

Exploring the Emergence of Tipping Points in a Socio-Ecological System in Southwestern Amazonia



GEFÖRDERT VOM

Bundesministerium
für Bildung
und Forschung



Presented at the  **General Assembly 2022** by **Alberto Andrino & The Prodigy TEAM**
Leibniz Universität Hannover



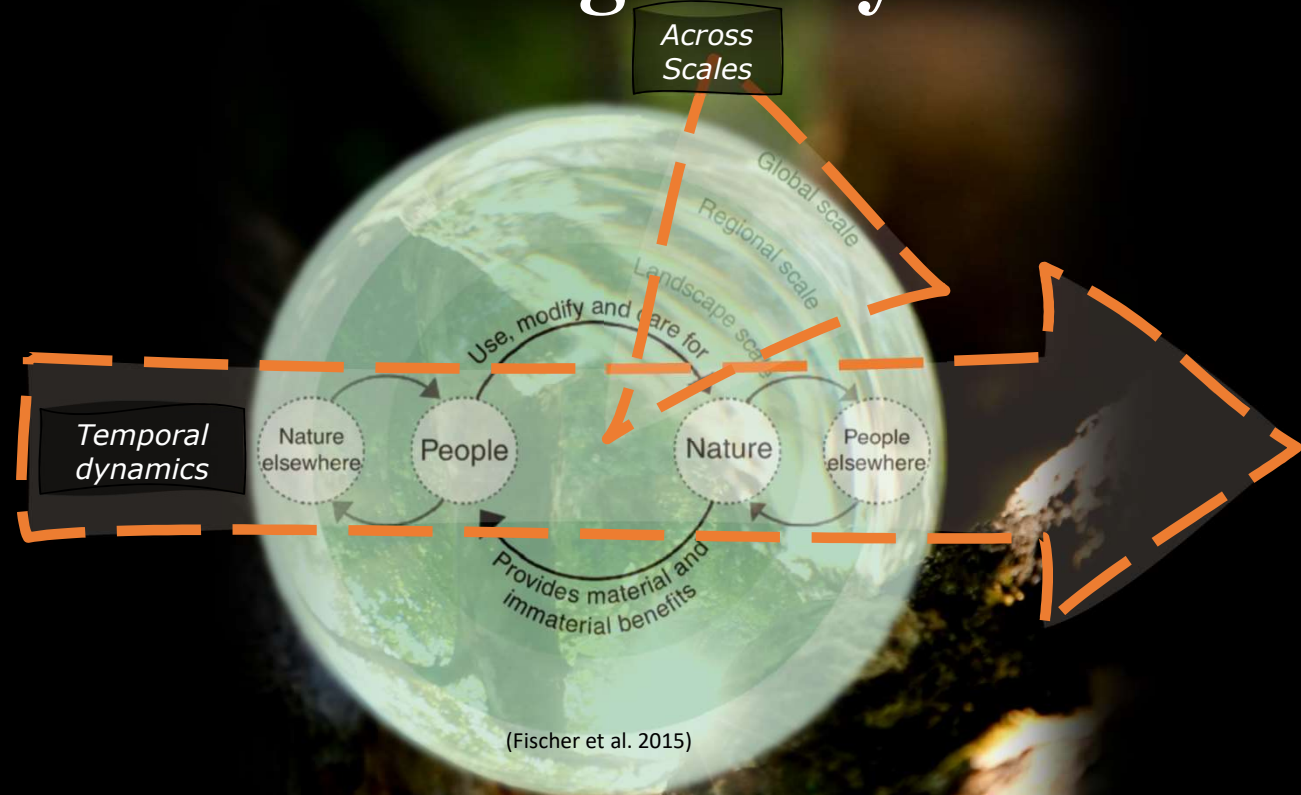
Towards systematic approaches...



