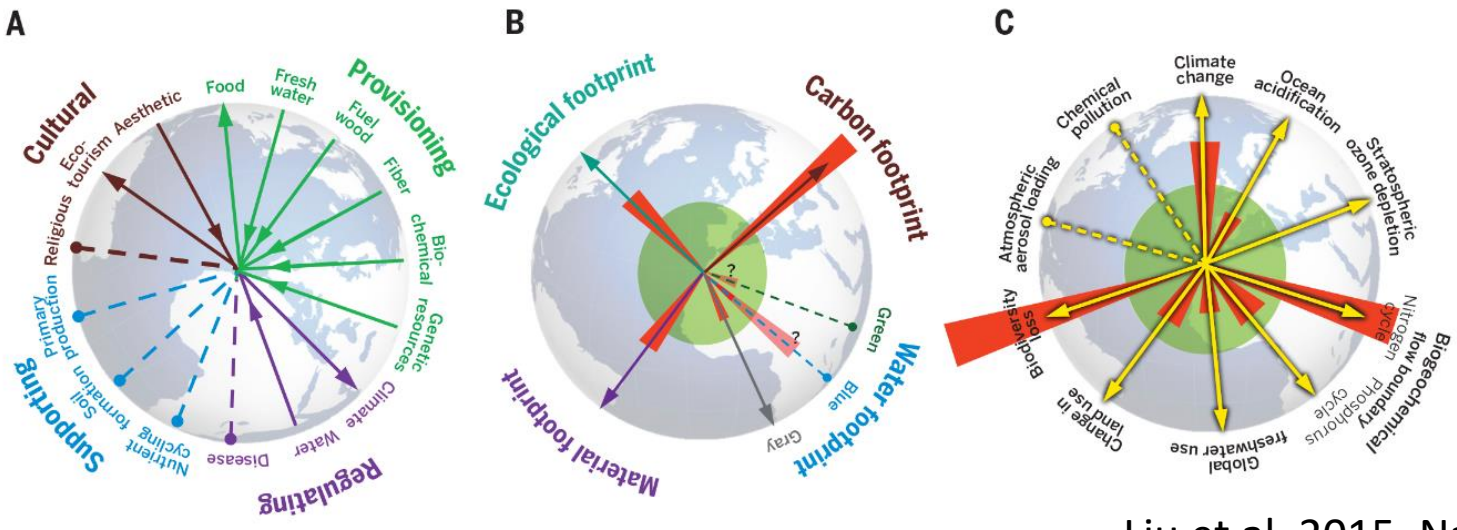
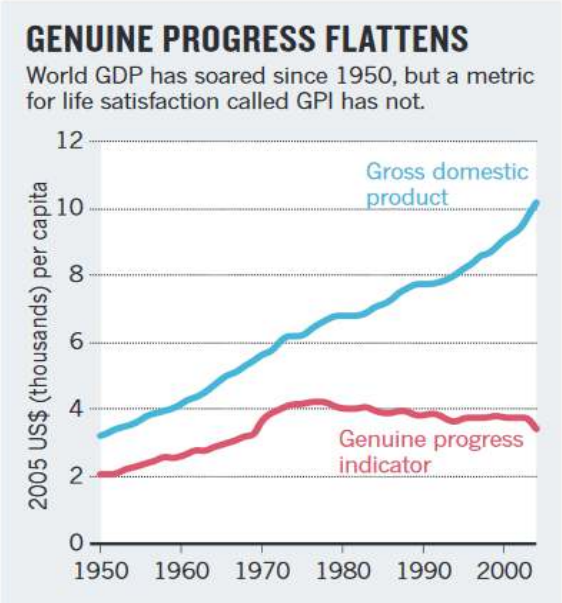
Biggs et al. 2015

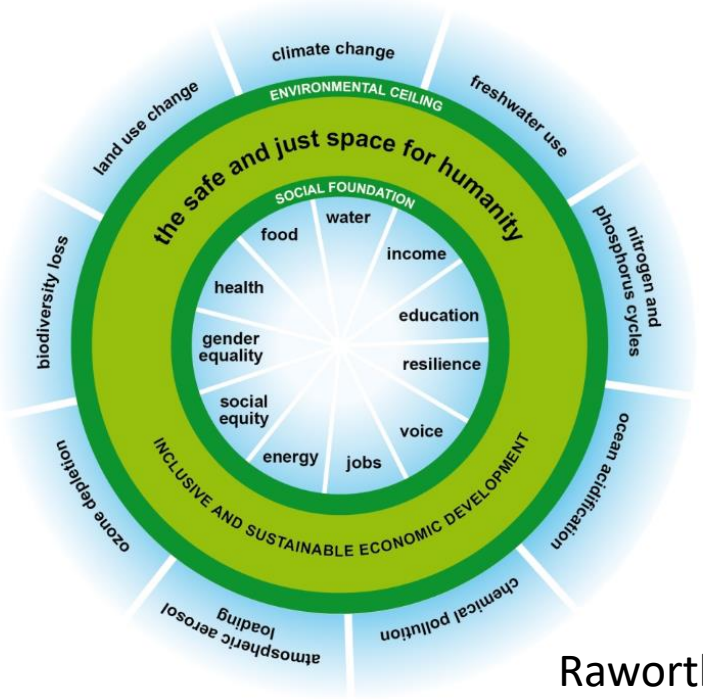
Non-linearity:
'soft' and
'hard'
thresholds



