

Social tipping mechanisms for rapid decarbonization

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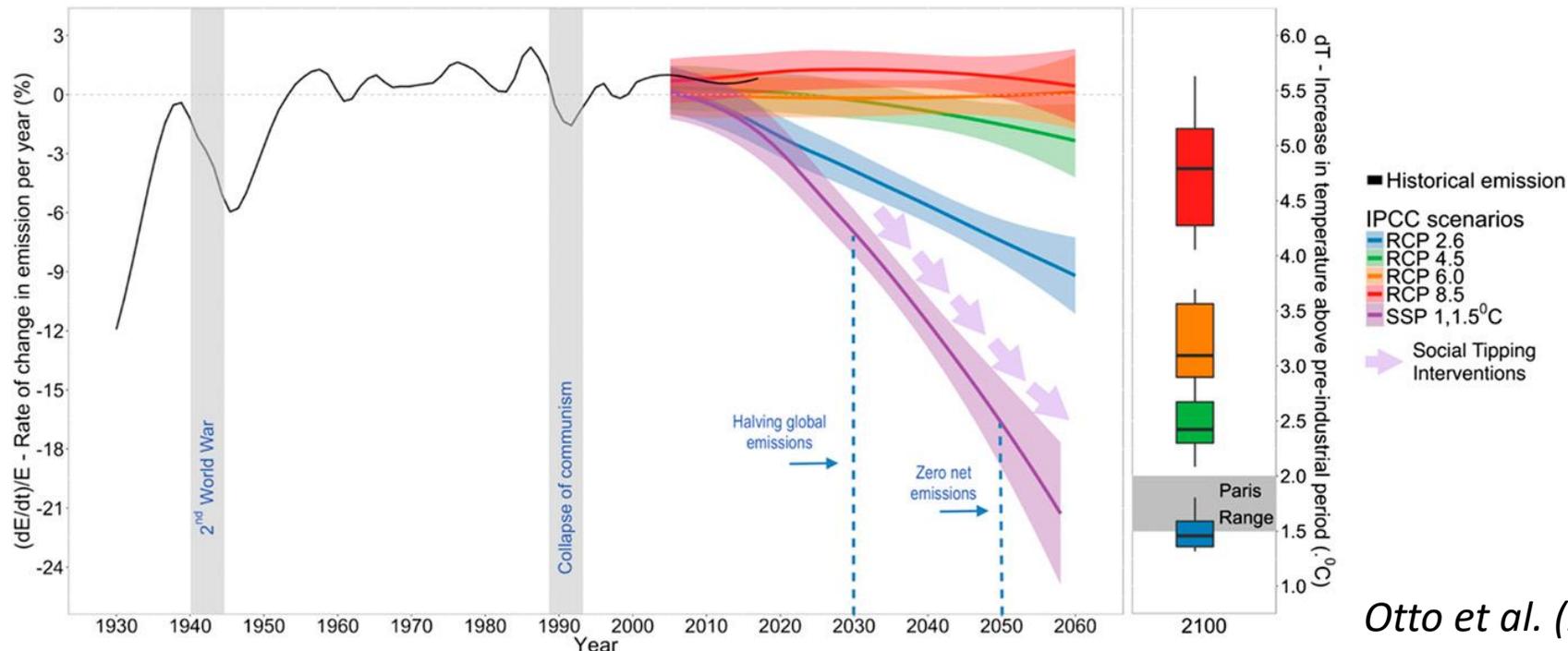
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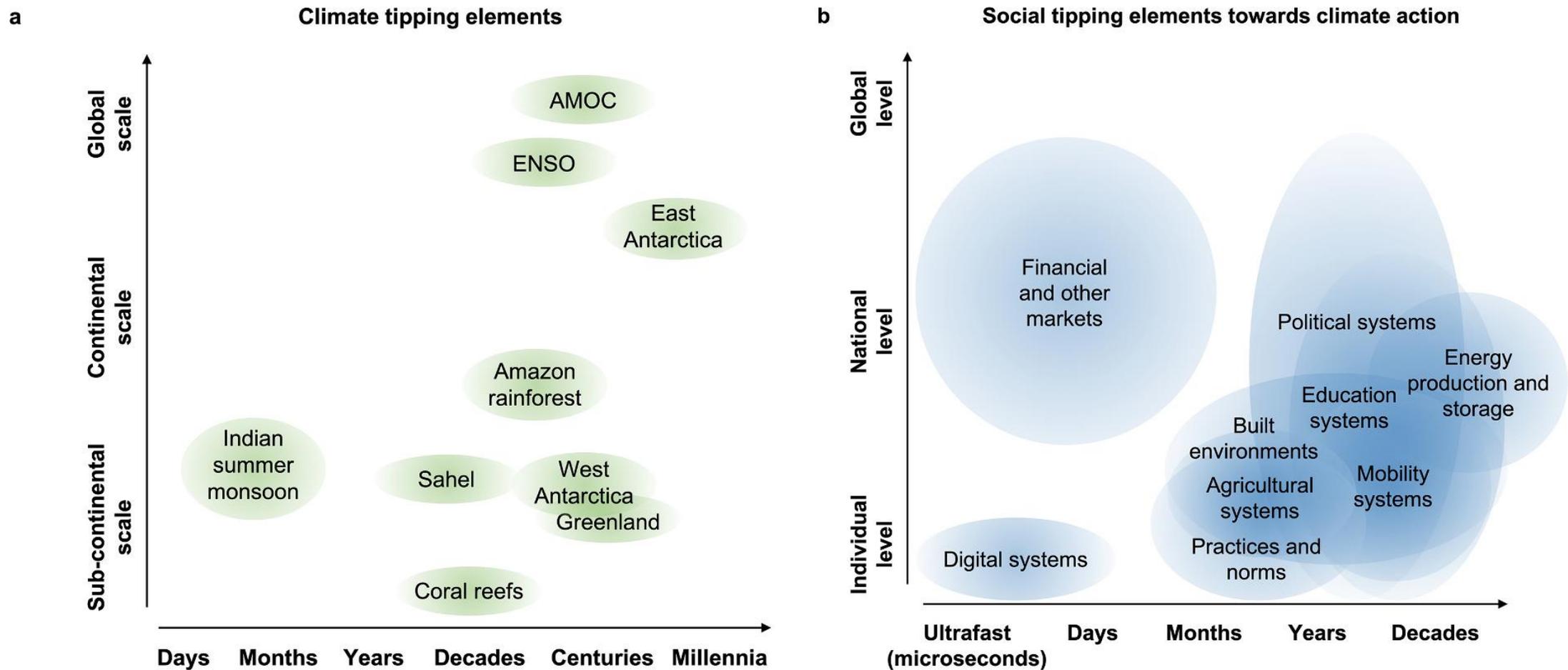
ISDC 2022

