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Using simple integrated assessment models to explore human and earth system feedbacks

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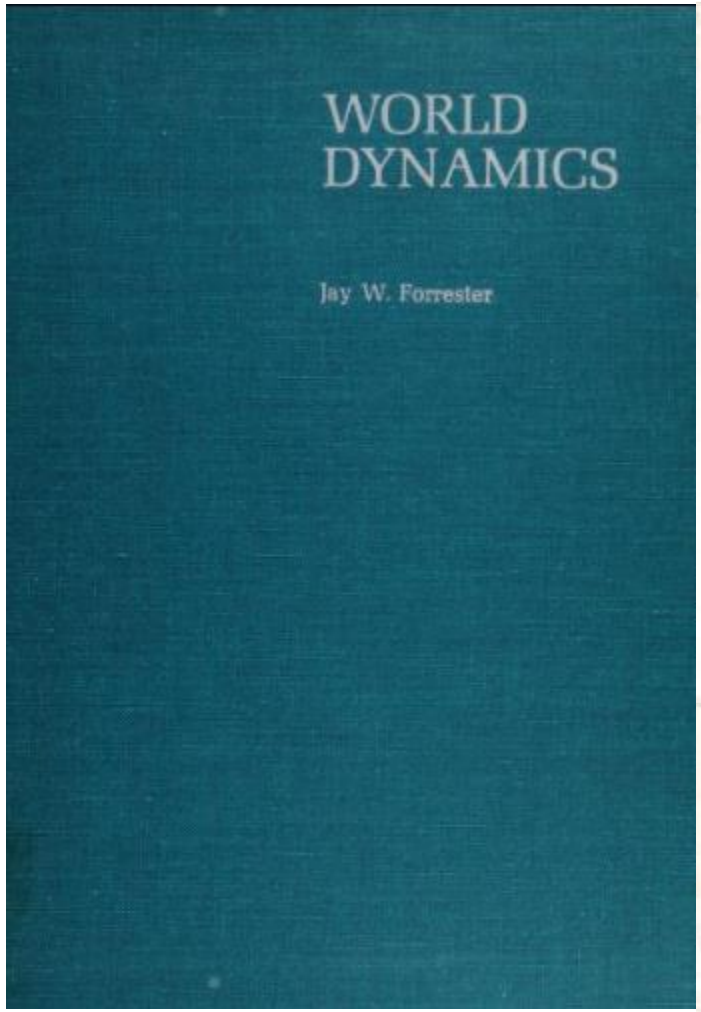
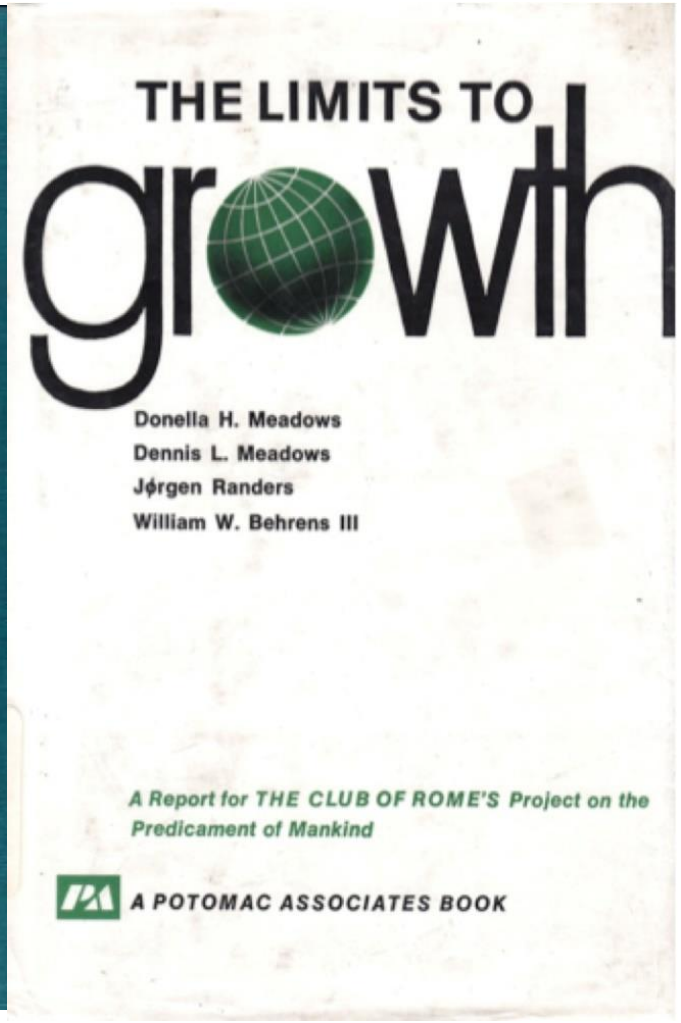
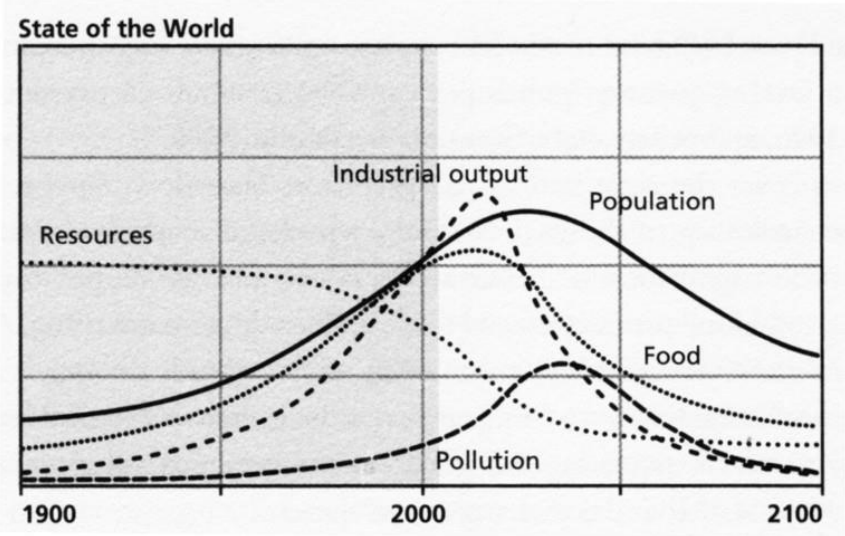
Scenarios Forum
June 2022

