

# Multidimensional poverty trap models

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**1. Introduction** – Social-ecological systems, as representatives of complex adaptive systems can be used for purely theoretical study of the intertwinedness of social and ecological components. Mapping this context to a dynamical systems approach, and in the light of existing literature<sup>1</sup>, the term 'trap' refers to an unwanted equilibrium point into which a social-ecological system can fall and persist. Moving out of a trap towards a desired state, e.g. a state of higher human well-being can be difficult because of self-reinforcing mechanisms of the poor state. Development interventions often fail because they do not account for all complexities that exist in a system. Recent research<sup>2</sup> shows importance of physical, natural and human capital in understanding poverty and planning alleviation strategy. This means that multidimensional models should be used instead of the classical Solow model.

**2. Results and Discussion** – We focus on agro-ecological system where nutrients and water are main limiting factors for crop growth. In order to analyse dynamics of the real life system, we formulate system of nonlinear ordinary differential equations with physical capital, soil quality, phosphorus and water as state variables. Using existing ecological and economic theories, we capture dynamics of variables. Depending on the type of feedback, we are looking for conditions of multistability or periodic behavior.

**3. Conclusions** – Our model-based approach offers a systemic way to study how the multiple ways in which nutrients, water and assets interact with farmland influence poverty. We show that there is no universal poverty alleviation strategies because the functional forms and parameters are context dependent. The long-term dynamics is clear if the system is characterized by positive or negative feedback, but further research is needed for systems with combined feedbacks.

## 4. References

- [1] Cumming, G. S. (2017). A review of Social Dilemmas and Social-Ecological Traps in Conservation and Natural Resource Management. *Conservation Letters*.
- [2] Lade, S. J., et al. "Resilience offers escape from trapped thinking on poverty alleviation." *Science advances* 3.5 (2017): e1603043.