On the Rice

Climate Change and the (in)stability of rice in Africa

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Rationale & Objectives

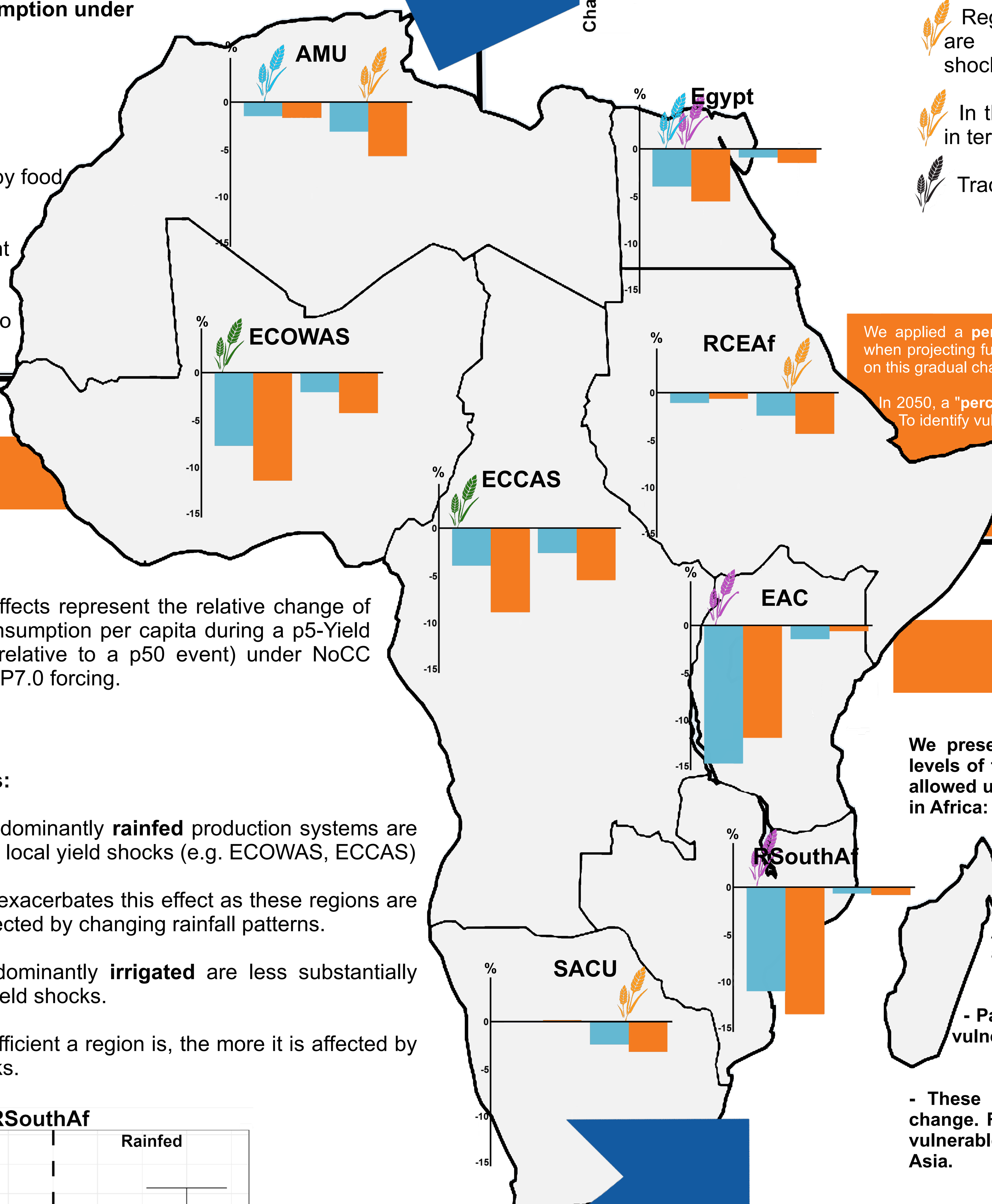
Food stability – or the lack thereof has caused several issues on global food security in the past. Prime examples are the COVID-19 pandemic, the Ukraine-Russian war, and the 2008 African food crisis. Meanwhile, the occurrence of **extreme meteorological events** has been increasing rapidly (droughts, floods, …), resulting in substantial harvest losses putting **food security under pressure** with strong indications that these will become even more prevalent under climate change.
Yet, the amount of studies assessing food stability or potential climate change effects is scarce – hindering purposeful policymaking. This makes a **methodological framework** to assess food stability urgent.

