

Planetary Boundaries & Planetary Guardians:

Giving the planet a seat at the table



Planetary boundaries and tipping points

Eric Lambin
UCLouvain & Stanford University

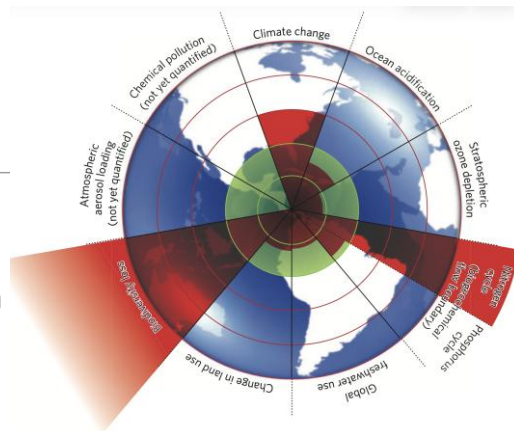
FEATURE

A safe operating space for humanity

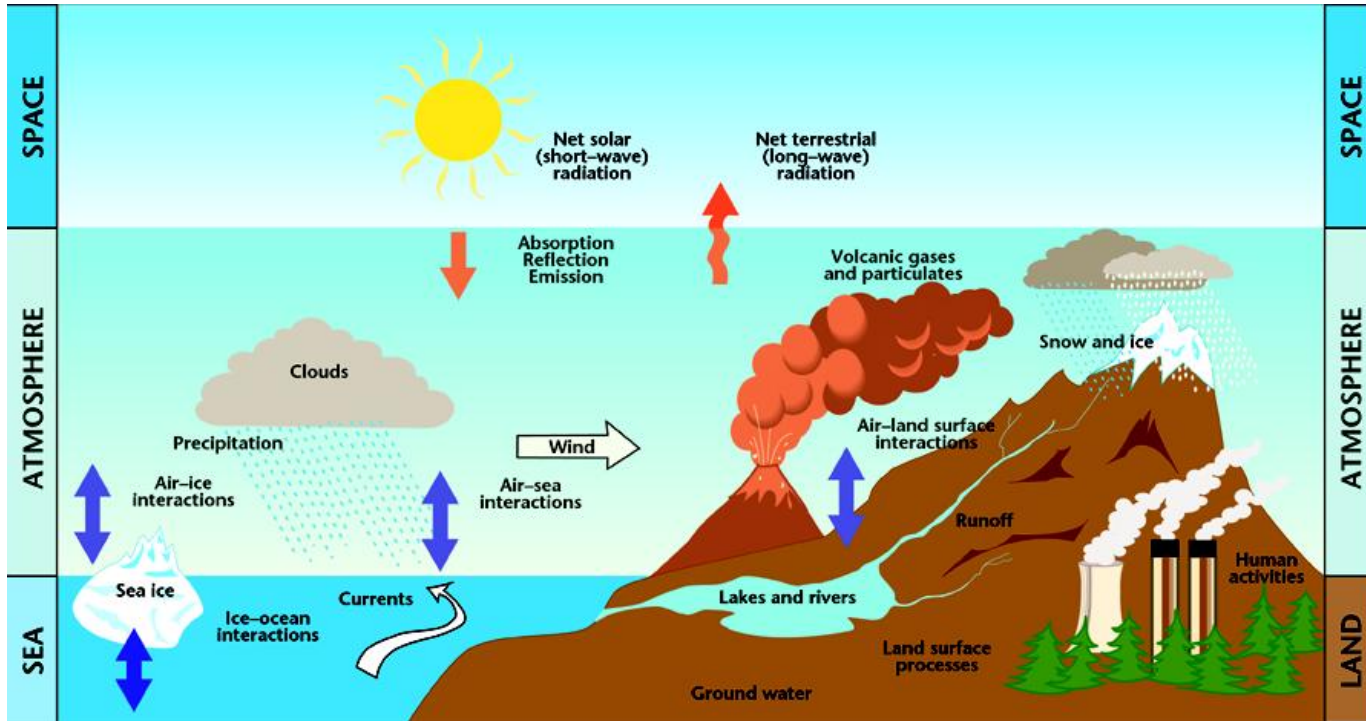
Identifying and quantifying planetary boundaries that must not be transgressed could help prevent human activities from causing unacceptable environmental change, argue **Johan Rockström** and colleagues.

