System Dynamics Modeling: 'Tools to Think With'

Agriculture and Ecosystem Dynamics: Implications for Landscapes and Livelihoods

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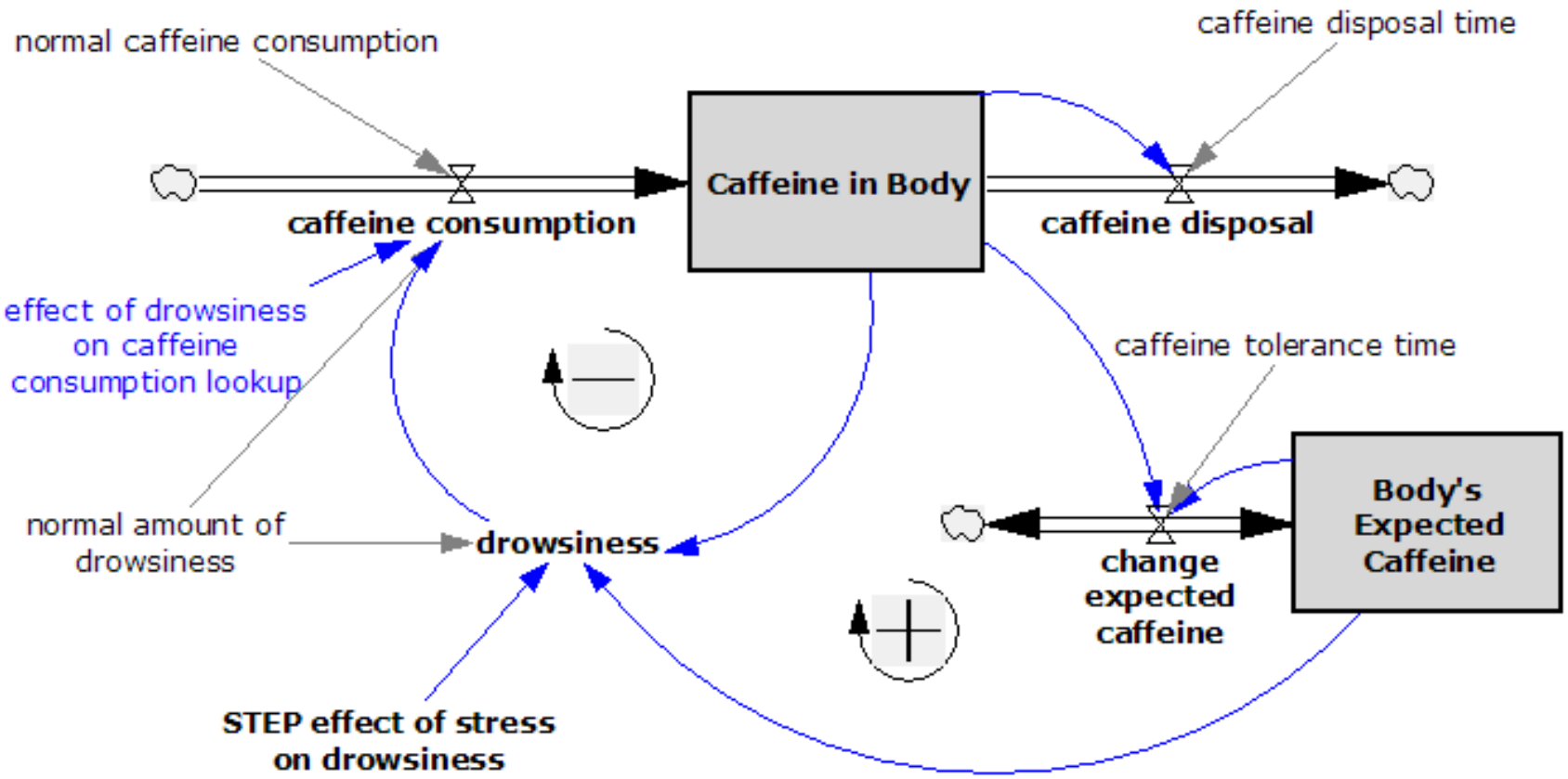
WHAT IS SYSTEM DYNAMICS MODELING?