Tipping

- *A small quantitative change that triggers a non-linear change process at a certain point or threshold*
- *Driven by system-internal feedback mechanisms and inevitably leads to a qualitatively different, often irreversible, state of the system*
(Milkoreit et al., 2018)

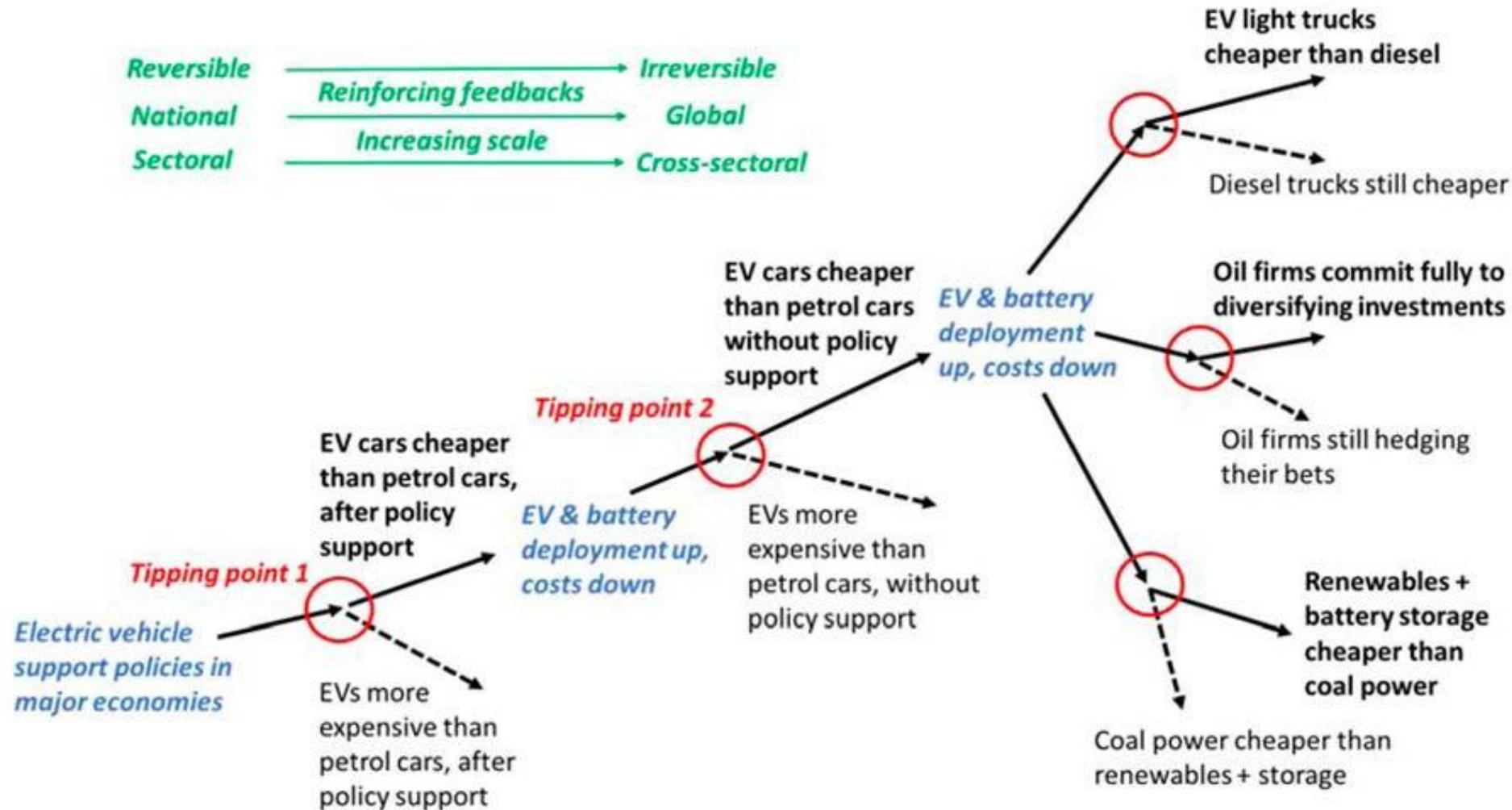


Social tipping processes are rapid



Spatial and temporal scales for climate tipping elements (panel a) and social tipping elements (panel b). Source: Winkelmann et al. (2022).

Example of a social tipping process



Upward-scaling tipping cascades. Source: Figure 2 in Sharpe & Lenton (2021).

System Dynamics of Social Tipping Points

Endogeneity

- To understand the basic system dynamics of interacting social tipping processes over different timescales.
- To strengthen the conceptual foundations for formal (quantitative) modelling of social tipping dynamics.