Liu et al. 2015, Nature



Costanza et al. 2014, Nature



Raworth 2012

Resilience

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the capacity of individuals, households, communities, institutions or systems in general to develop with change - includes the ability to persist, to adapt or to transform

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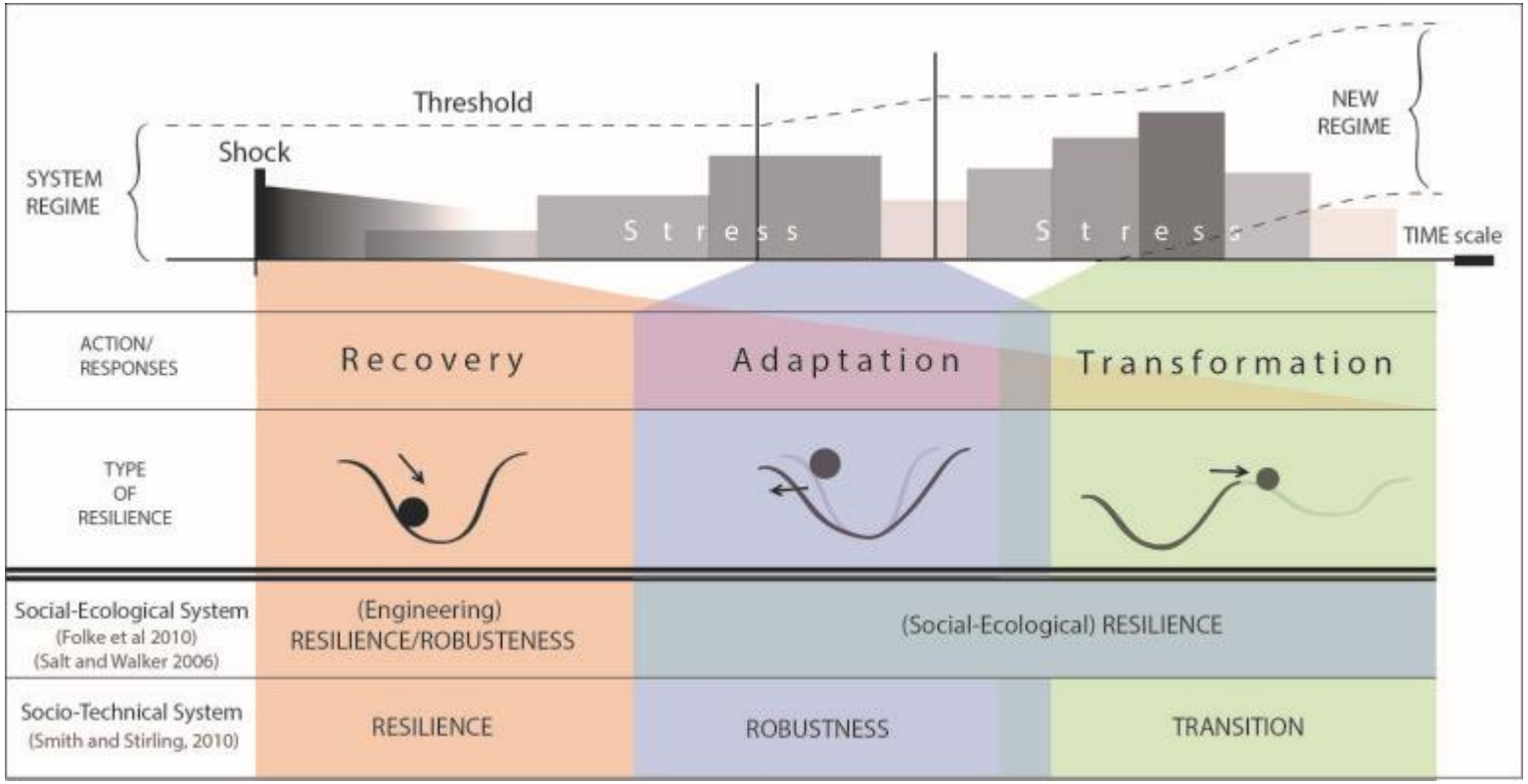
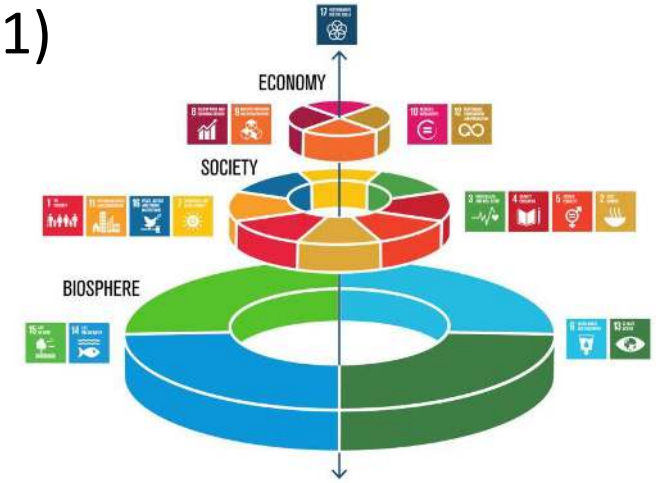
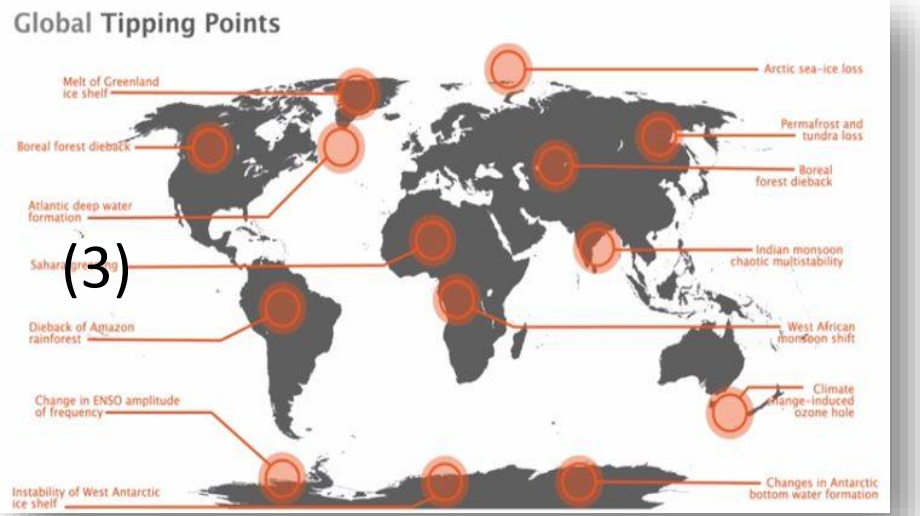