Key attributes: *feedback, stocks and flows, nonlinearity*

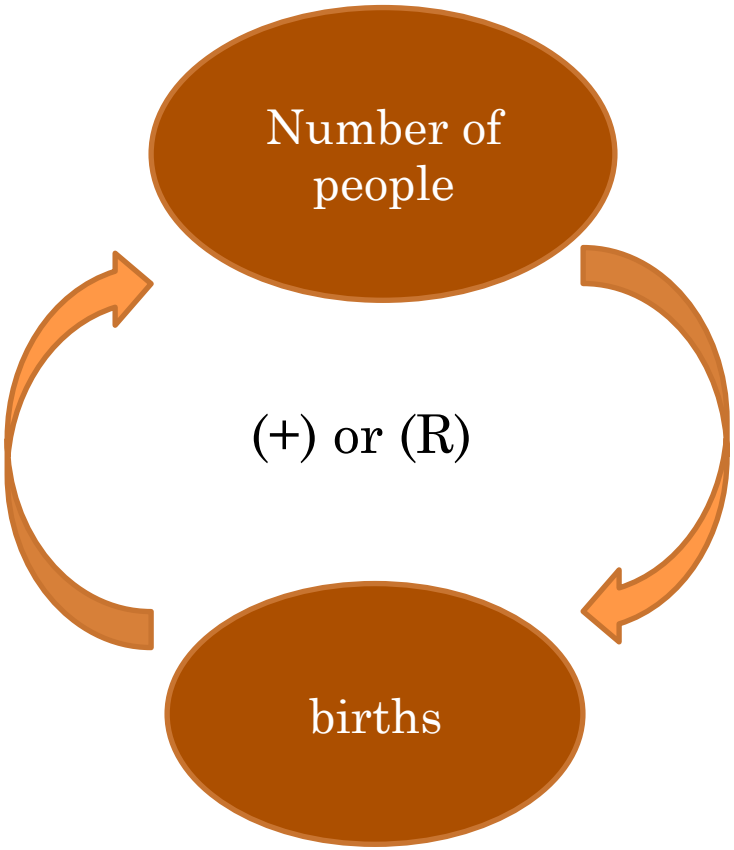
Agriculture and the environment in Zambia: a systems approach

- many potential, interacting problems
- stocks and flows
- feedback (‘A’ causes ‘B’ and ‘B’ causes ‘A’)
- many types of data in one framework