Authors

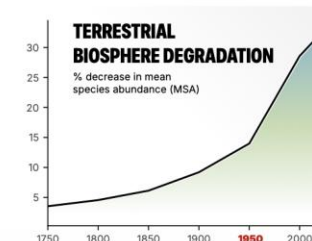
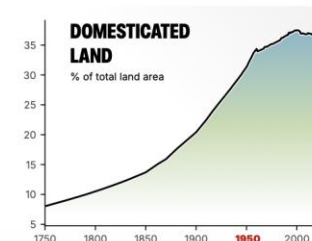
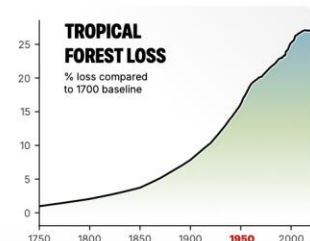
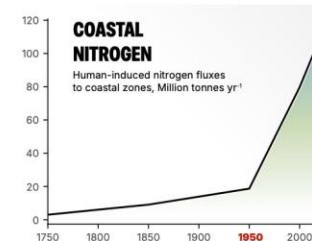
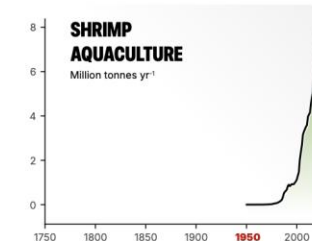
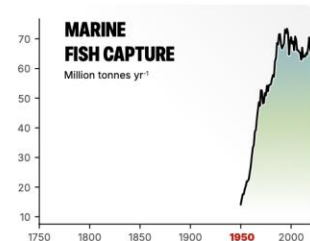
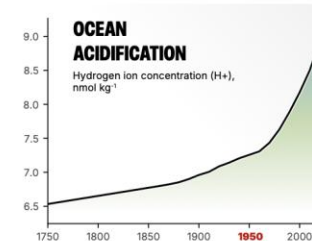
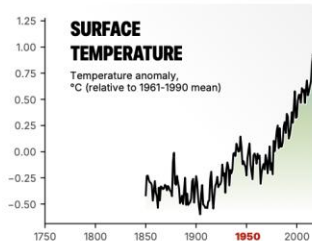
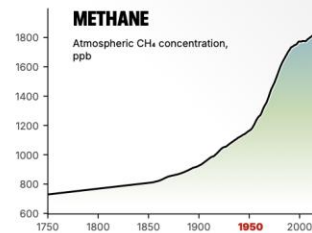
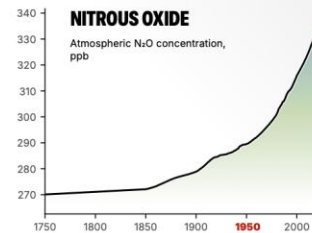
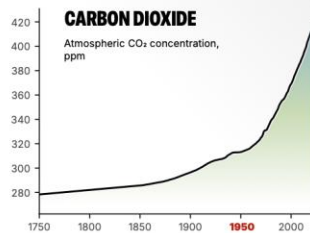
Johan Rockström^{1,2}, Will Steffen^{1,3}, Kevin Noone^{1,4}, Åsa Persson^{1,2}, F. Stuart Chapin, III⁵, Eric F. Lambin⁶, Timothy M. Lenton⁷, Marten Scheffer⁸, Carl Folke^{1,9}, Hans Joachim Schellnhuber^{10,11}, Björn Nykvist^{1,2}, Cynthia A. de Wit⁴, Terry Hughes¹², Sander van der Leeuw¹³, Henning Rodhe¹⁴, Sverker Sörlin^{1,15}, Peter K. Snyder¹⁶, Robert Costanza^{1,17}, Uno Svedin¹, Malin Falkenmark^{1,18}, Louise Karlberg^{1,2}, Robert W. Corell¹⁹, Victoria J. Fabry²⁰, James Hansen²¹, Brian Walker^{1,22}, Diana Liverman^{23,24}, Katherine Richardson²⁵, Paul Crutzen²⁶, Jonathan A. Foley²⁷