STE1: Energy production and storage

STI 1.1
Subsidy programs

STI 1.2
Decentralized energy production

Relative price of fossil-fuel-free energy

STE 2 : Human settlements

STI 2 Carbon-neutral cities

Demand for fossil-fuel-free technology

STE 3 : Financial market

STI 3.1
Divestment movement

Profitability of fossil fuel exploitation

Global GHG Emissions
Otto et al. (2020) PNAS

STI 4.1
Recognition of the immoral character of fossil fuels

Perception of fossil fuels as immoral

STI 5.1
Climate education and engagement

Climate change and impacts awareness

STI 6.1
Emission information disclosure

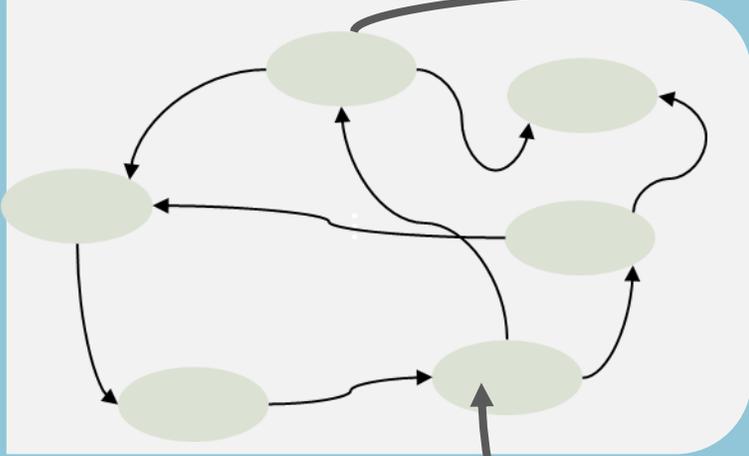
Number of products and services disclosing their carbon emissions

STE 4 : Norms and value systems

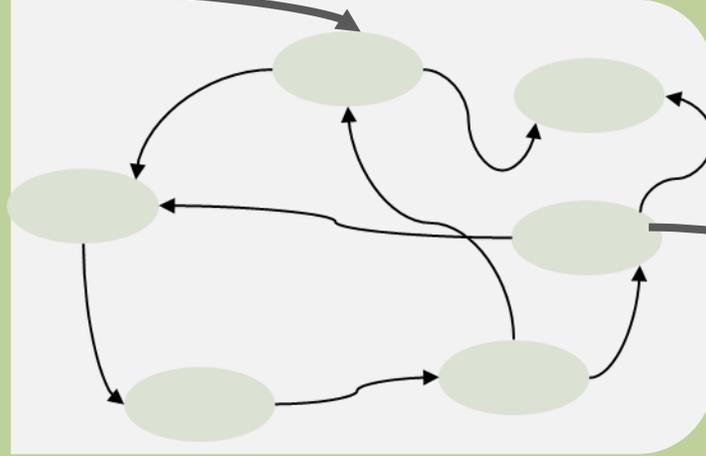
STE 5 : Education system

STE 6 : Information feedback

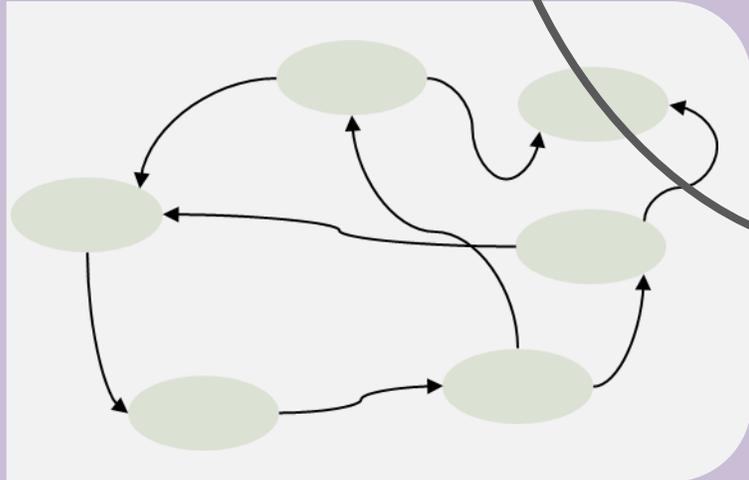
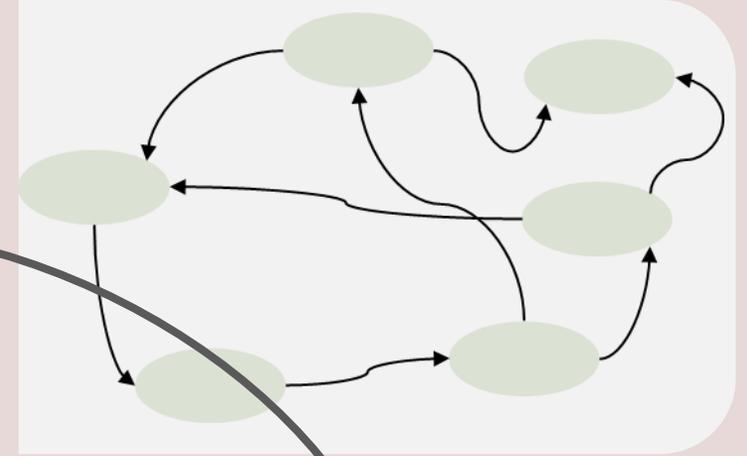
STE1: Energy production and storage