Objectives

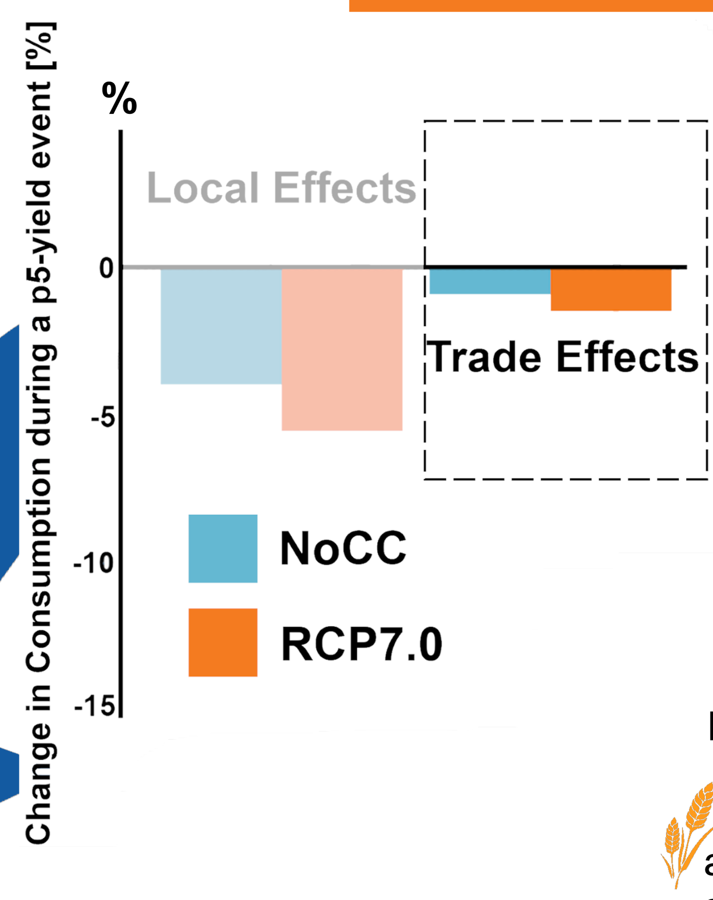
- **Construct a framework to assess effects of climate change on food stability**
- **Demonstrate the impact of (1) local production shocks and (2) external shocks in important supplying regions on consumption under different climate scenarios**

Case: Rice Stability in Africa

- African continent disproportionally affected by food insecurity
- Rice = important staple crop on the continent
- Rice has a large variety of local production systems and supply strategies: model crop to investigate complex interactions



Trade Impacts



Southeast Asia (SEA) is an important source of rice import for the African continent. The consumption effect of a p5-yield event (relative to a p50-event) in SEA is expressed in these two right bars under NoCC and RCP7.0 forcing.

Main Take Homes:

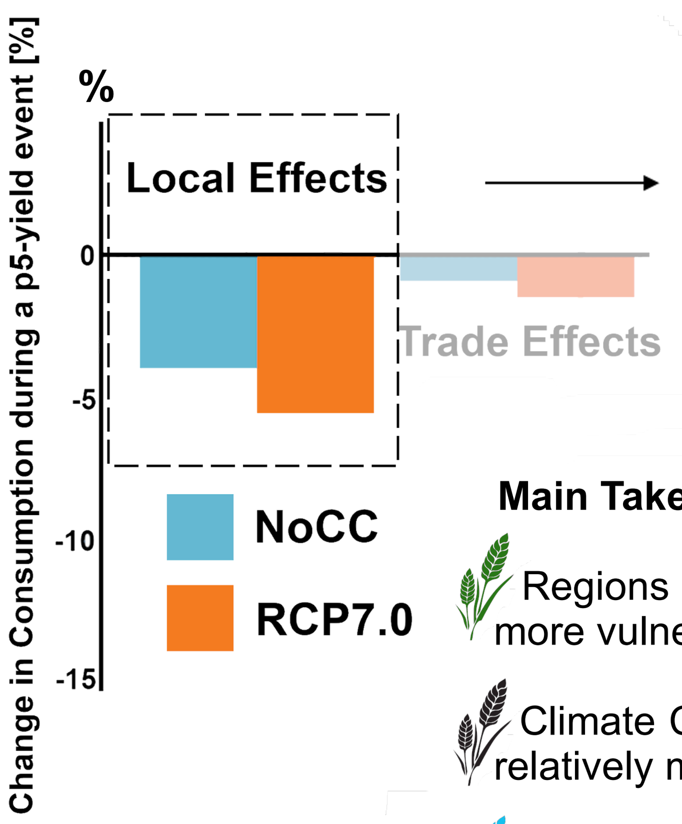
- Regions that predominantly rely on imports from SEA are particularly vulnerable to climate-induced yield shocks in SEA.
- In these regions, external shocks outweigh local effects in terms of their relative impact on local consumption
- Trade "Ripple" effects are important to consider

We applied a **percentile approach,** where instead of only using the 30y-average levels when projecting future rice yield levels, we used a range of percentile values that superpose on this gradual changes. For this, we used annual output of the **EPIC-IIASA crop model**.

In 2050, a "**percentile shock**" is introduced to the yield in the **GLOBIOM model**. To To identify vulnerable regions, this shock is only introducted in one region at a time.