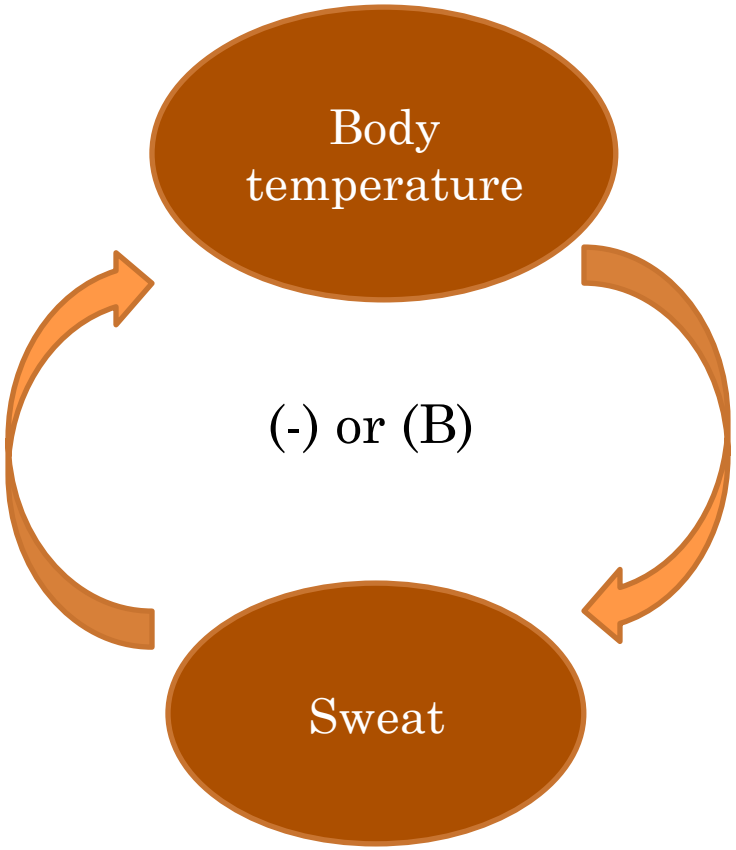
source: ifad-un.blogspot.com

System dynamics modeling: feedback

