

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

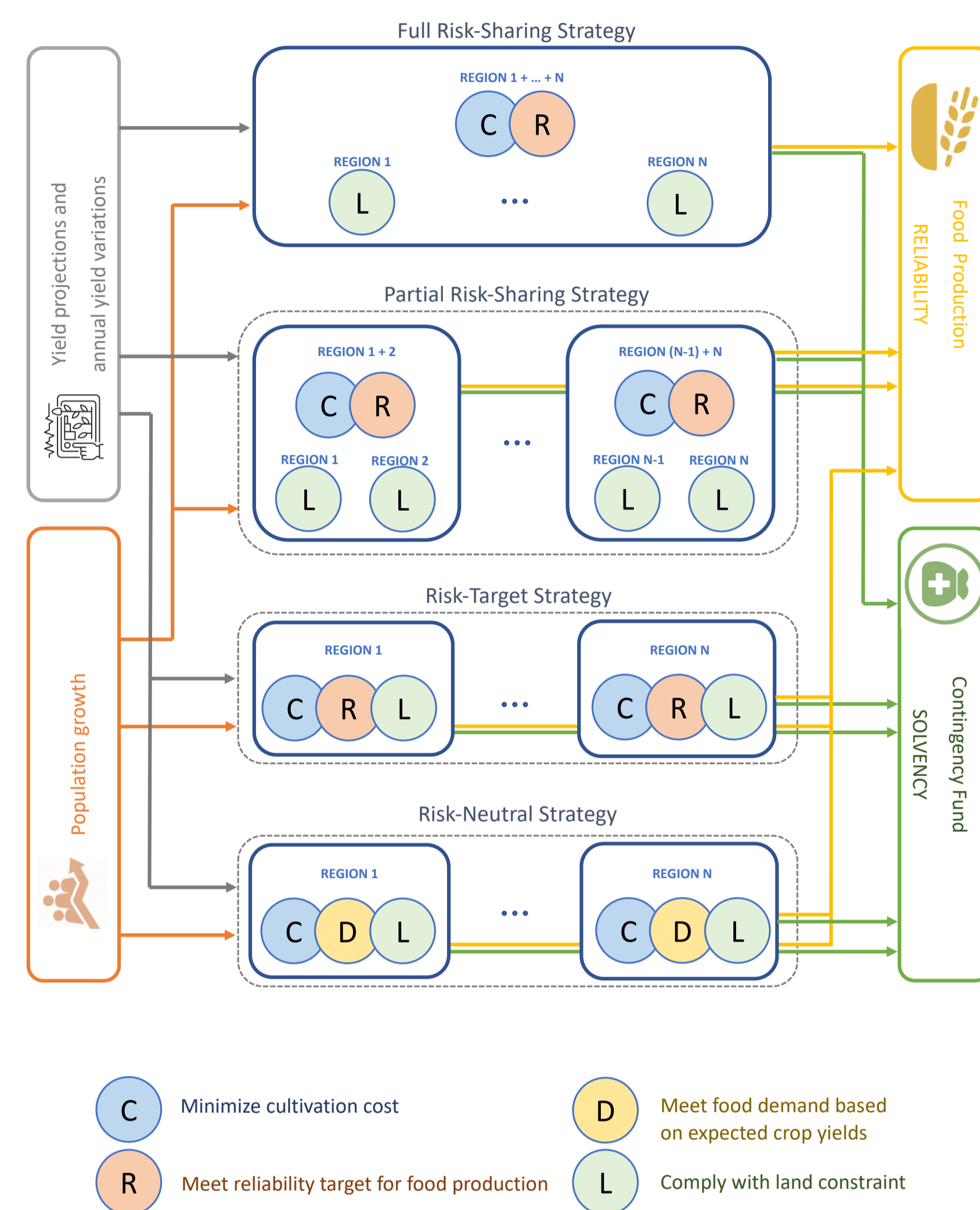
Debbora Leip^{1,2}, Elena Rovenskaya¹, Matthias Wildemeersch¹

¹International Institute for Applied Systems Analysis, ²Potsdam 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 crop 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).