Global Modelling

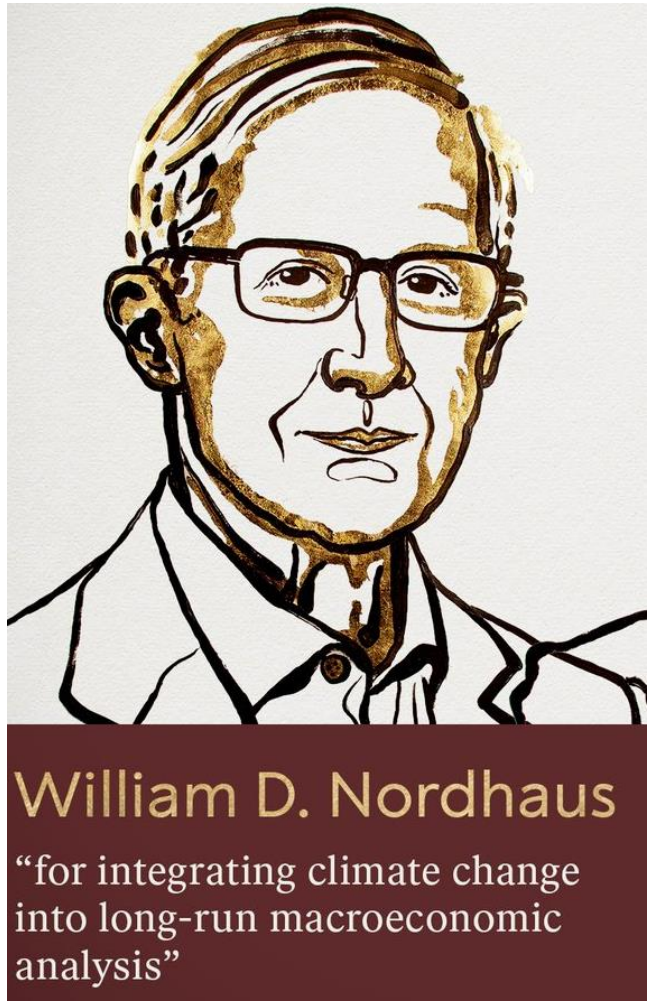


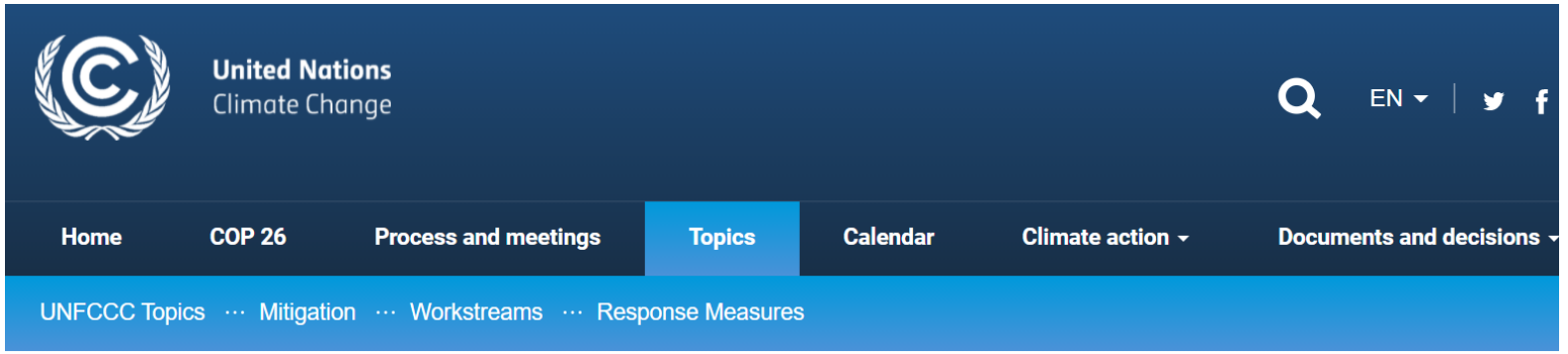




Another strong criticism of the system dynamics method is given by [redacted] (1973). His paper consists mostly of specific technical criticisms of Forrester's *World Dynamics* (1971). The technical criticisms are beyond the scope of our article (a detailed response is provided by Forrester, Low, and Mass 1974), but the general character of the assertions made by [redacted] on the question of model validity are pertinent to our discussion. [redacted] states that "the treatment of empirical relations in *World Dynamics* can be summarized as measurement without data, ... as not a single relationship is drawn from empirical studies." From a relativist point of view, the validity of [redacted]'s criticisms depends on what he means by empirical studies and on the purpose and intended use of the model, neither of which is specified in his article. It is evident that [redacted] holds an empiricist philosophy of science quite incompatible with that of system dynamics. Quoting from Naylor and Finger, he claims that a model not subjected to empirical validation is "void of meaning." Such a criterion of meaning is reminiscent of the extreme logical empiricism of the 1930s.