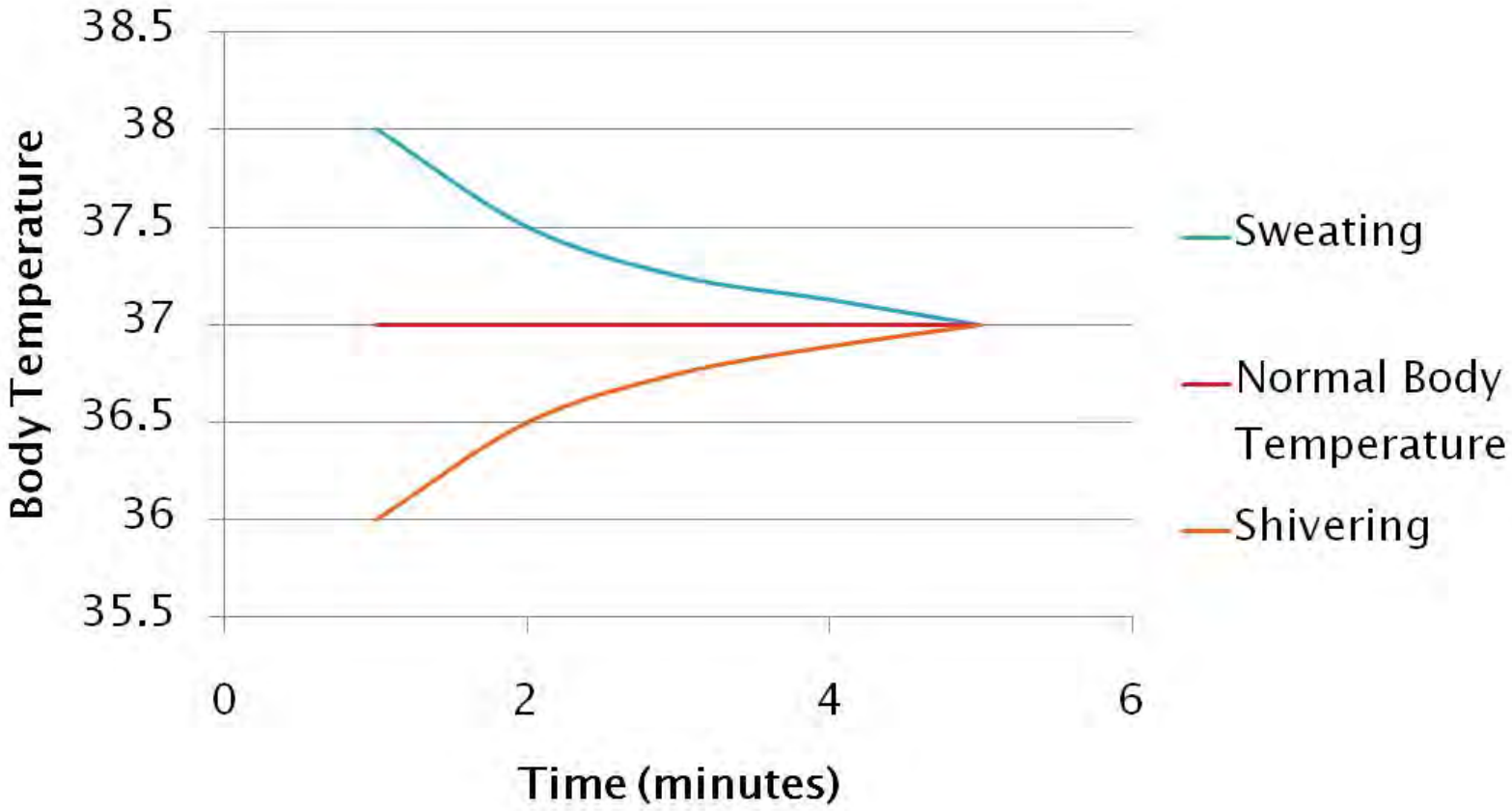
‘Positive’ or ‘Reinforcing



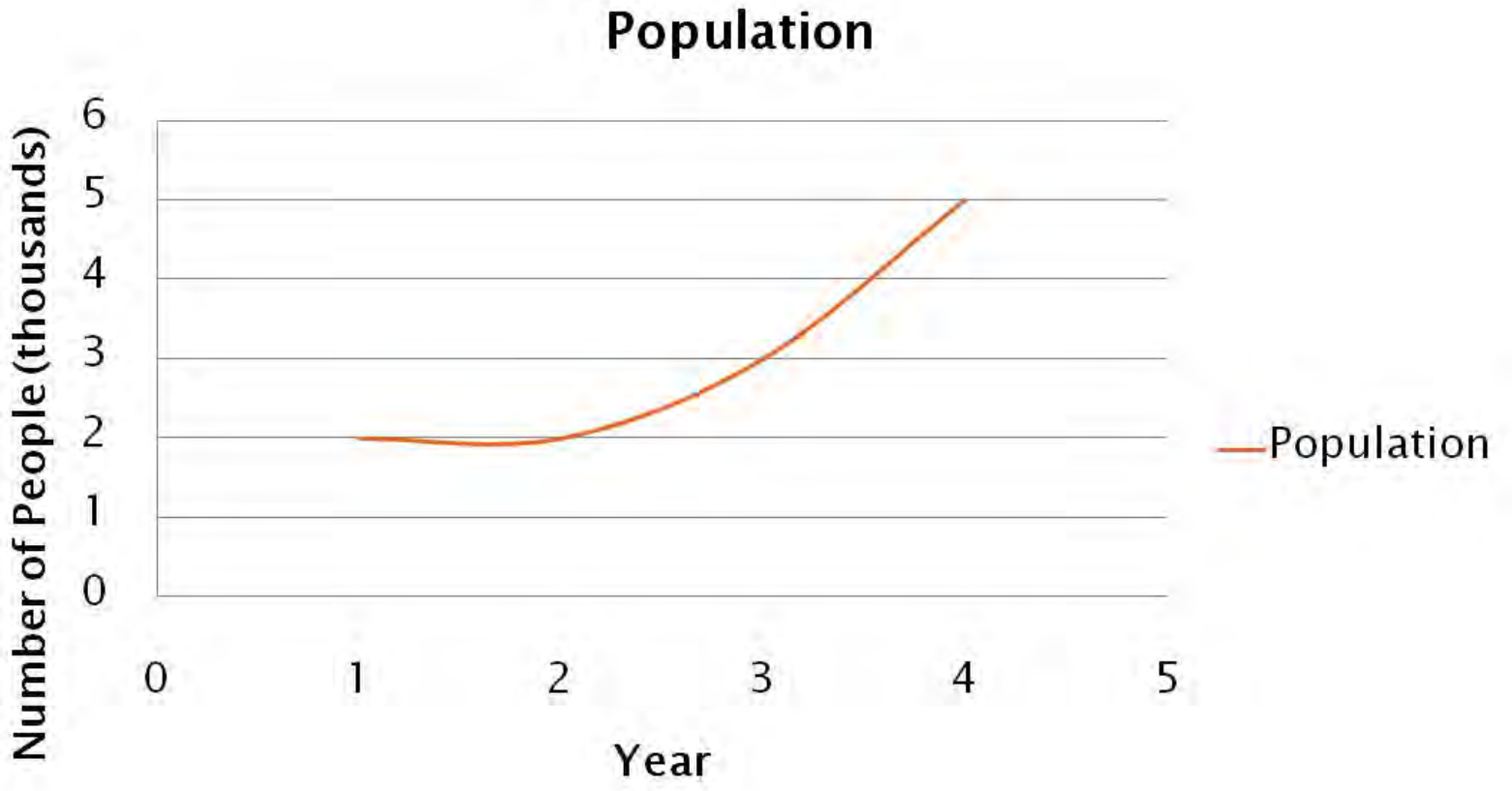
‘Negative’ or ‘Balancing’



