Protecting Food Supply and Farmer Livelihoods in West Africa: Strategies for Risk Reduction

Debbora Leip\textsuperscript{1,2}, Elena Rovenskaya\textsuperscript{1}, Matthias Wildemeersch\textsuperscript{1}

\textsuperscript{1}International Institute for Applied Systems Analysis, \textsuperscript{2}Potsdam Institute for Climate Impact Research

Motivation and contributions

- Weather extremes and high population growth are challenging the achievement of SDG 2 Zero Hunger in West Africa. It is essential to understand how crop production decisions by farmers affect the reliability of food production and the stability of their livelihoods.
- Future food security scenarios are often based on models that ignore annual weather variability and weather extremes. As a result, this approach also disregards the risk of having lower than expected yields, with adverse consequences for food security and farmer livelihoods.
- We propose a stochastic modelling framework that allows to study the reliability of food production under yield uncertainty, and explore different strategies to increase this reliability at a minimum cost.
- To share the financial risk of farmers over time, we include a contingency fund that is capitalized by means of annual contributions from farmers. The fund is used to guarantee a minimum income for farmers in the event of very low harvests.
- Outcomes of different cultivation strategies are tested under a stationary scenario, a high-pressure scenario (high population growth), and a low-pressure scenario (increasing yield trends).

Results

- To transport to industrial production.

Stochastic modelling framework for food production reliability analysis

Cultivation strategies can balance the risk of food insecurity with the cost of overproduction

1. Risk-neutral strategy: satisfy food demand on average
2. Risk-target strategy: ensure a desired level of reliability of food production
3. Risk-sharing strategy: regional cooperation

Discussion and Outlook

- Fund solvency at the regional scale only achievable for infrequent events and high contributions.
- Risk-targeting combined with regional cooperation and contingency funds can significantly improve the reliability of food production and provide guarantees for farmer livelihoods.
- Trade liberalization is a prerequisite to obtain the benefits of risk pooling.
- The success of the contingency fund depends on the willingness of countries to participate in risk pools and the availability of fiscal space in the participating countries.
- Ignoring uncertainty can result in solution pathways that contain excessive residual risk. This insight applies to multiple systems relevant to sustainability, ranging from energy to transport to industrial production.