Earth system: a complex, dynamic system



« The great acceleration »



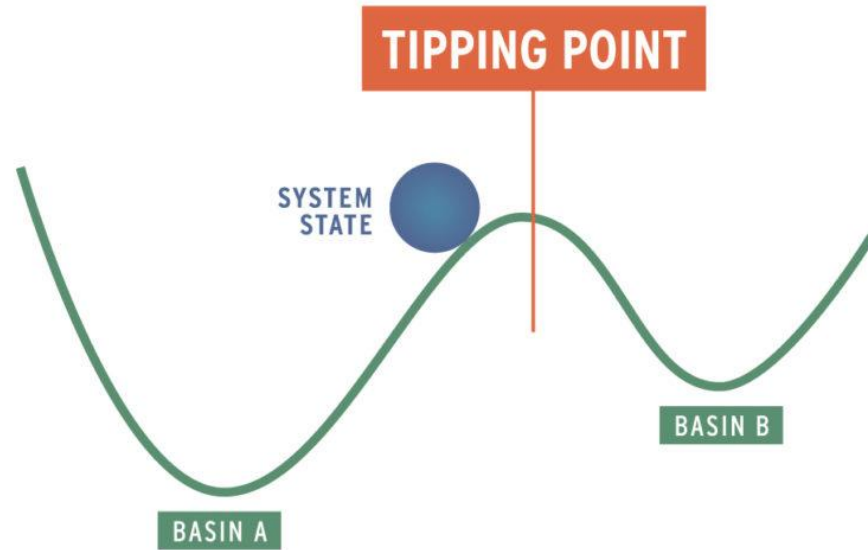
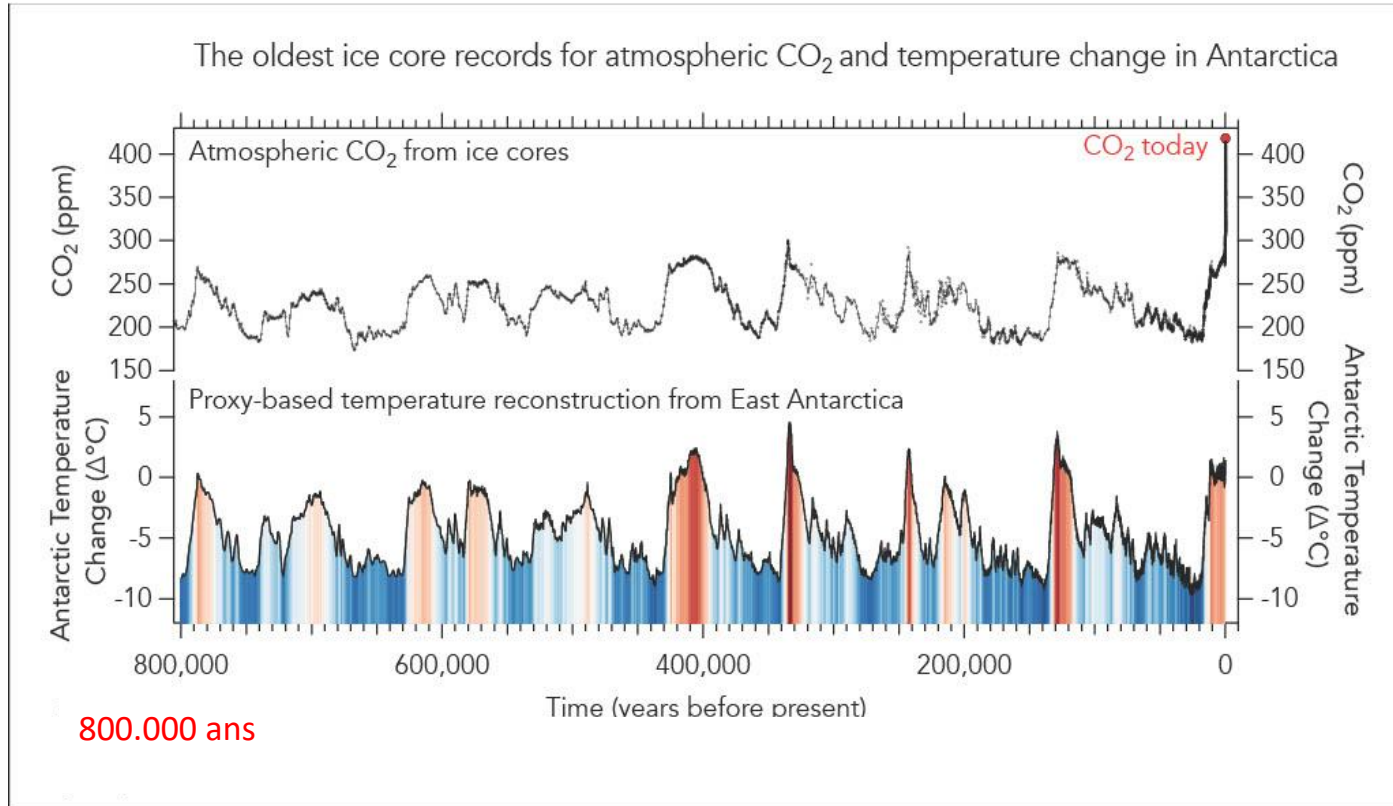
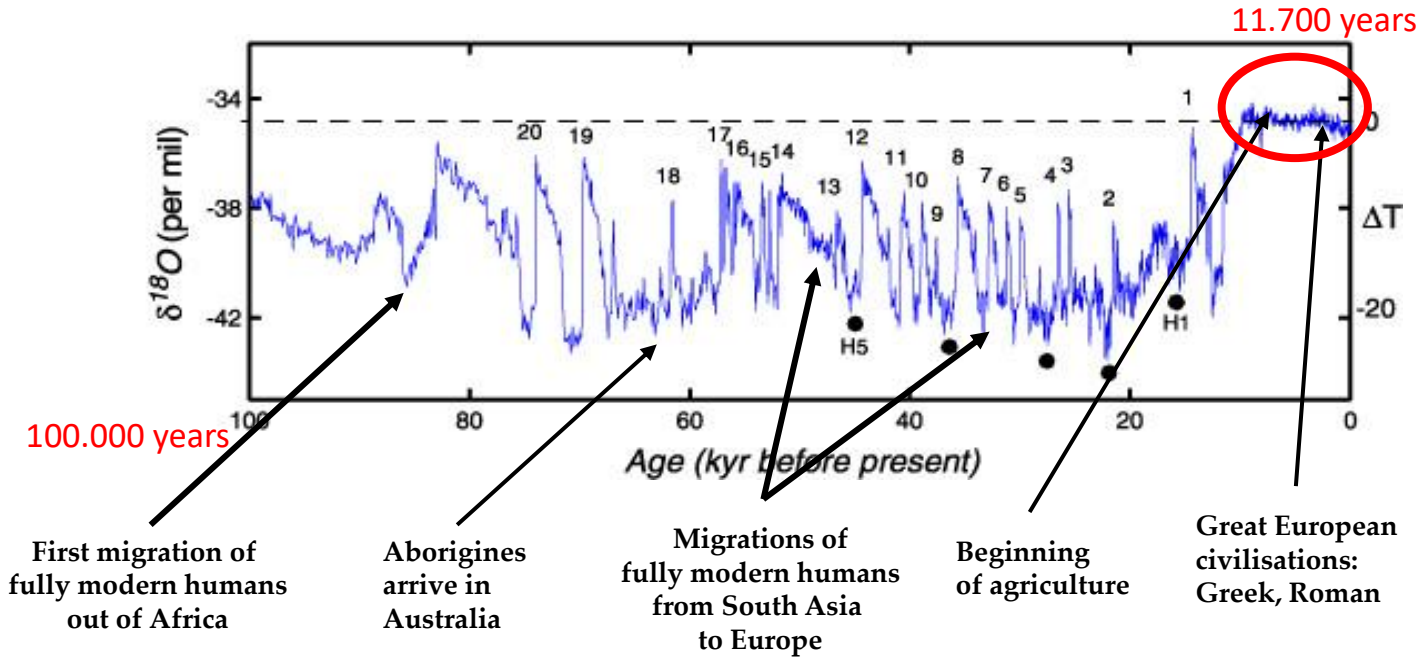


Illustration by Andrew Bernier, adapted from Walker, B. & Salt, D. (2006) Resilience Thinking: Sustaining Ecosystems and People in a Changing World. Island Press: Washington, DC.

