Community seed banks and the emergence of multifunctional agroecosystems in climate-vulnerable smallholder systems: Evidence of sustainability trade-offs in Kenya

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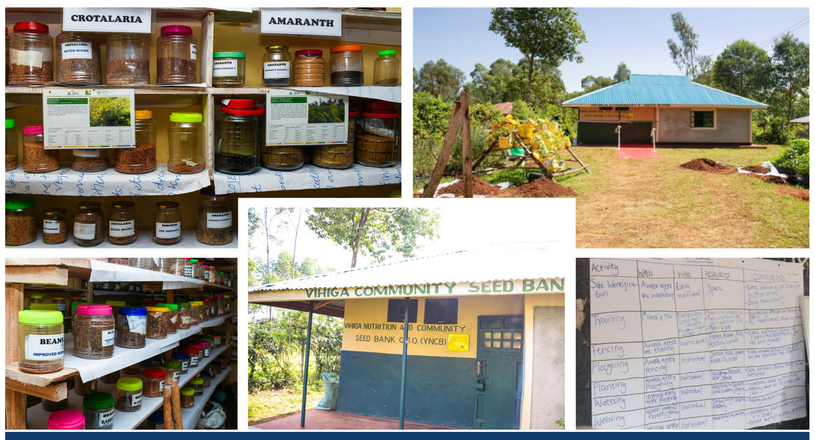
Core message: CSBs can catalyse agroecological transition, but sustainability outcomes are multidimensional and do not move uniformly.

1 JUSTIFICATION AND STUDY DESIGN

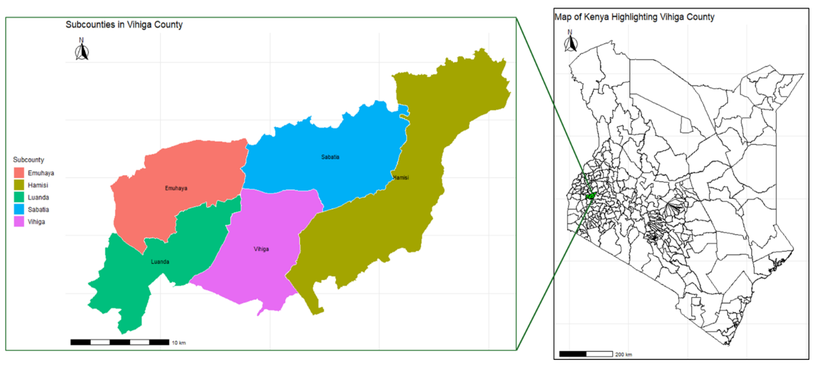
WHY THIS MATTERS

- Community seed banks strengthen farmer-managed seed systems, knowledge exchange and agrobiodiversity.
- Their broader role in agroecological transition and multidimensional sustainability remains poorly understood.



Vihiga Community Seed Bank: seed access, conservation, exchange and training hub

STUDY LOCATION



INTERVENTION PACKAGE

Community action plans linked seed access to broader agroecological support.

Components included training, traditional leafy vegetables, nutrition education, seed saving, participatory variety selection and collective organisation.

RESEARCH QUESTION

Is participation in a CSB-centred agroecological intervention associated with stronger agroecological transition and sustainability performance in Vihiga, Kenya?

DATA AND ANALYSIS

239 households	120 intervention	119 comparison

- FAO TAPE for agroecological transition and performance outcomes.
- Detailed 24-hour dietary recall for women's dietary diversity.
- Propensity-score full matching followed by weighted, covariate-adjusted regression.

Interpretation: adjusted cross-sectional associations, not causal programme effects.