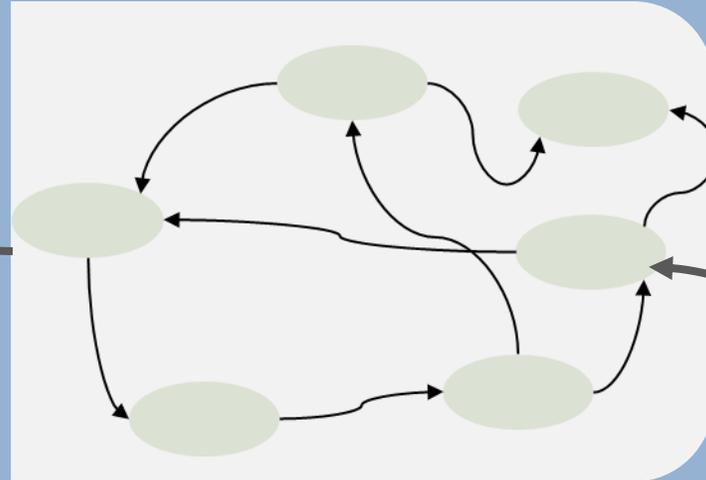
STE 2 : Human settlements



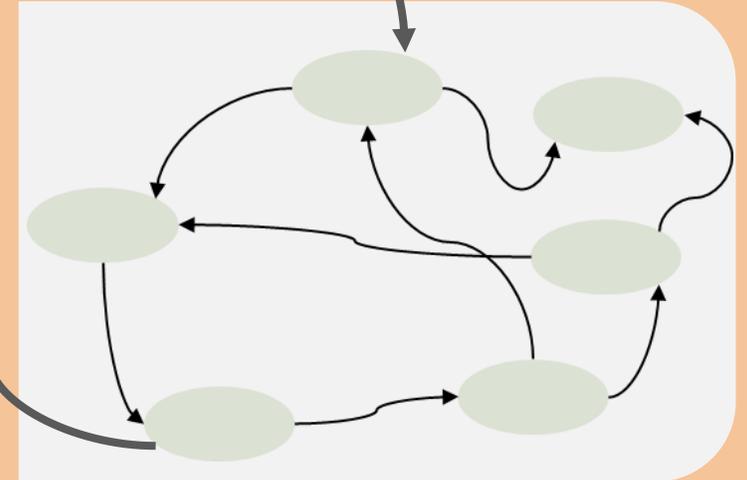
STE 3 : Financial market



STE 4 : Norms and value systems



STE 5 : Education system



STE 6 : Information feedback

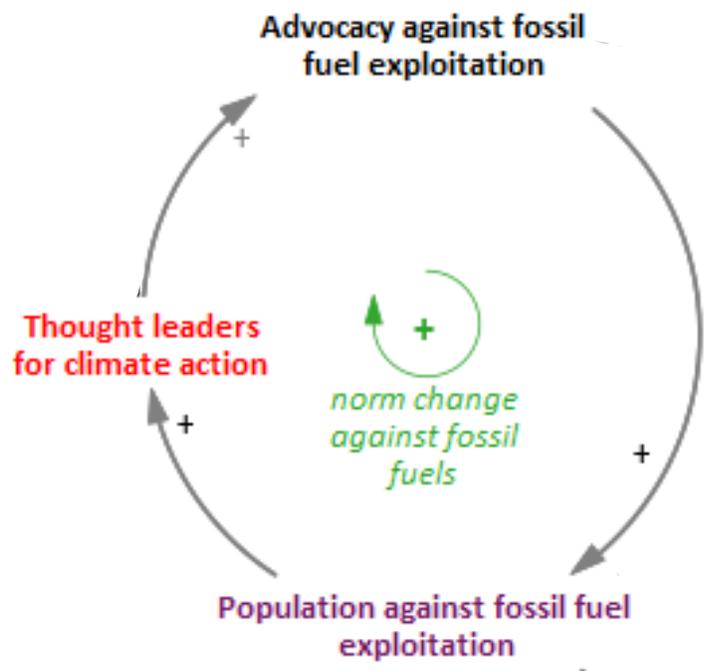


Outcome 1:

Delineating the feedback mechanisms by taking potential barriers into account

LEGEND

- Social tipping intervention
- Control parameter
- Variable in another STE
- Positive feedback loop
- Negative feedback loop



Outcome 2:

Identifying cross-system interactions to evaluate the cascading effects of social tipping interventions

Energy Production – Norms and Values - Education and Information – Urban Infrastructure – Finance

Fossil fuel
energy supply

LEGEND

Norms

Energy

Finance

Education

Urban



*Positive
feedback loop*

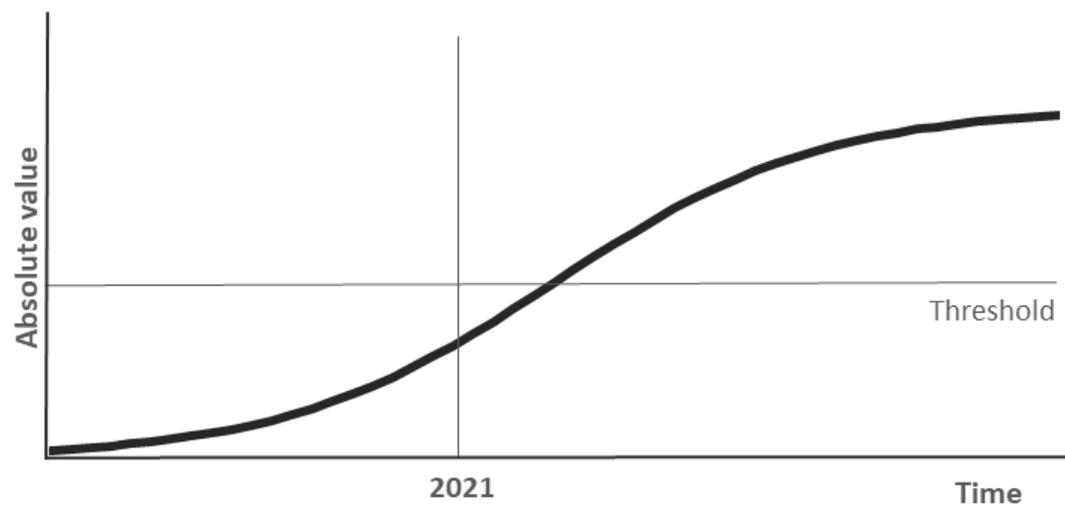


*Negative
feedback loop*

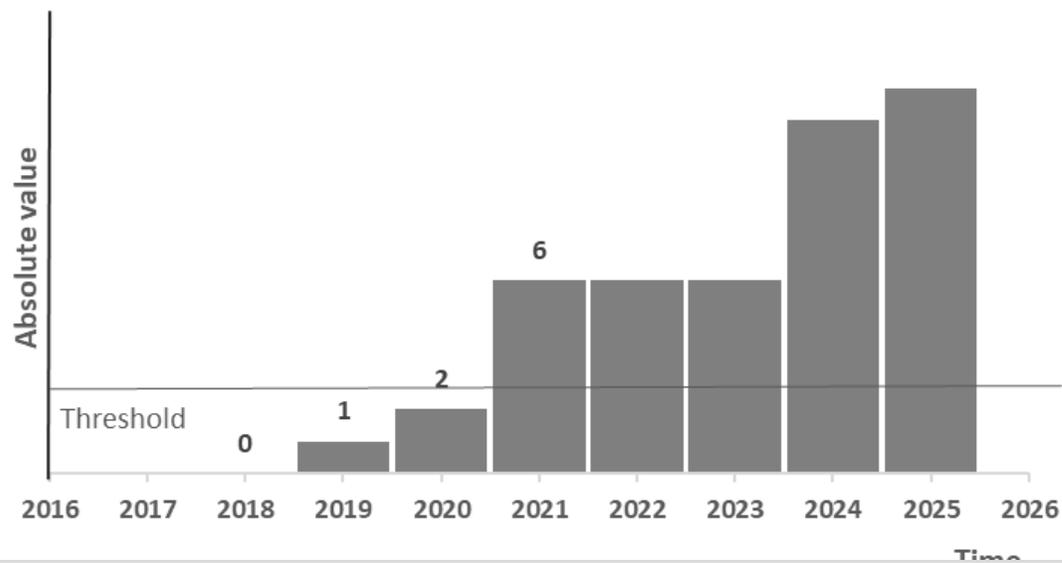
Outcome 3:

Identifying the variables that can guide data collection efforts and help monitoring the tipping processes

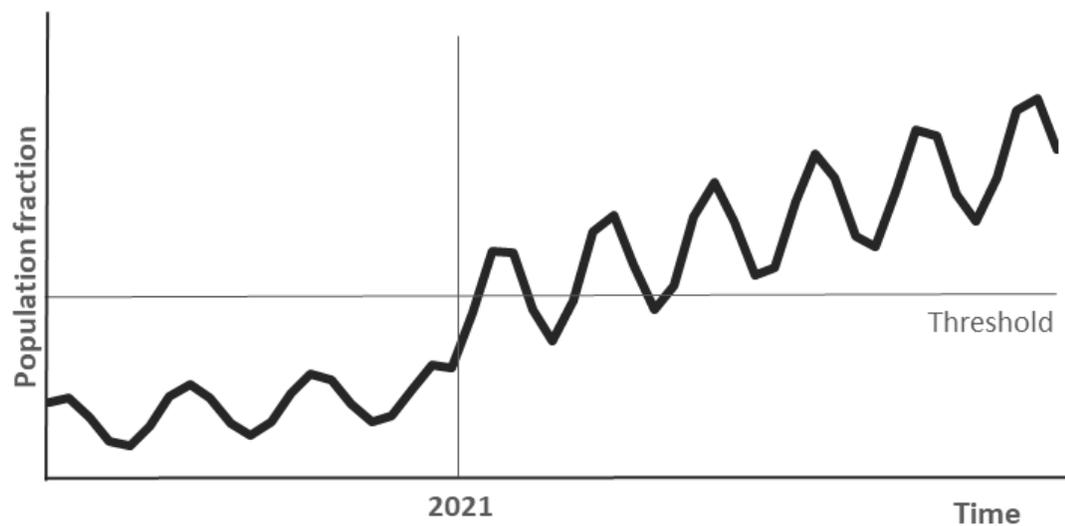
Number of systemically important companies calculating climate VaR



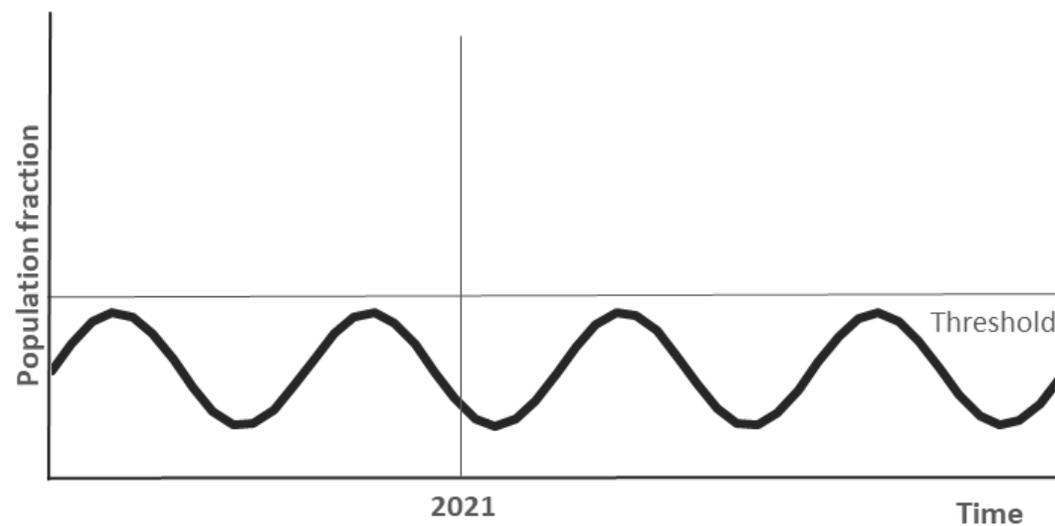
Central banks doing climate stress tests



Population fraction willing to pay for climate action (middle income)