Barlas, Y. & Carpenter, S. (1990) Philosophical roots of model validation: two paradigms. *Syst. Dyn. Rev.* **6**, 148–166

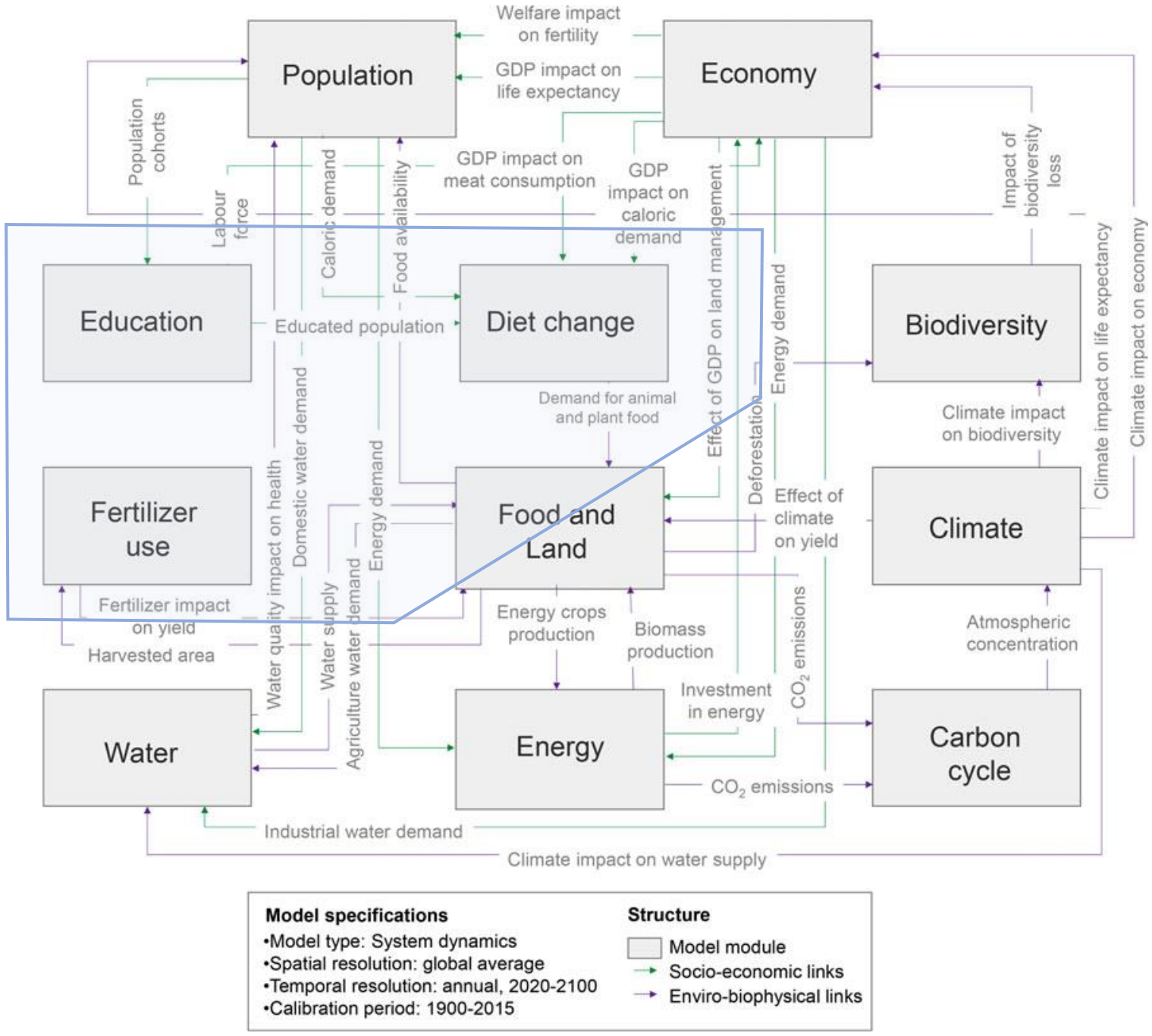




Integrated Assessment Models (IAMs) and Energy-Environment-Economy (E3) models:

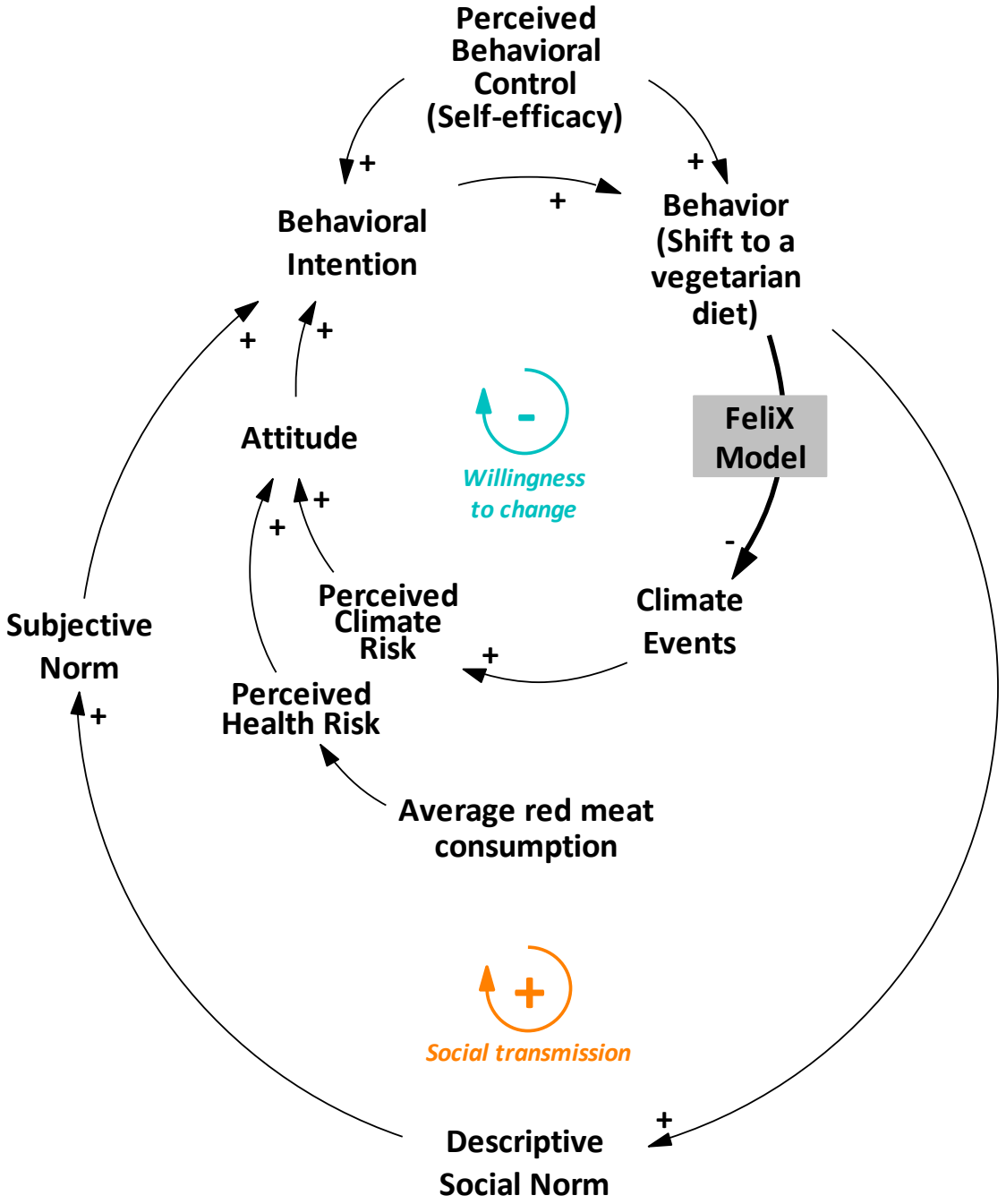
Integrated assessment models (IAM) aim to provide policy-relevant insights into global environmental change and sustainable development issues by providing a quantitative description of key processes in the human and

FeliX model



Source: Moallemi et al. (2022) adapted from Rydzak (2013)