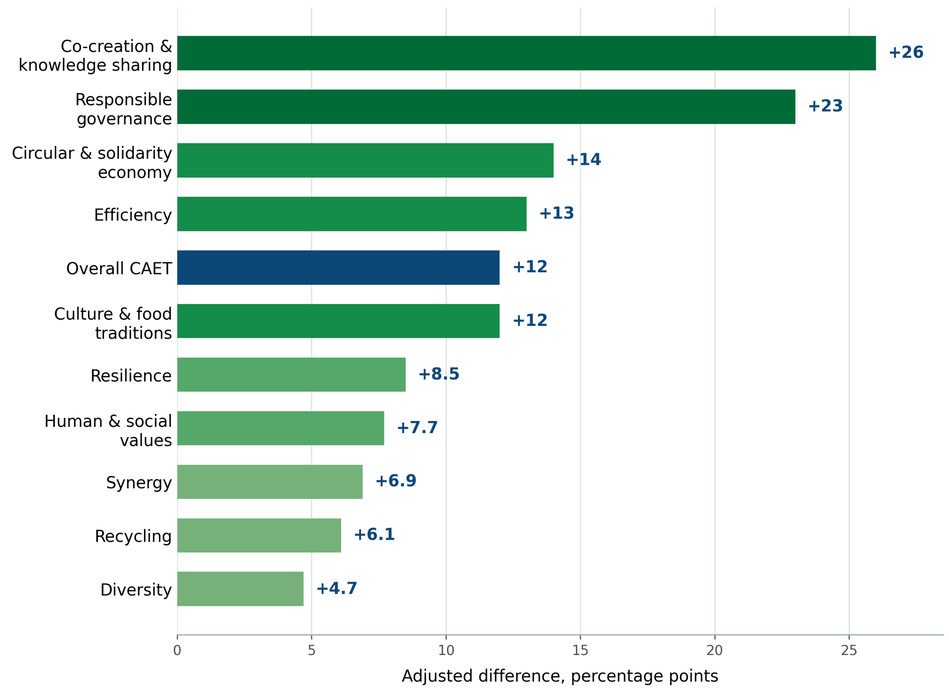
2 AGROECOLOGICAL TRANSITION

+12 percentage points higher adjusted CAET

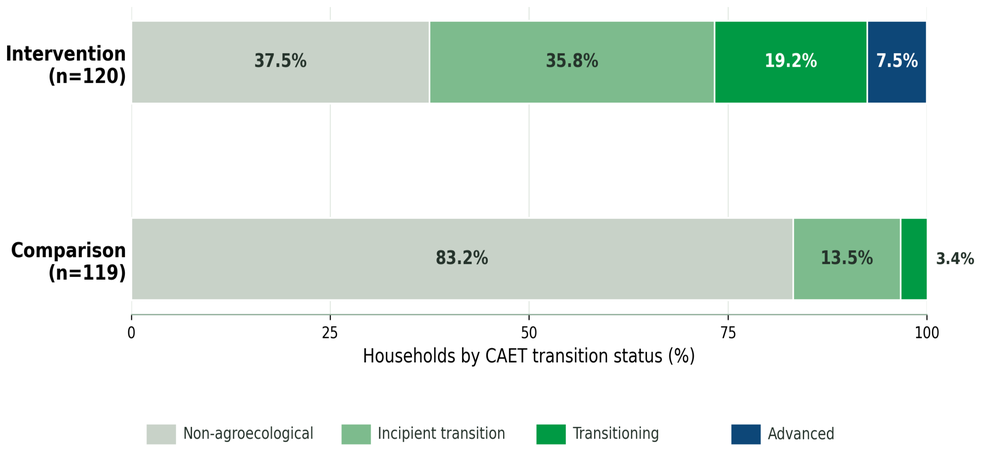
Participation was associated with higher overall transition and higher scores across all ten agroecological elements after **False Discovery Rate (FDR)** adjustment.

Largest signals: knowledge sharing, governance and circular economy

ADJUSTED ASSOCIATION WITH AGROECOLOGICAL TRANSITION ELEMENTS



TRANSITION STATUS SHIFTED AWAY FROM THE NON-AGROECOLOGICAL STAGE



55.0% intervention households in incipient or transitioning stages

7.5% intervention households reached advanced agroecological status

No comparison household reached the advanced stage.

Most transition leverage was social and institutional, not only technical.

This supports presenting CSBs as platforms for collective learning and governance, not simply seed-storage infrastructure.

3 SUSTAINABILITY OUTCOMES

TRANSITION ADVANCED, BUT OUTCOMES DID NOT MOVE UNIFORMLY

Note

After FDR correction, intervention participation was not significantly associated with any measured multidimensional sustainability outcome.

HIGHER OVERALL CAET WAS ASSOCIATED WITH:

- Land tenure
- Food security
- Women's empowerment
- Soil health
- Agrobiodiversity

No CAET measure was associated with dietary diversity or youth opportunity after FDR adjustment.

SIMPLIFIED ASSOCIATION PROFILE

Measure	Economic	Land tenure	Food security	Women's emp.	Soil + agrobio.
Overall CAET	○	●	●	●	●
Diversity	●	○	●	●	●
Efficiency	○	○	●	●	●
Resilience	○	●	●	●	●
Culture & traditions	○	●	●	●	○

Green checks show significant positive associations after FDR correction. Diversity showed the broadest profile, including economic outcomes.

INTERPRETATION

Different agroecological elements appear to support different sustainability pathways. Programme design should combine technical, social and institutional components rather than expect one element to deliver all gains.

DESIGN PRINCIPLES

1. Combine seed access with soil, pest, market and nutrition support.
2. Track outcomes over time because transition and wellbeing may respond at different speeds.
3. Monitor trade-offs explicitly across economic, social and environmental dimensions.

TAKE-HOME MESSAGE

- ✓ **Community seed banks can act as transition platforms, not standalone solutions.**
- ✓ **To translate transition into sustained sustainability gains, connect seed banks with extension, markets, local governance and long-term monitoring.**

Policy implications

Design integrated packages: seed access + farmer-led experimentation + soil and pest management + nutrition education + collective governance.

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MULTIFUNCTIONAL LANDSCAPES