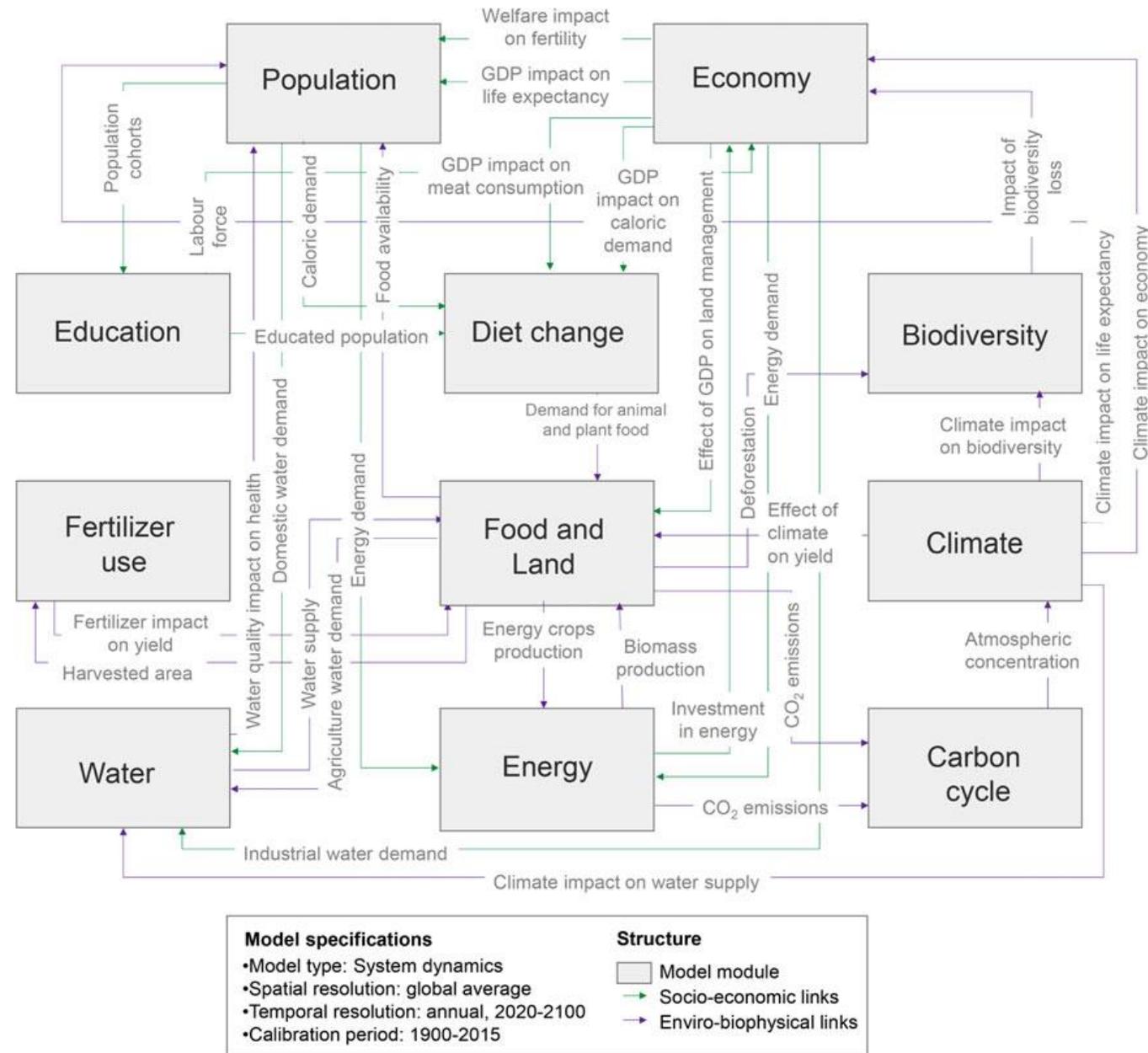


Population fraction willing to pay for climate action (lower income)



Next steps

- Empirical evidence for the feedback mechanisms within and between systems characterized by social tipping processes
- Quantitative modelling to evaluate the potential of social tipping dynamics for decarbonization, and the effectiveness of interventions



Source: Moallemi, Eker et al. (2022) *One Earth*
 adapted from Ryzak (2013)

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