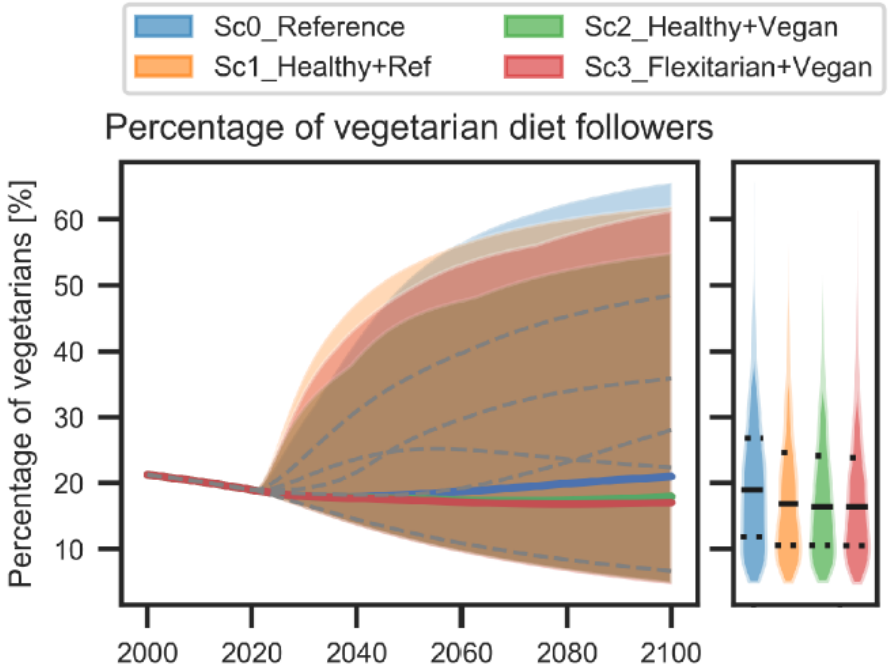
Dietary shifts

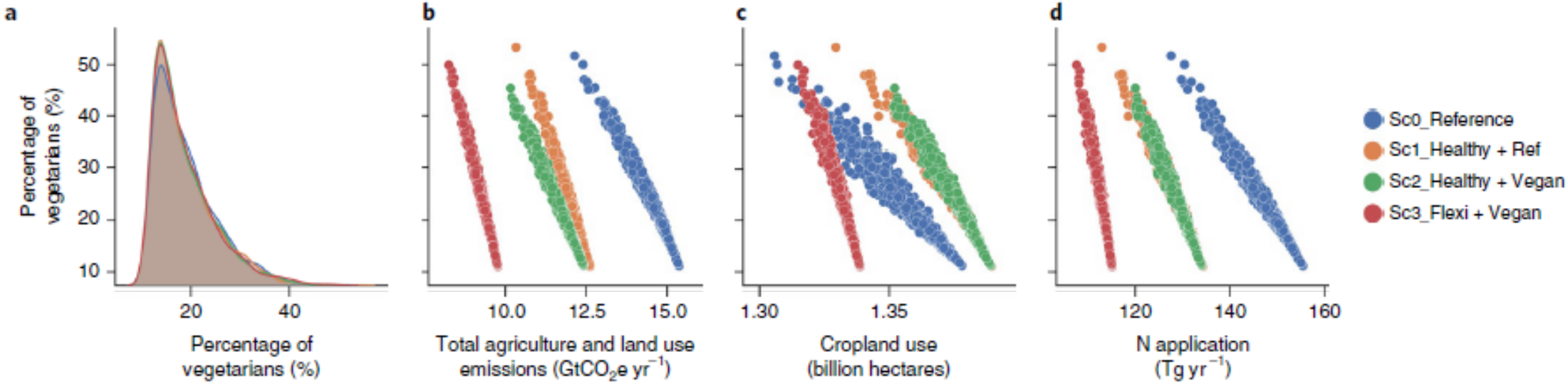


Source: Eker et al. (2019) *Nature Sustainability*

Dietary shifts

Connecting behavioral factors to environmental indicators

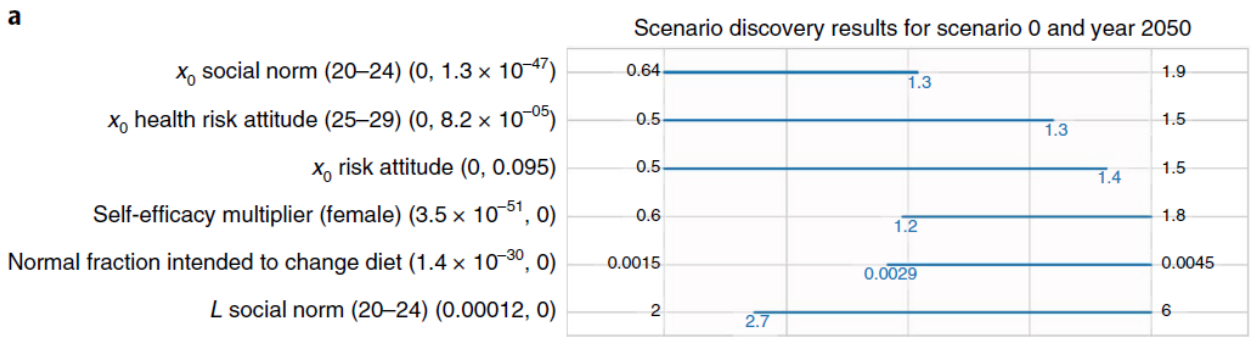


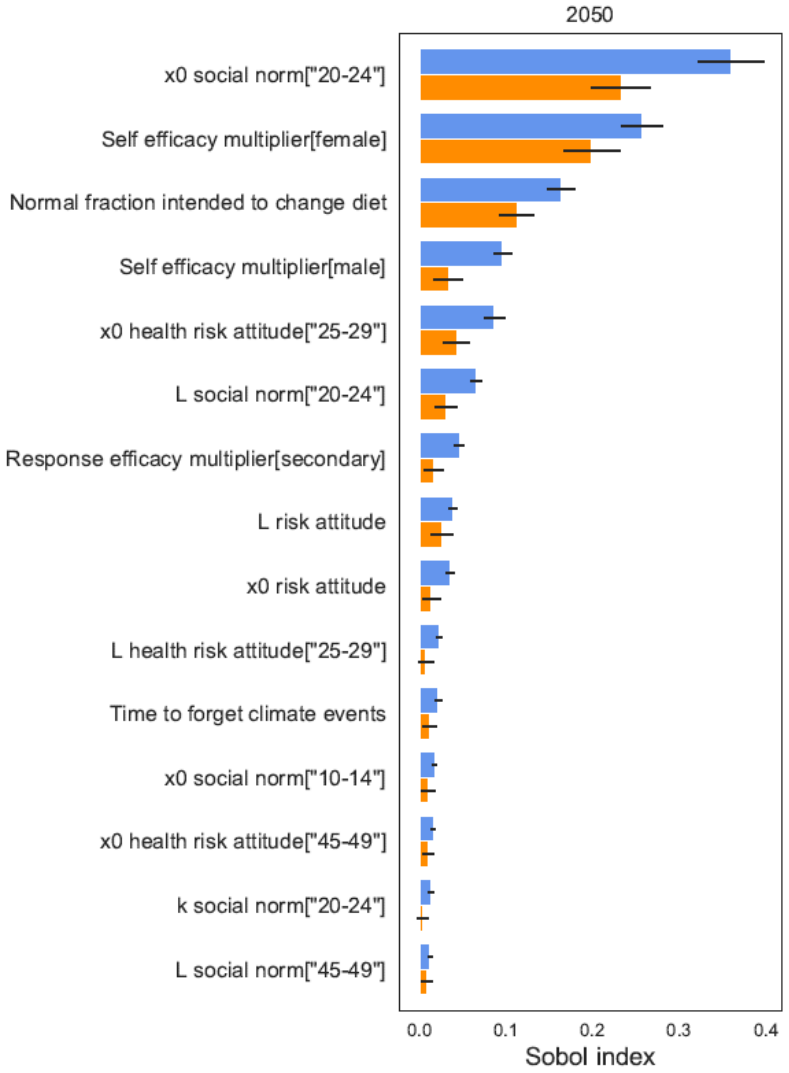


Source: Eker et al. (2019) *Nature Sustainability*

Dietary shifts

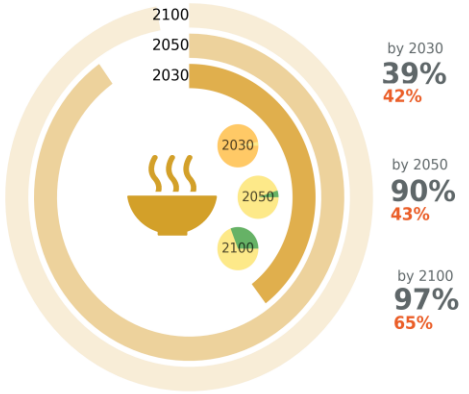
Identifying the most 'important' elements