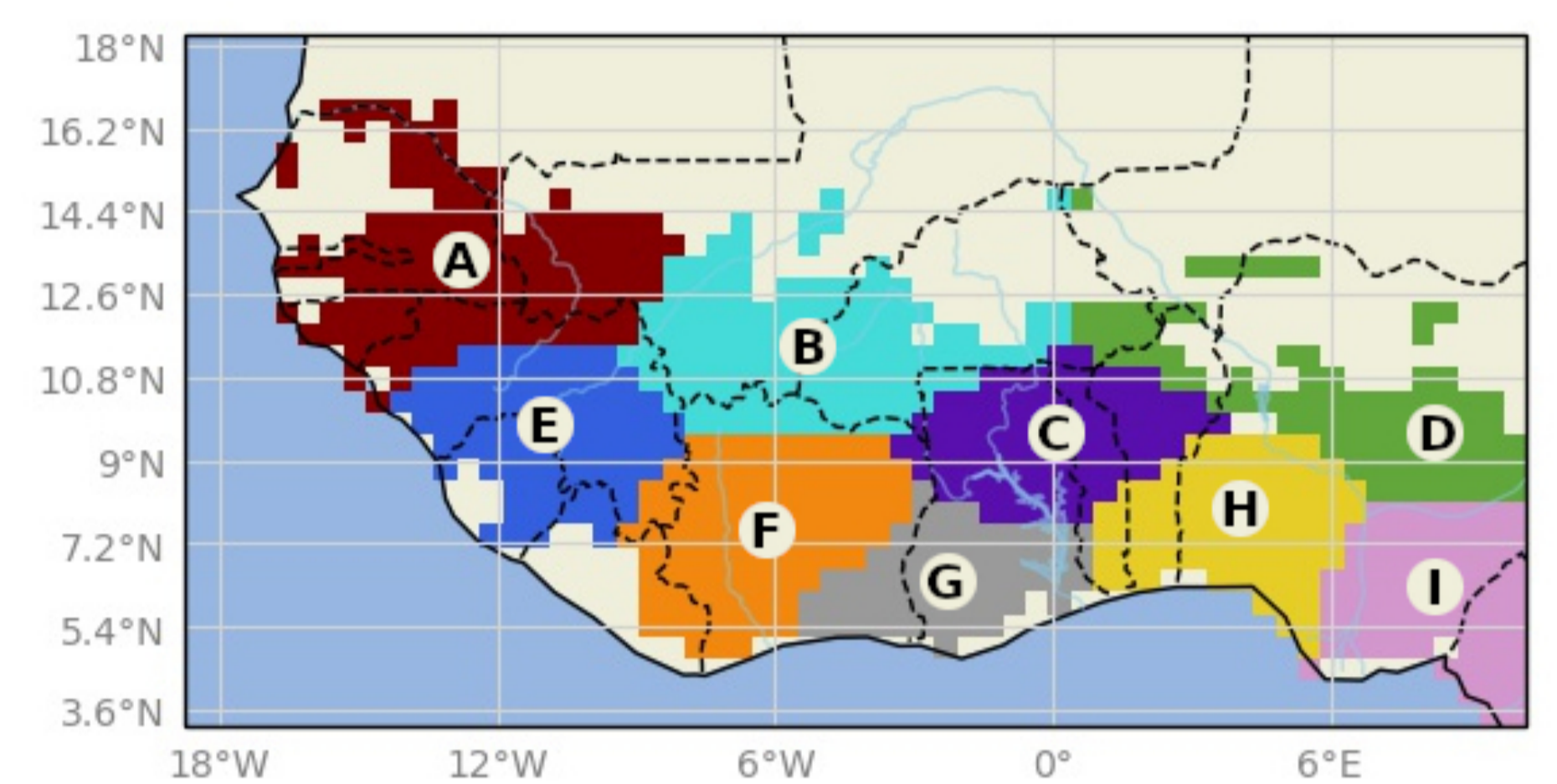
Stochastic modelling framework for food production reliability analysis