Glacial and interglacial periods



The grace period for humanity: Holocene



To be preserved:

Stability

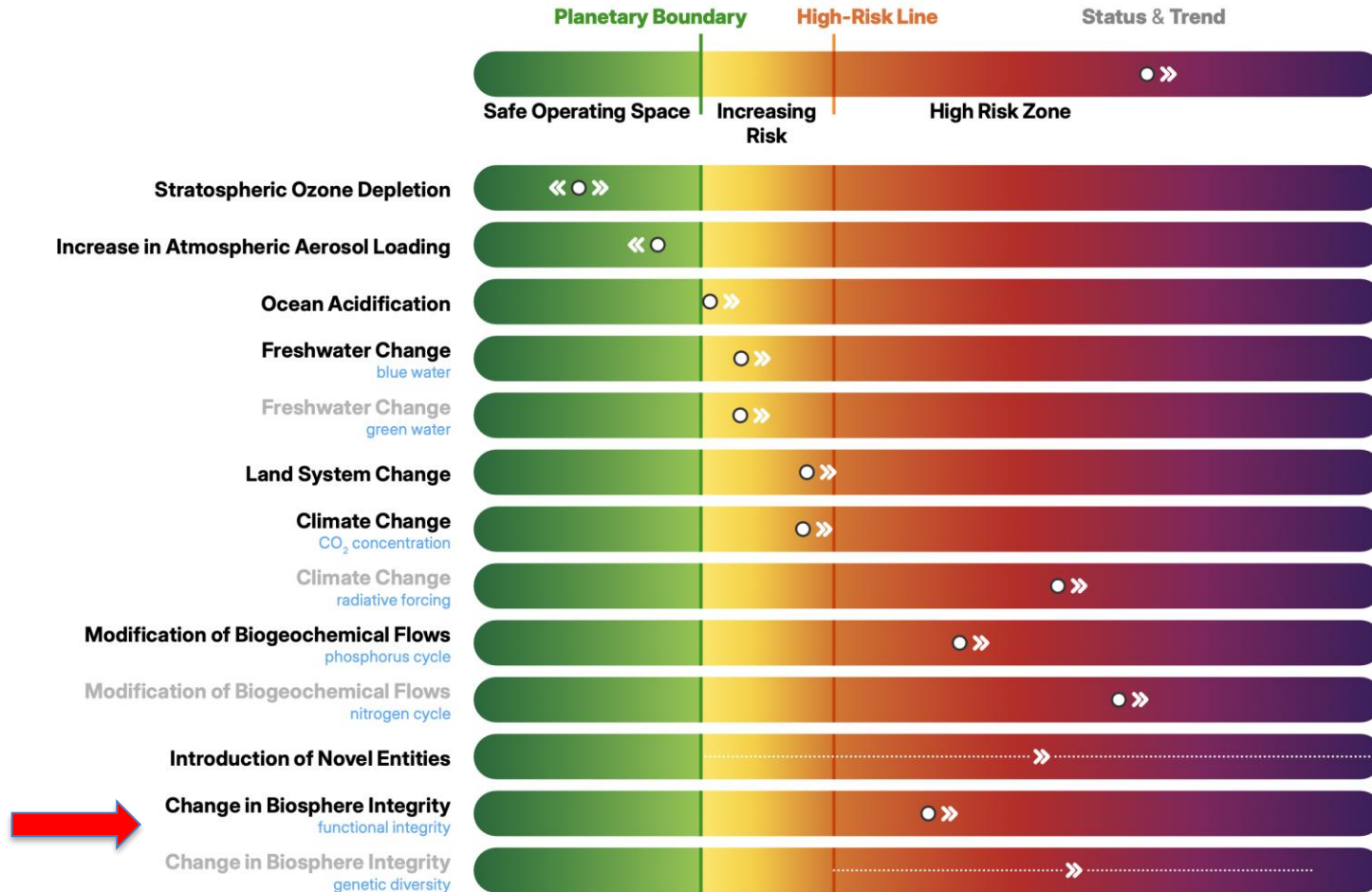
The Earth system's ability to not disrupt relatively constant conditions over long periods, as seen during the Holocene.