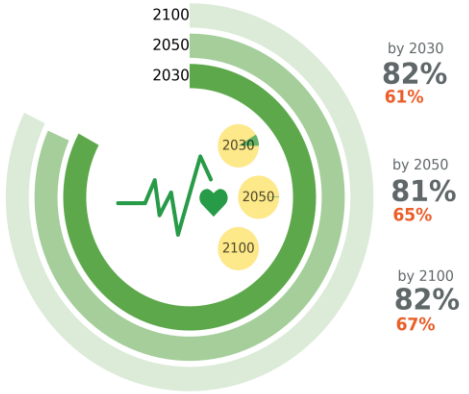


Source: Eker et al. (2019) *Nature Sustainability*

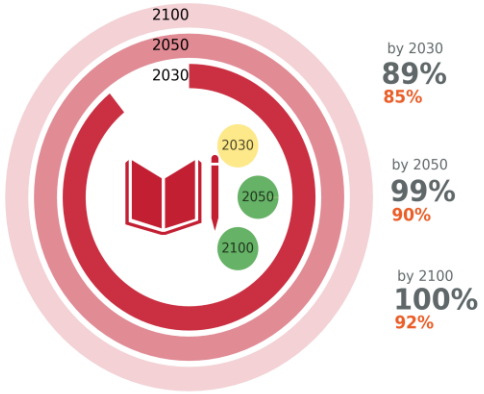
Sustainable Development Pathways (Session #47)