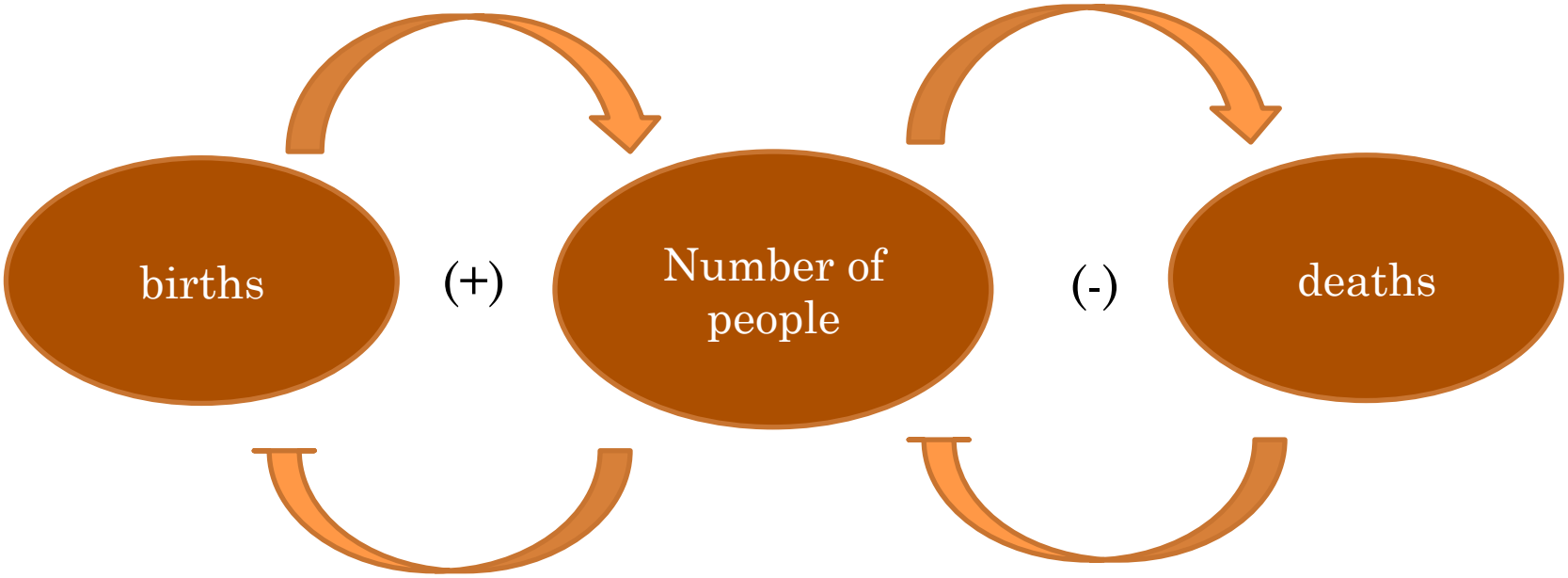
Systems with Balancing Loops tend to achieve equilibrium