Resilience

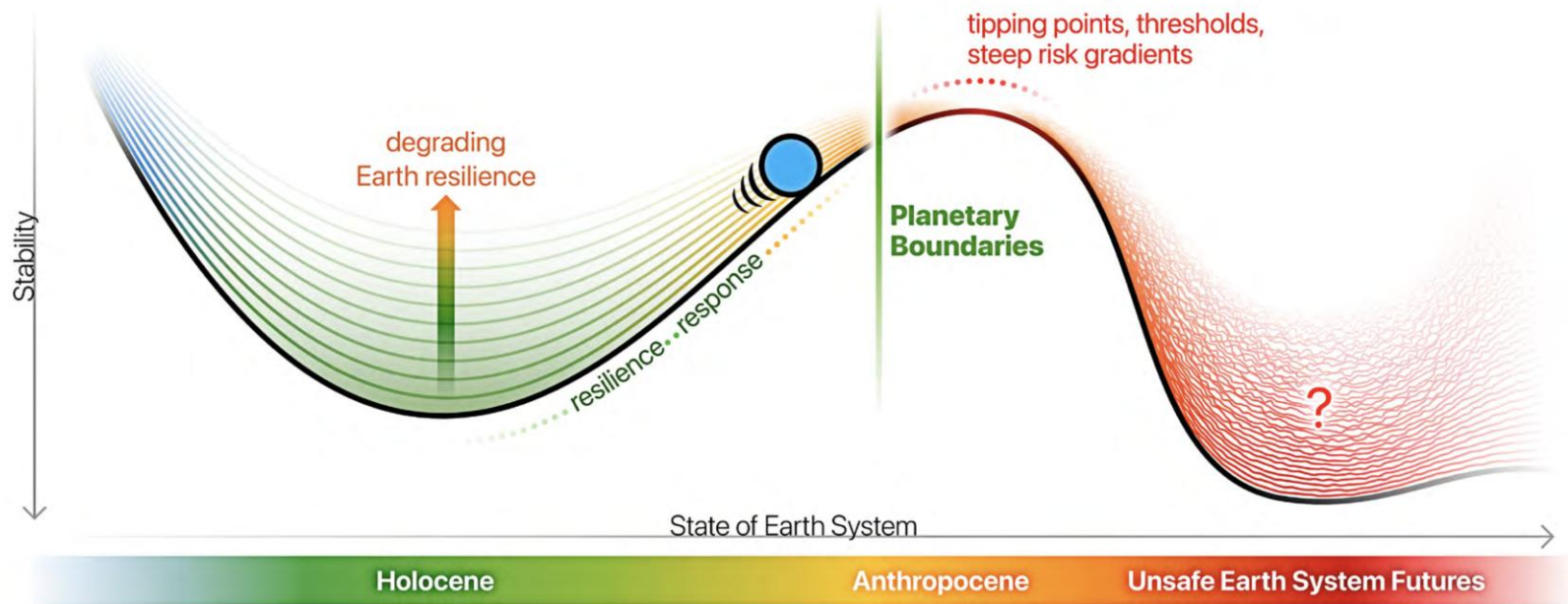
The Earth's capacity to withstand disturbances and recover from them, such as the ability of a forest to recover from a wildfire disturbance and return to a comparable pre-fire state.

Life-support functions

The essential processes provided by the Earth system that sustain life on our planet, for example by maintaining temperature ranges suitable for abundant life in many regions or sustaining the water cycles.