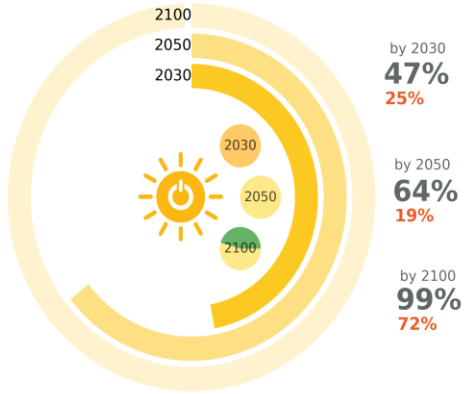
Sustainable Food



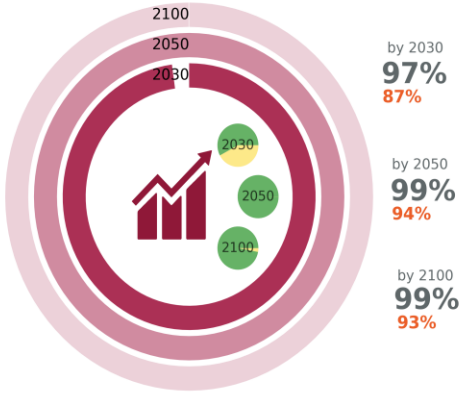
Health & Well-being



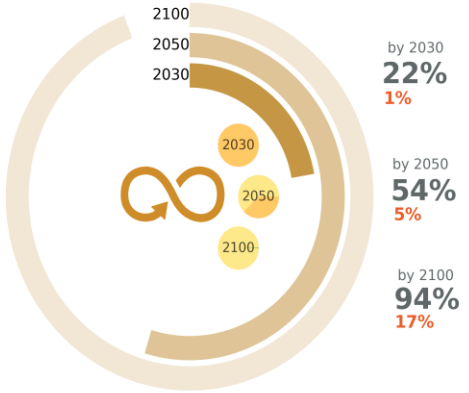
Quality Education



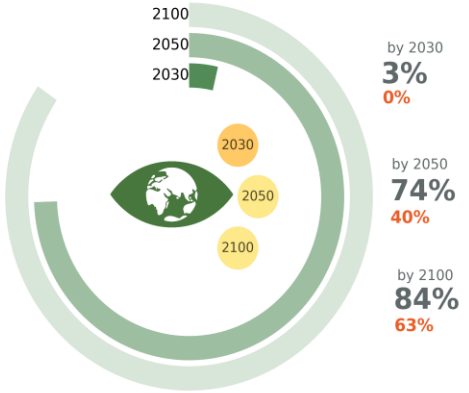
Clean Energy



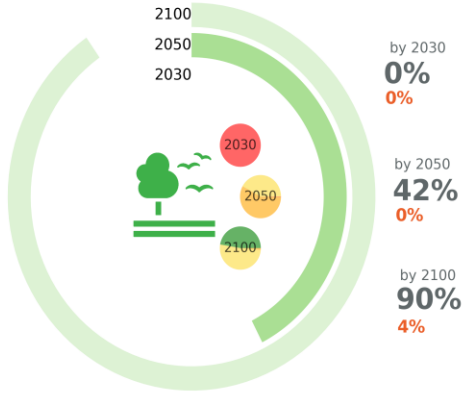
Economic Growth



Responsible Production



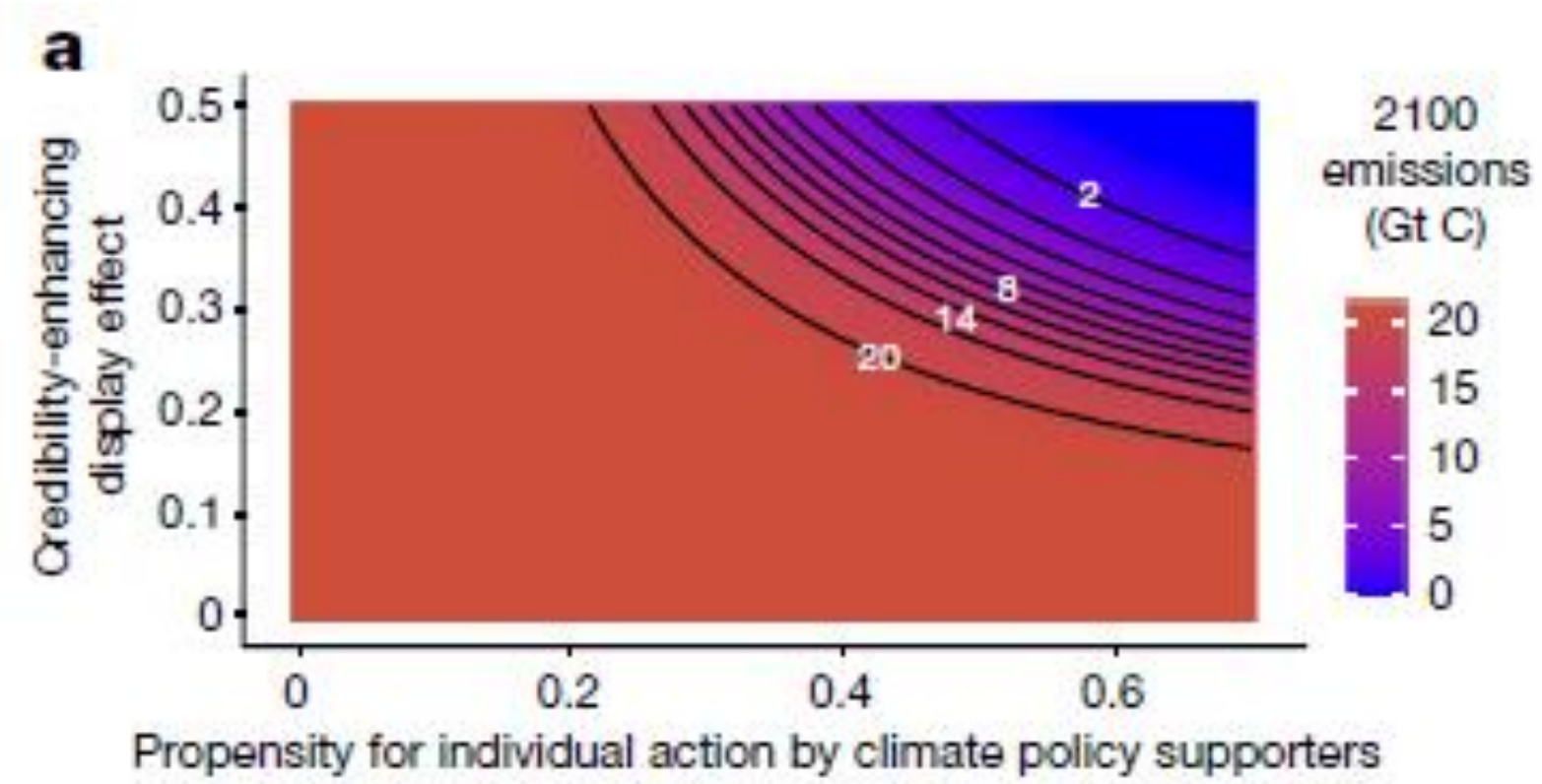
Climate Action



Biodiversity Conservation

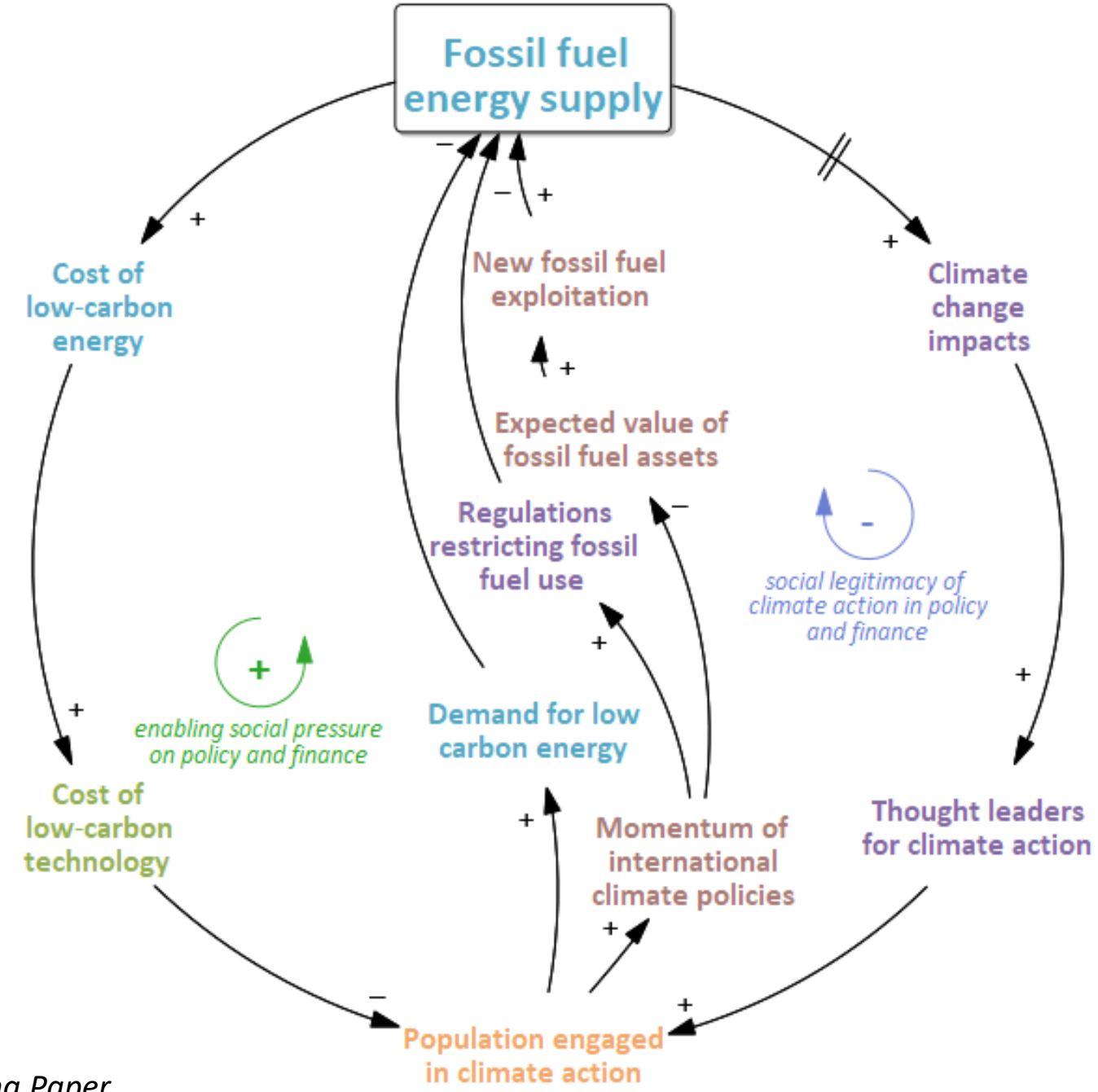
Source: Moallemi et al. (in press) *One Earth*