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

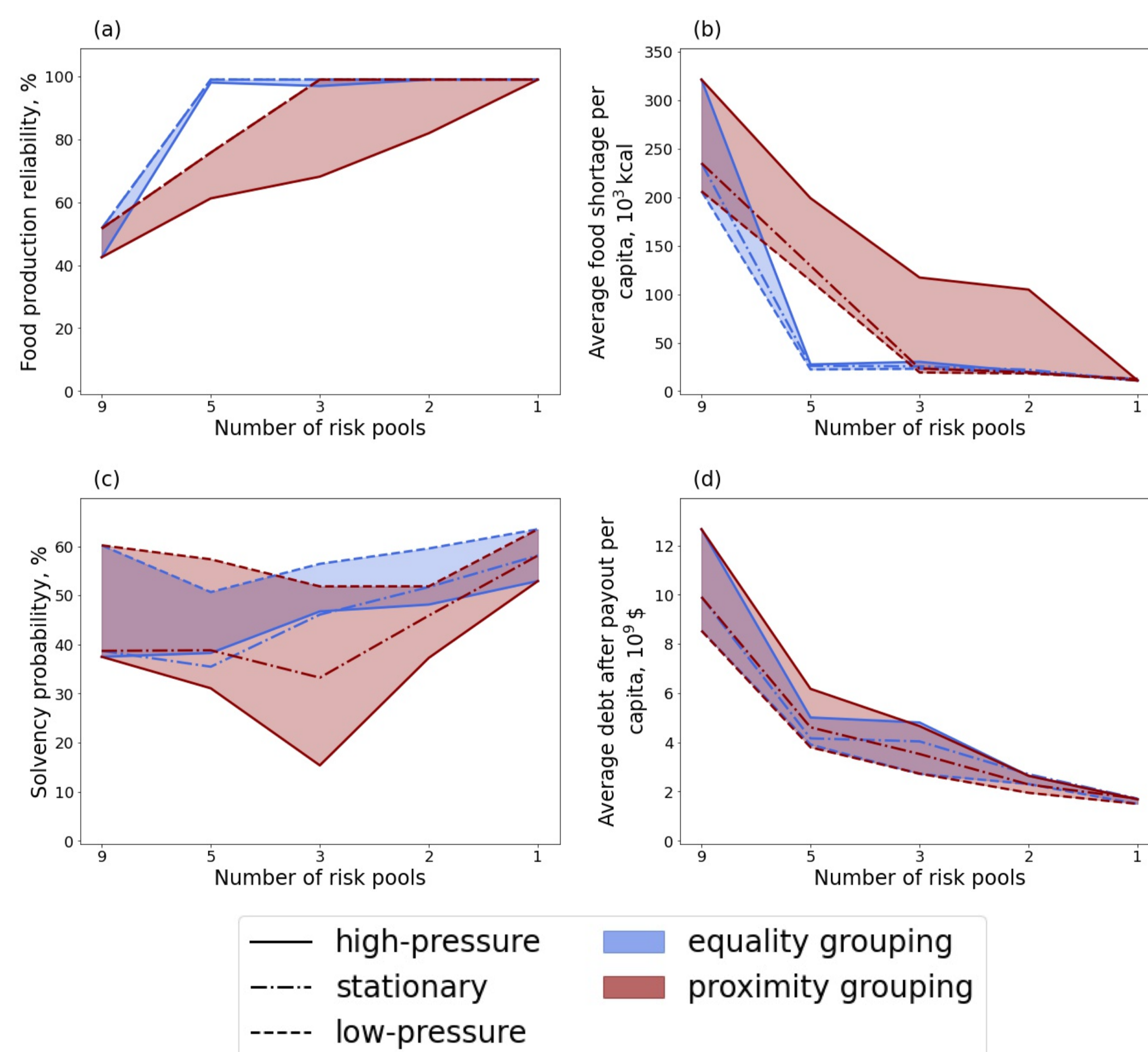
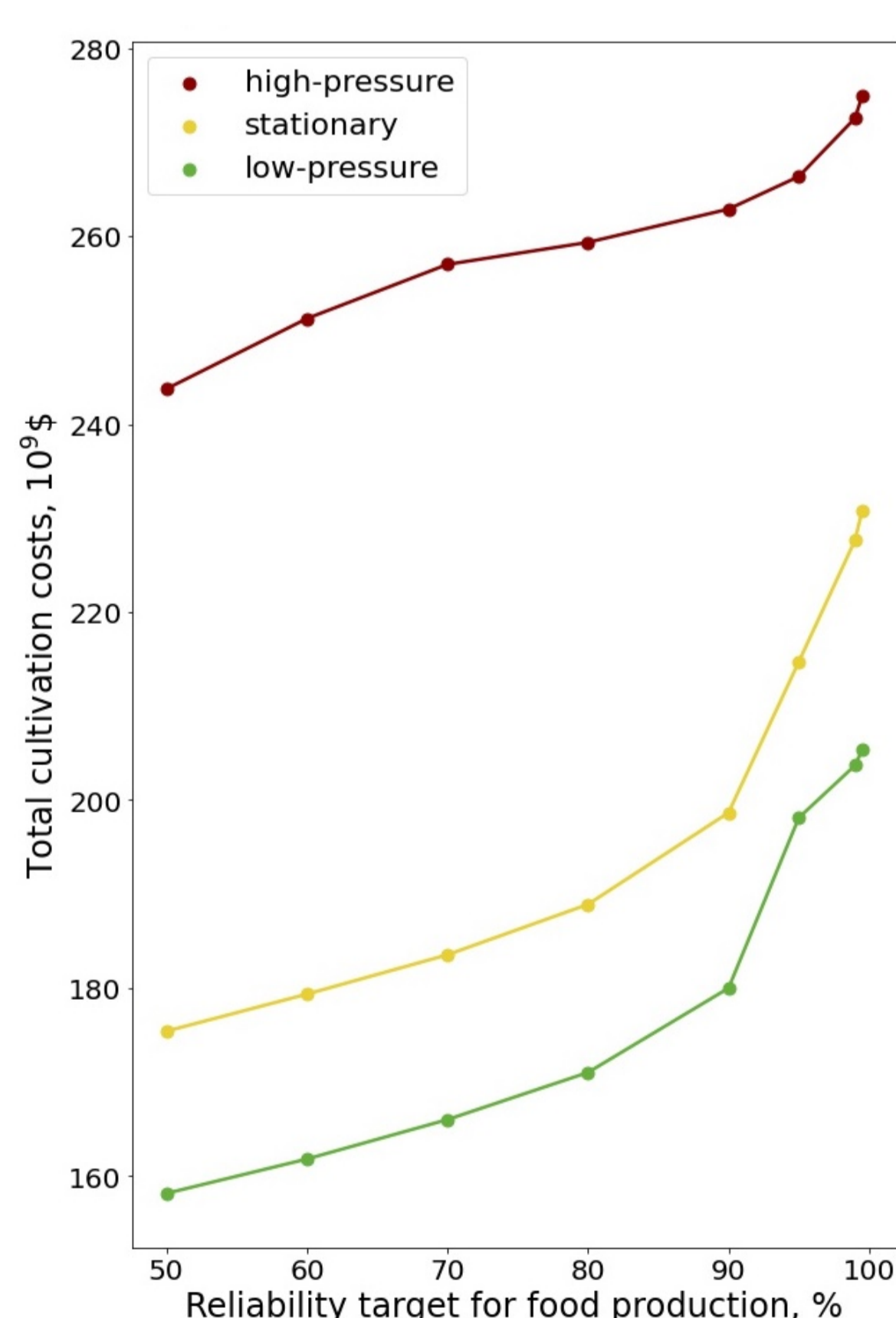
- Risk-neutral strategy: satisfy food demand on average
- Risk-target strategy: ensure a desired level of reliability of food production
- Risk-sharing strategy: regional cooperation

Clustering West Africa in regions with similar weather patterns



Accounting for weather variability together with cross-regional cooperation are necessary to achieve a substantial reduction of risks.

Results



Applied to the West African context, accounting for weather variability can substantially improve the reliability of the food supply. Yet, setting reliability targets for food security is costly and leaves high residual risk in certain regions.

- (a-b) Cross-regional cooperation through risk pooling at the West African scale can strengthen the reliability of the food supply to very high levels (i.e., 99%), while virtually eliminating food shortages.
- (c-d) Full cross-regional cooperation can reduce the reliance on international aid by approximately a factor 5.5 and 7.5 for the low-pressure and the high-pressure scenario.

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.