Boundaries *versus* tipping points



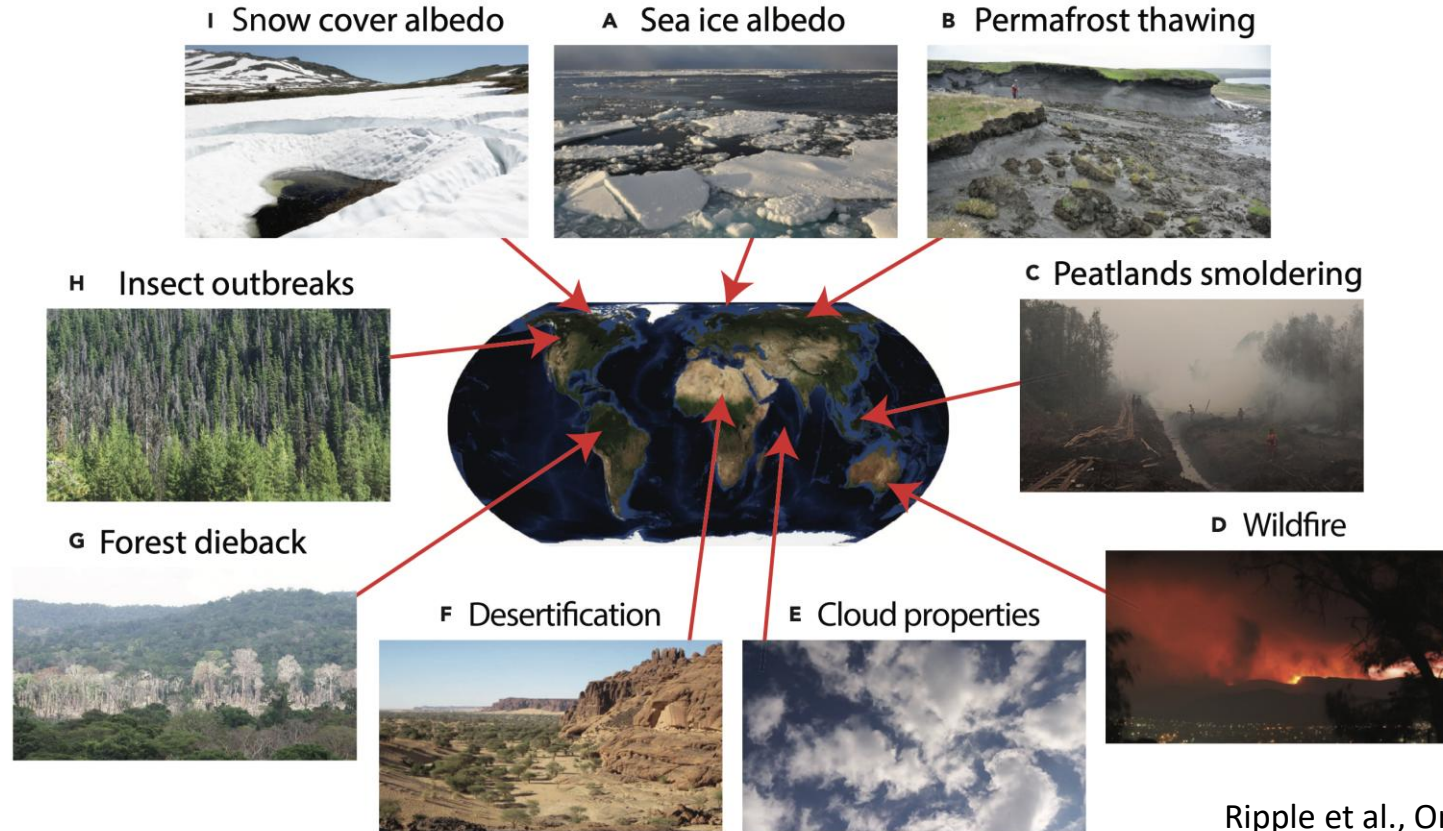
Tipping points

Critical thresholds at which small perturbations qualitatively alter the state or development of the system.

Shift from negative feedbacks (dampening) to positive feedbacks (amplifying).

Self-perpetuating/self-reinforcing evolution leading to state shifts in systems, thus difficult to reverse.

