Are Sub-Saharan Africa’s agricultural systems too heterogeneous for Climate Smart Agriculture?

Anthony Oyoo, Sep 6th 2016.
Africa’s Food Sovereignty Working Group meeting – HAAS Institute
Are Sub-Saharan Africa’s agricultural systems too heterogeneous for Climate Smart Agriculture?

Outline

1. SSA’s agriculture and the role of CSA in global food security
2. Yield gaps in SSA in comparison to the World
3. Landscape-level adoption of CSA in heterogeneous landscapes
4. Effect of spatial and temporal heterogeneity on CSA adoption
5. Empirical modelling to relate biophysical and socio-economic variables to aerial imagery
6. Conclusions on meeting Adaptation and mitigation goals in SSA
SSA’s agriculture and it’s role in global food security

SSA can make largest contribution to future food demands due to technological potential – productivity and mitigation.
SSA’s Yield Gaps

Water-limited (YW) and Actual yields (YA) for select SSA countries vs rest of world (Maize)

Countries

Source: GYGA (2016)
What is CSA and how does it fit in SSA’s agricultural goals?
Goal: Climate Smart landscapes in SSA
SSA’s agricultural system’s spatial and temporal heterogeneity

80% farm land in SSA under smallholding

1. Diverse crops, farm-management activities within farm

2. Diverse production systems from farm to farm

3. Diverse timing of decision-making (adoption)
Spatial farm-type distribution

Simulation of large-scale adoption of CSA technologies in farm populations and multi-dimensional impacts on social, ecological and economic factors
Modelling CSA adoption in heterogeneous landscapes

Opportunity cost, system choice and adoption

Opportunity cost $\omega = v_1 - v_2$ follows distribution $\varphi(\omega)$

- System 1: $\omega > 0$ (non-adopters)
- System 2: $\omega < 0$ (adopters)

Map of a heterogeneous region
What is the adoption rate of the technology?

Simulated adoption rate for high-residue yielding Maize-based system
Impacts of adoption of CSA

Impact on farm net-returns

Mean Net farm income increases by 17.6%

$40+ net return per farm
When do farmers make the decision to adopt? – temporal heterogeneity

80.46 % of the entire population vulnerable to CC

Vulnerability different for farm types (strata)
Red: tightened N cycle
Blue: low integration of production elements

Driven by both bio-physical and socio-economic factors: farm size, hhld size, off-farm income, farm soil OM, land tenure, farm distance to hhld
Relating aerial imagery to heterogeneous household and farm characteristics

Climate analogues sites with i) similar rainfall variability, and ii) different temperature regimes
Training landscape model for spatial and temporal correlation

‘Representative groups’ of farmers correlated statistically

Re-distribution of where CSA practices are adopted

Timing of when CSA practices are adopted re-distributed for the groups
Preliminary conclusions

Based on household and farm characteristics, CSA can be targeted spatially for small landscapes.

SSA’s farmers inadvertently mitigate only when critical thresholds are reached (bio-physical and socio-economic interactions).
Thank You