When comparing the gradual effects of climate change with the effects yield variability, we observe that the effects of climate change on yield or consumption) variability are more substantial than long-term effects.

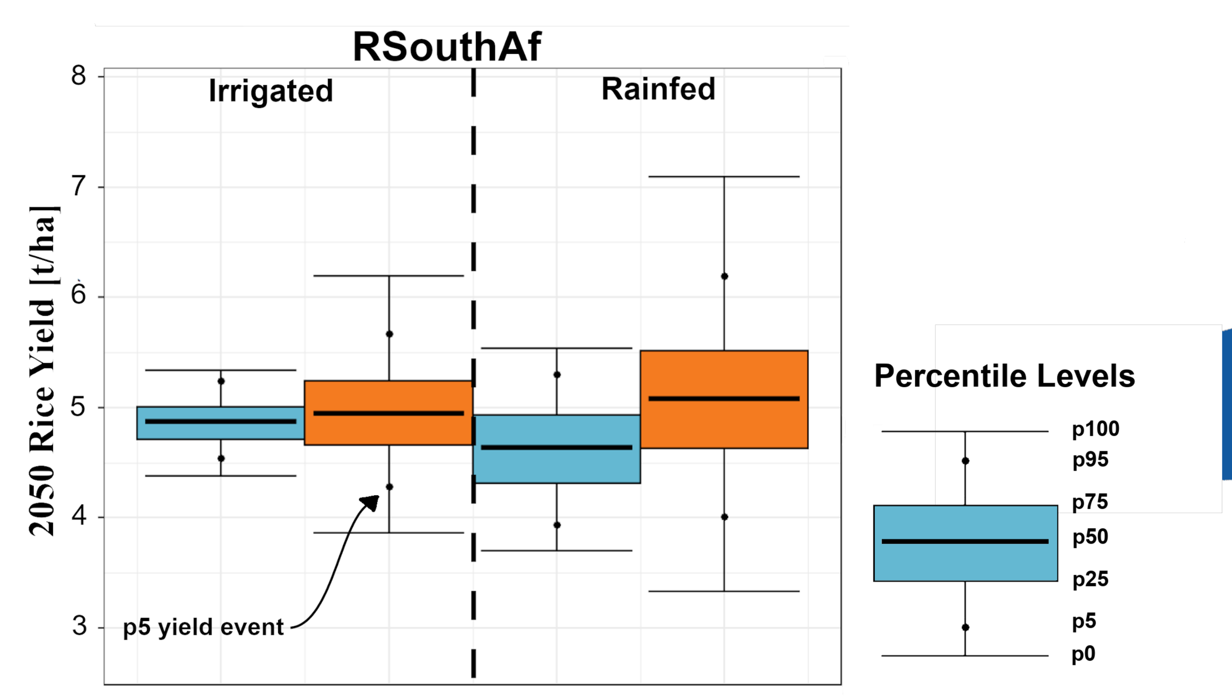
Local Impacts



Local effects represent the relative change of rice consumption per capita during a p5-Yield event (relative to a p50 event) under NoCC and RCP7.0 forcing.

Main Take Homes:

- Regions with predominantly **rainfed** production systems are more vulnerable to local yield shocks (e.g. ECOWAS, ECCAS)
- Climate Change exacerbates this effect as these regions are relatively more affected by changing rainfall patterns.
- In contrast, predominantly **irrigated** are less substantially affected by local yield shocks.
- The more self-sufficient a region is, the more it is affected by local climate shocks.



Estimated Rice Yield Variability in RSouthAf for 2050 following SSP2 socioeconomic development for irrigated (left) and rainfed (right) production systems. Blue indicates a no climate change scenario (NoCC) representing the historical variability, orange indicates a climate change scenario following RCP7.0. Yield estimates are modelled through using the EPIC-IIASA crop growth model

Conclusions

We present a modelling framework that allows to predict future levels of food stability under climate change. This novel framework allowed us to identify the following conclusions for the case of Rice in Africa:

- **Climate Change will increase rice yield variability in Africa, which in turn will lead to a destabilitzation of rice availability.**
- **Particularly regions that rely on rainfed production systems vulnerable to local climate change effects**
- **These effects are, however, not bounded to local climate change. Regions that rely trade to meet their demand are also vulnerable to an increase in yield variability occurring in Southeast Asia.**

So, what can be done to increase Resilience?

Our study indicates that both self-sufficiency and importing strategies make a region vulnerable to climate change effects on yield variability. To counter these effects, regions can **expand on irrigation** - given that the local hydrological/social context allows for this.

Countries that rely on imports can **diversify their trading partners** to buffer foreign shocks occuring in single regions.

Upgrading storage capacity appears to be the solution that fits both self-sufficiency and importing strategies. It is unclear whether the current storage capacity and the governance thereof is capable of buffering the increase in volatility for rice in Africa we predict here.

Key References

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