Social tipping dynamics



Moore et al. (2022) *Nature*

Social tipping dynamics



Eker and Wilson (2022) *IIASA Working Paper*

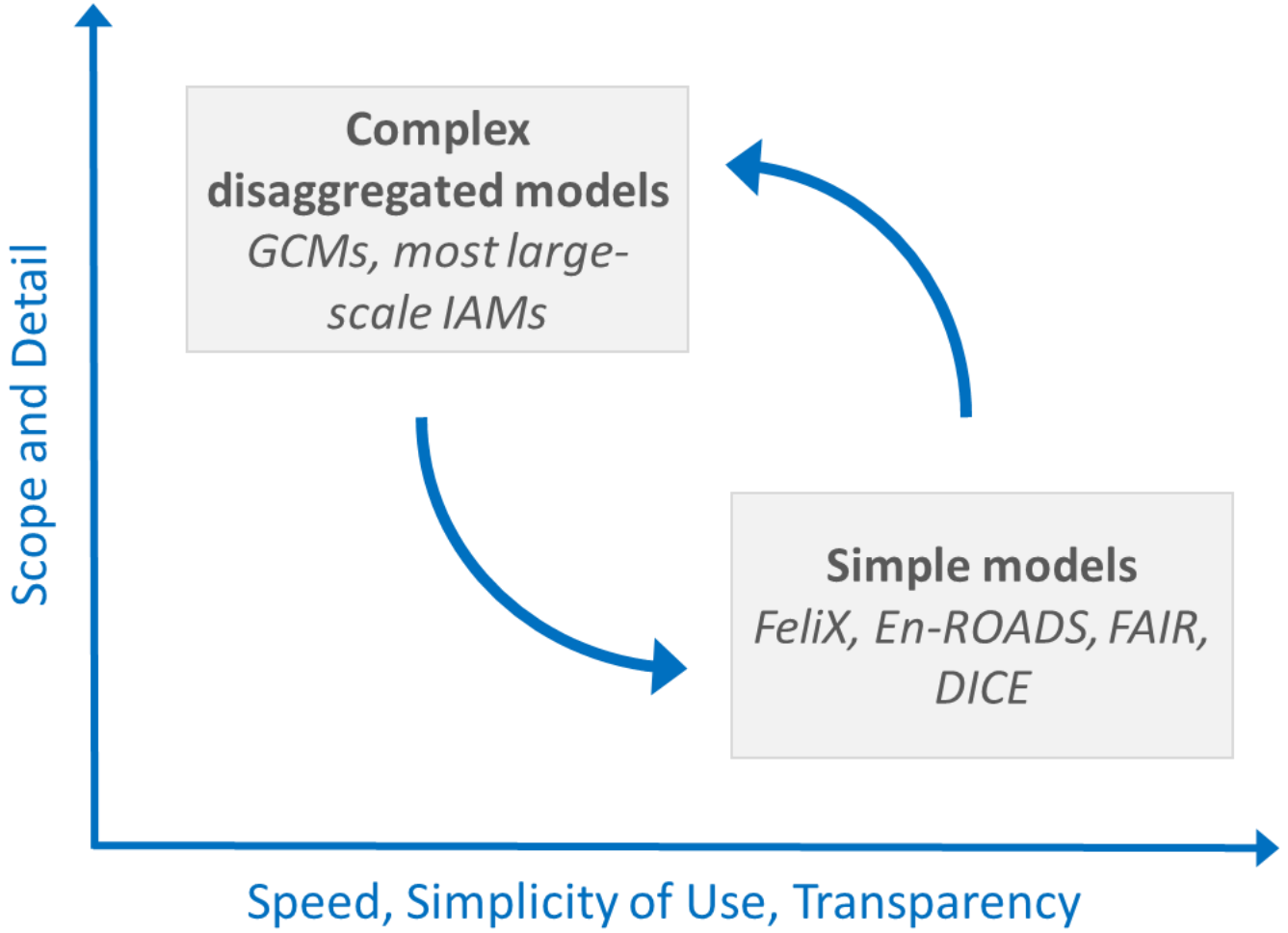
Feedbacks and nonlinearities between human and earth systems

Exploring uncertainties through speed, scope and accessibility

Accessible and usable by non-experts

Plausible and feasible scenarios through stakeholder participation

Simple models



Source: Climate Interactive

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