MILLENNIUM ECOSYSTEM ASSESSMENT

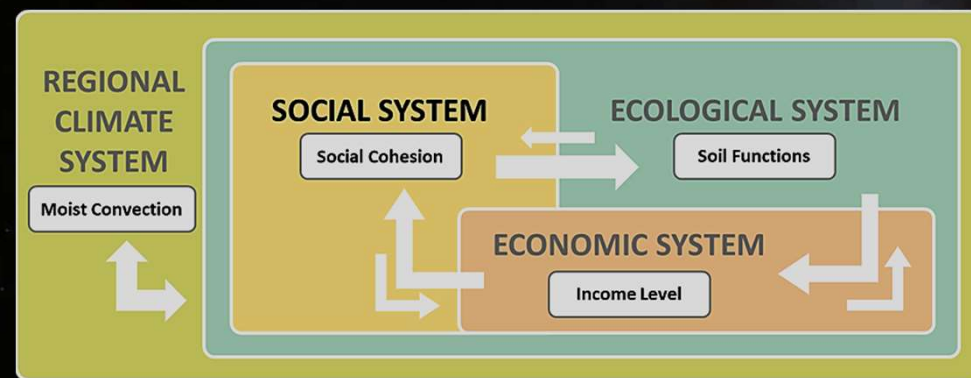


Social-Ecological Systems

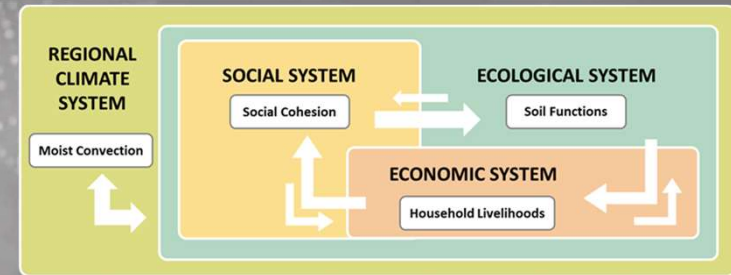


Open systems operating far from equilibrium, and requiring a constant interaction (information, energy, or materials) into or out of the system boundaries to maintain their organization

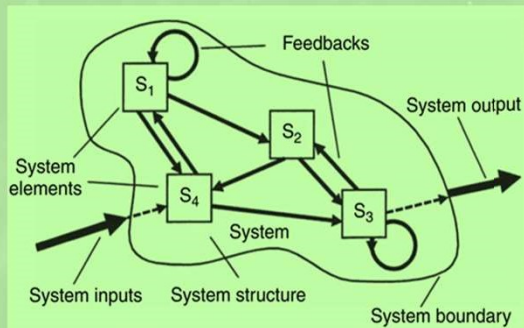
Our Social-Ecological System: MAP region



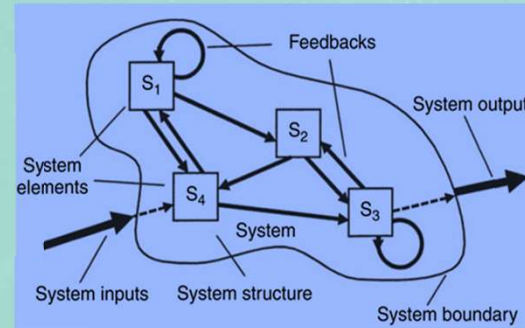
Major tipping element
(a large-scale sub-system of the Earth System)



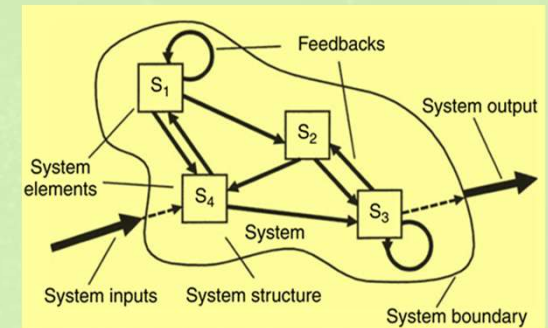
REGIONAL CLIMATE Tipping element (TE)