Biophysical (regional) tipping points: *+20-30% of warming*

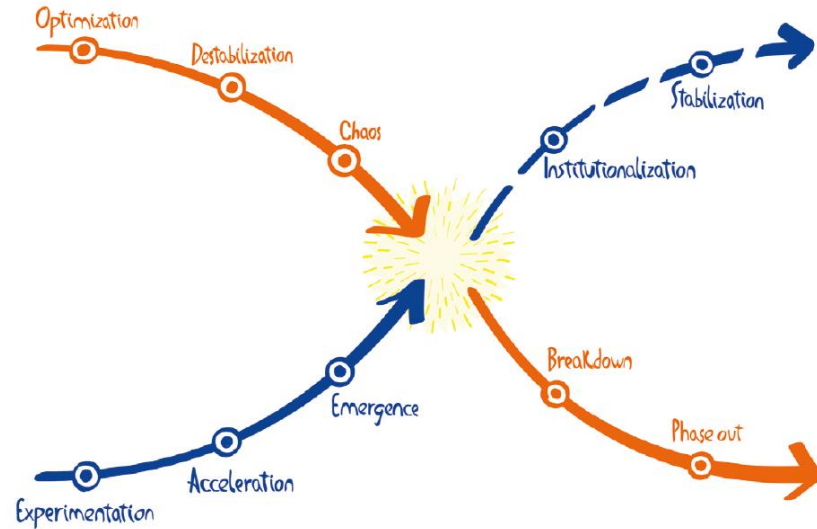


Ripple et al., One Earth, 2023

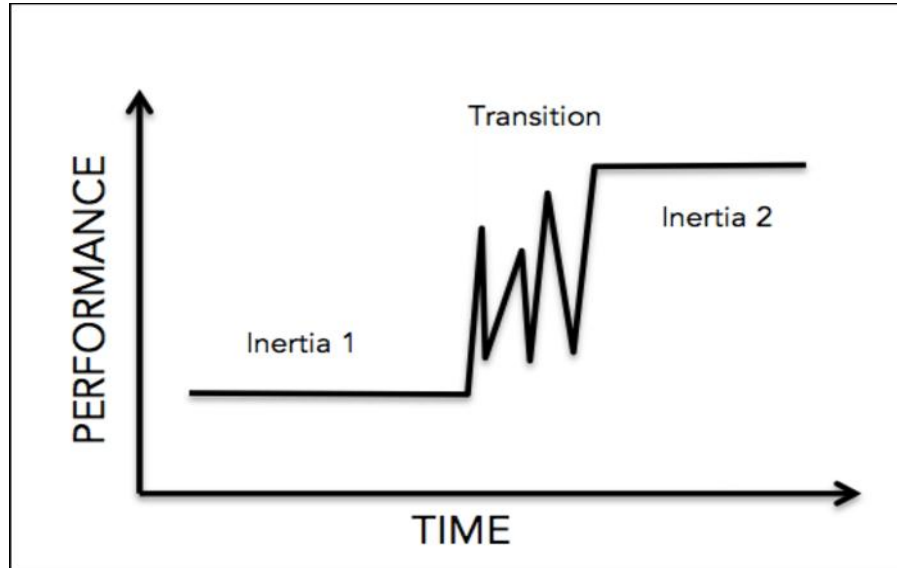
Social (positive) tipping points

- **Clean and cheap electricity** (solar & wind): unlocks electric mobility, heat pumps, clean industry, clean air.
- **Plant-based diets**: health benefits, animal well-being, land sparing for nature, less CO₂ & CH₄ emissions, water savings, ...
- **Effective marine protected areas**: recovery of fish stocks, sustainable fishing, ...
- **Responsible commodity supply chains** (soy, palm oil, timber, beef, cocoa, coffee): decrease tropical deforestation, less CO₂ emissions, biodiversity conservation, indigenous groups, ...

Upscaling innovations + phasing out incumbent system



Change as a nonlinear process: *punctuated equilibrium*



Paleontology: Eldredge & Gould (1972)

Political science: Baumgartner and Jones (1993)

Policy mixes

Multiple complementary policies that reinforce each other



Pathways to transformation at scale

- **Governments** initiate sectoral transformations, which are implemented by private sector – e.g. EU's mandate on 90% tailpipe emissions reduction for cars by 2035.
- **Large private firms** voluntarily adopt sustainable practices and apply them throughout their supply chains – e.g. zero deforestation sourcing commitments.
- Innovations initiated by **civil society** and then integrated in public or private policies – e.g. voluntary sustainability standards: FSC, MSC, BCI, ...

Panel

Eric Lambin (UCL) ; Mary Ann Manahan (UGent) ;

Delphine Misonne (UCL) ; Luc Bas (CERAC)

Moderator: Brent Bleys (UGent; President of the FRDO-CFDD WG for sustainable development strategies)



Q&A

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Presentation will be available on our website