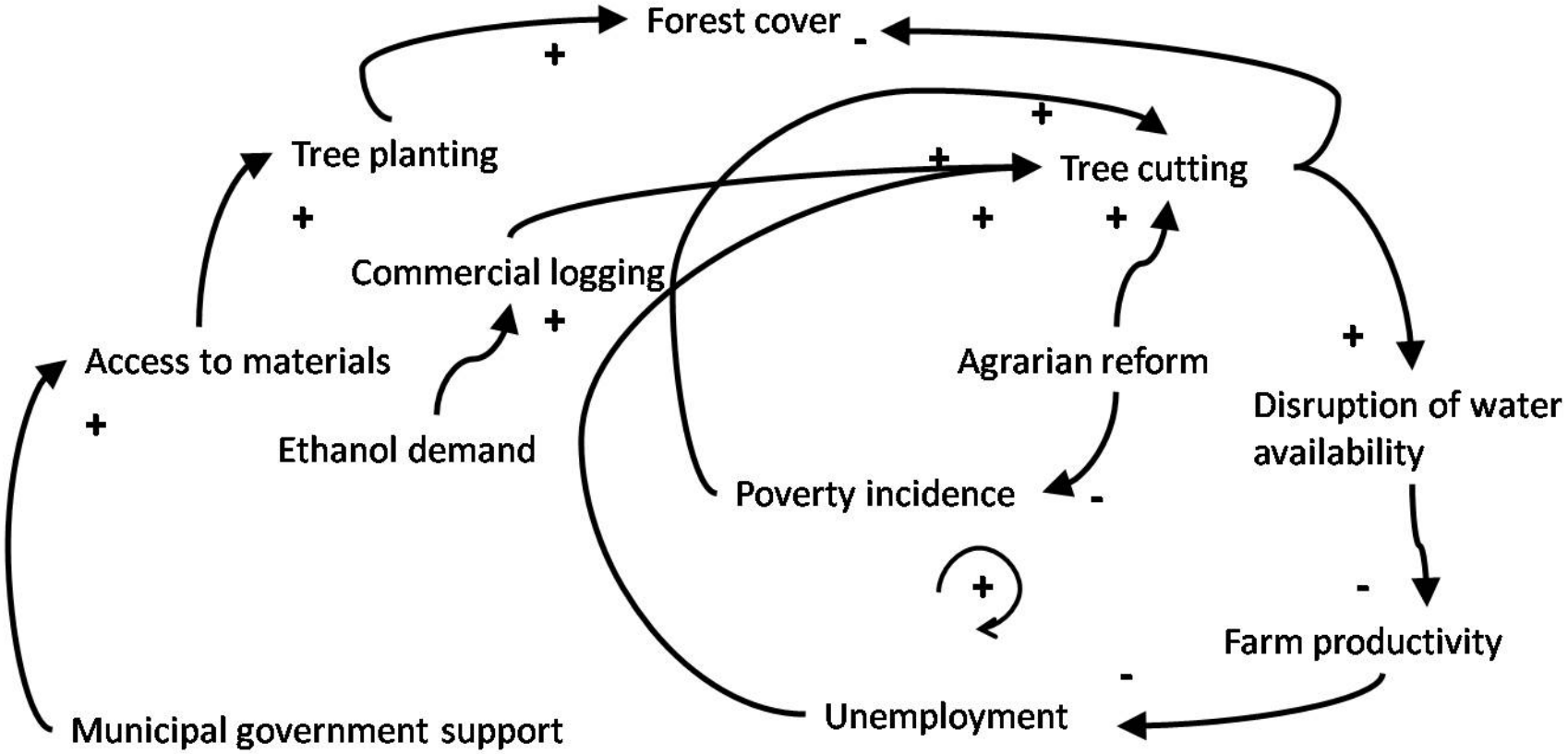
Systems with reinforcing loops tend to exhibit exponential growth



Many systems have both reinforcing loops (+) and Balancing loops (-)



EXAMPLE OF A CAUSAL LOOP DIAGRAM



Model example

- Mid-Michigan heat model
- What factors affect the impact of a heat wave in Detroit
- Policy levers: # of cooling centers, access to public transportation, media campaign, # of people at risk.

Activities

- Problem statement
- Causal tables
- Causal loop diagramming (CLD)
- Presentation and discussion of CLDs

Problem statement Activity

- Individual exercise
- What are the problems related to agriculture or the environment that your organizations work on?
- On what scale do you perceive the problem to be?