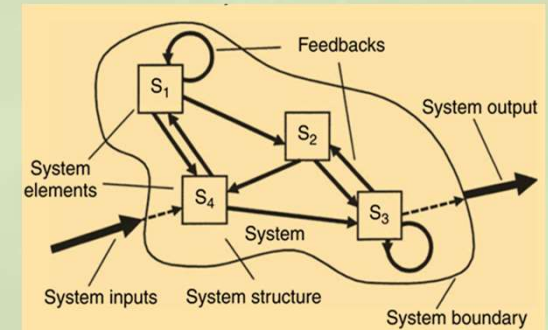
SOIL ECOSYSTEM TE

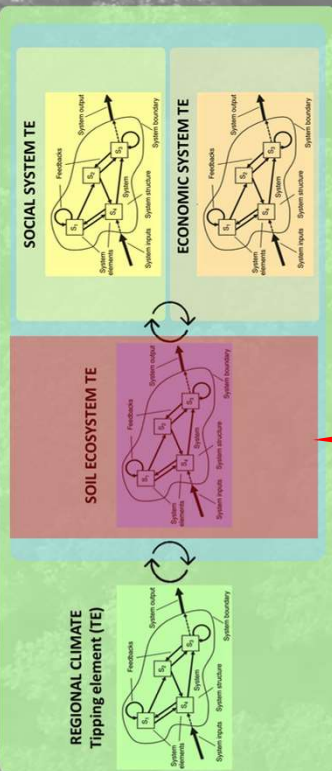


SOCIAL SYSTEM TE

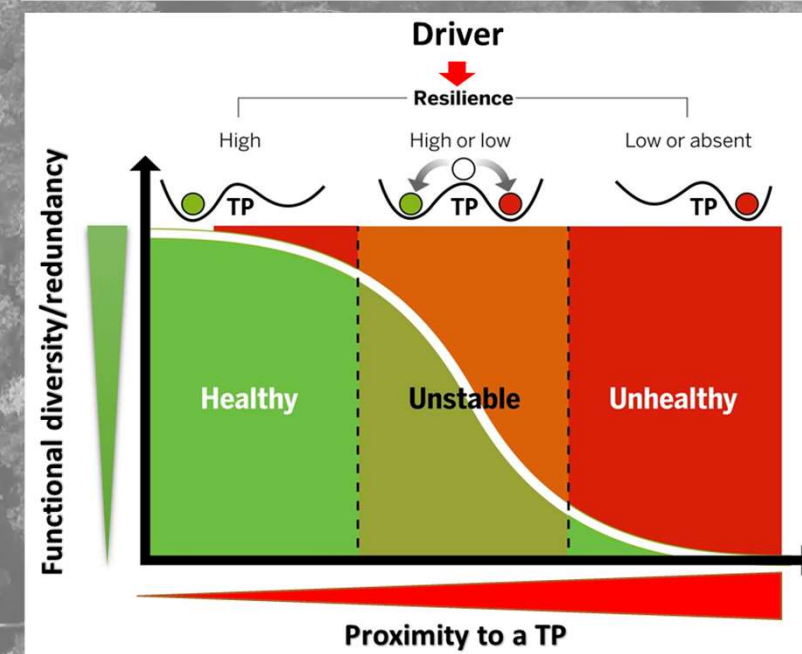
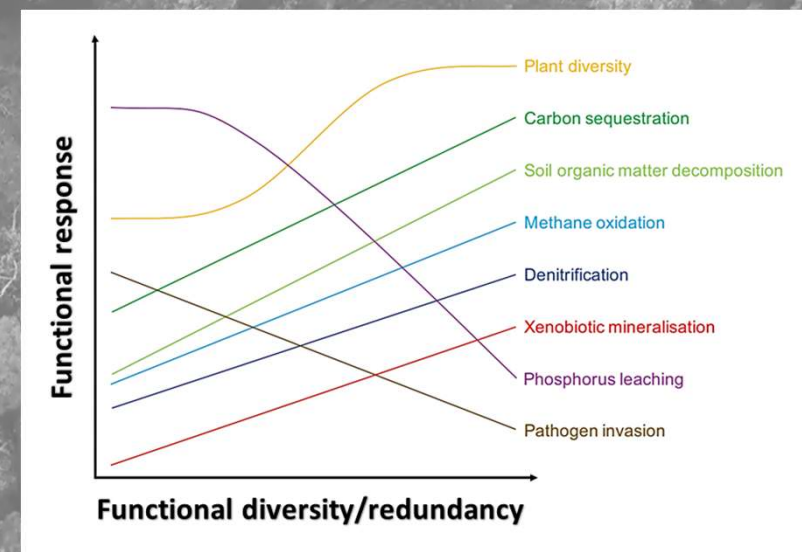


ECONOMIC SYSTEM TE





Tipping element (a sub-system of the major tipping element)	Soil Ecosystem
Crucial system feature (main properties of the system)	Soil functions (through plant water availability and nutrient provision)
Control parameter(s) (parameter that controls the crucial system feature)	Below/aboveground functional diversity and redundancy
Critical control value (measure that quantifies the control parameters)	Diversity/redundancy of plant functional traits and soil microbial functional genes
Regional Driving forces (forces that impact the control parameter)	Land Use and Land cover Change (LUCC); Global Climate Change
Internal stabilizing feedback mechanisms (Negative Feedbacks)	The soil-plant feedback mechanism (PSFM) is enhanced if there is a greater diversity of plant functional traits and soil microbial functional genes, promoting soil buffering functions
Internal self-amplifying feedback mechanisms (Positive Feedbacks)	Reduced above (e.g., plant functional traits) and below ground functional diversity and redundancy (e.g., microbial functional genes) results in a reduction of the soil buffering functions supporting water and nutrient supply
Early warning Indicators (quantify change of the control parameter)	Metrics on: greenhouse gas emissions; nutrient stoichiometry; microbial functional diversity; plant functional traits



Example of a gradient within one country (4 clusters made up of 16 plots and 48 subplots)

*Gradient of
Aboveground
Biodiversity*

*Gradient of
Belowground
Biodiversity?*

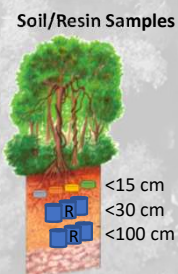
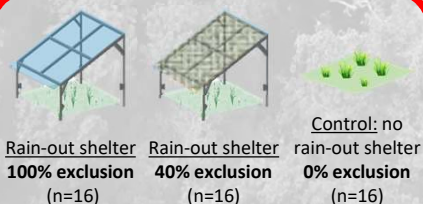


RESEX Chico Mendes

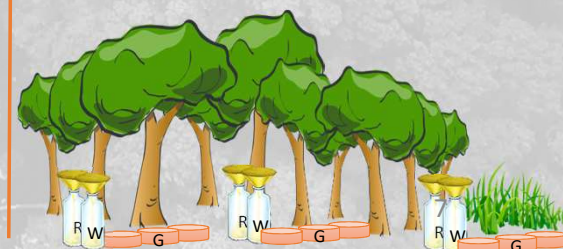
- Primary forest (n=4)
- Secondary forest (n=4)
- Bushy pasture (n=4)
- Pasture (n=4)



- Functional bags:
- Two sets below each ROS type: one at 15 cm, other inside a ring without root access.
 - One set in the Control treatment: at 15 cm.



Gas (N₂O)/Water Samples (Rainfall and throughfall)



More info here