Chelleri et al (2015) Environment and Urbanization

SDGs with a complexity lens

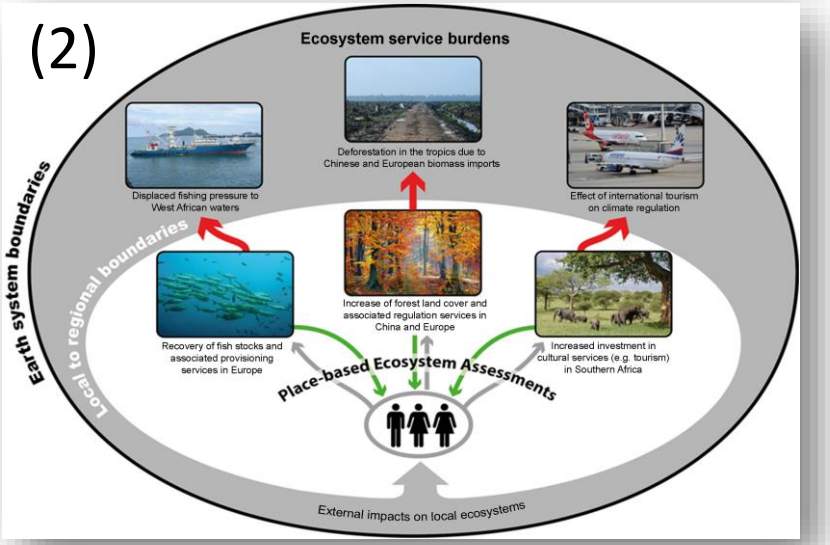
(1)

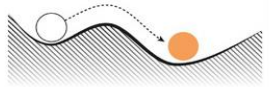
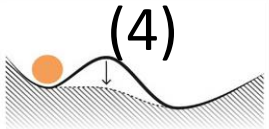
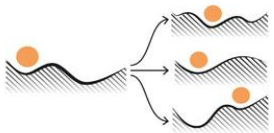




(3)

(2)



Type I Push over the barrier	Type II Lower the barrier	Type III Transform the system
External asset input to the poor state to move it over the barrier	Change in practice to lower the barrier to an existing nonpoor state	Reconfiguration of system structure in fundamentally novel ways
		
Agricultural inputs: improved seeds, fertilizer, and machinery Cash transfers	Access to markets Market liberalization Savings groups	Agroecological farming principles or movement to conserve or enhance ecological system while promoting social justice

(4)

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