Causal tables activity

- Break up into four groups
- Fill out causal tables

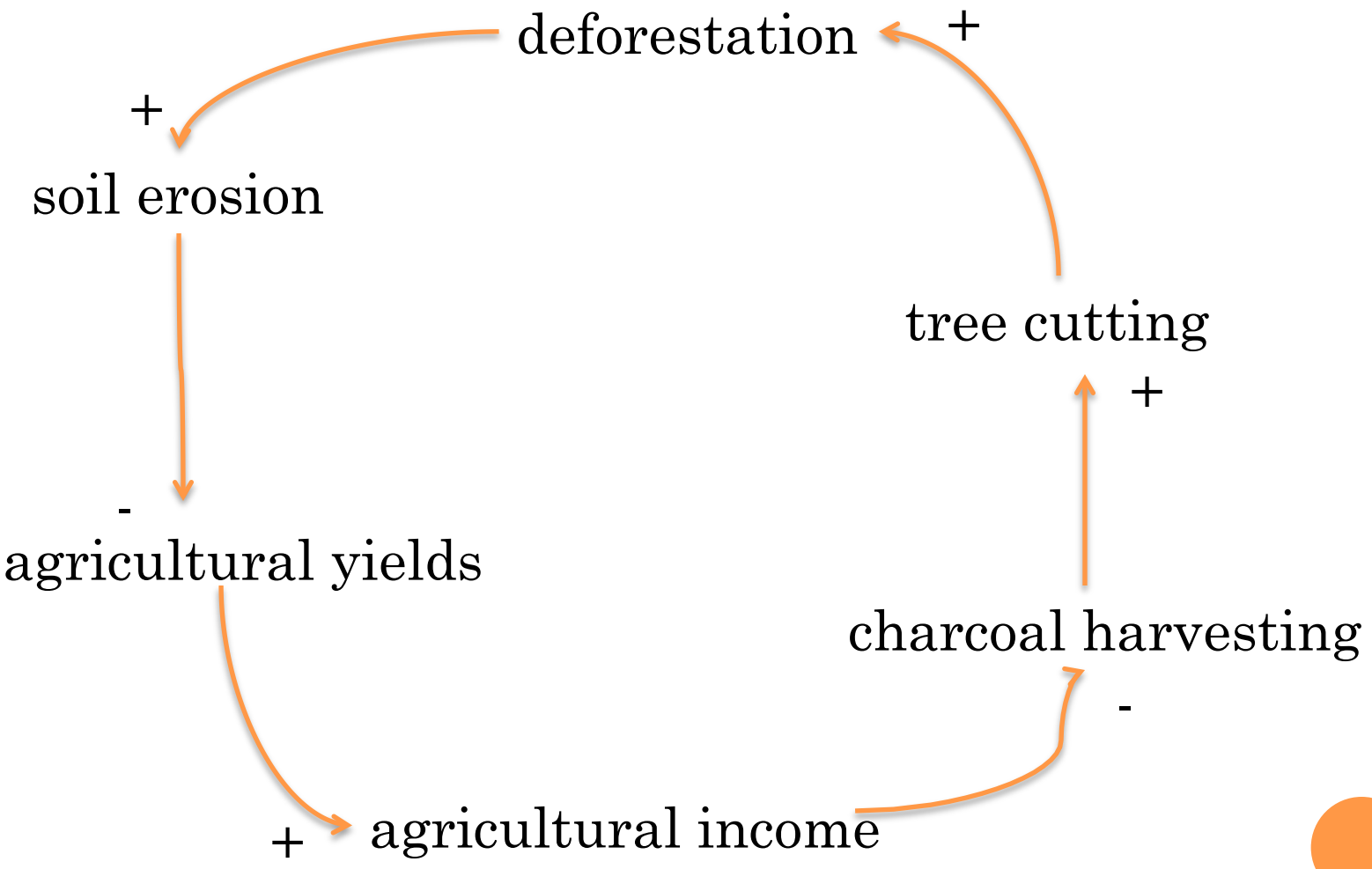
Example of causal table

Problem	Proximate cause	Ultimate cause
Low yields	Lack of inputs	Poverty, lack of market access
	Low soil fertility	Farming on marginal land; erosion

Causal loop diagramming

- Stay in the small groups
- Questions:
  - How are the problems related to one another?
  - What feedback loops are present? If ‘A’ is causing problem ‘B’, is ‘B’ also exacerbating ‘A’?

Feedback loop example



CLD HINTS

- Don’t use verbs! Forest cover not deforestation
- Use variables that are measurable
- Focus on feedback loop (the internal dynamics of the system)
- Start simple and then get more complicated

Group discussion of CLDs

Discussion Questions:

- Which variables are the most important ones to track/model over time?
- Where can we find data on the variables in the diagrams?