

Horticultural diversity upon a home gardening intervention in rural Kenya: An exploratory cluster analysis

Erick Agure¹, Grace Wothaya Kihagi^{1,2}, Erick M.O Muok³, Elsie Kangai⁴, Nicholas Okoyo⁴, Raissa Sorgho¹, Thomas Döring⁵,
Adi Lukas Kurniawan^{1,2} and Ina Danquah^{1,2}

¹Center for Development Research, University of Bonn, Bonn, Germany; ²Heidelberg Institute of Global Health, Heidelberg University, Heidelberg, Germany; ³Kenya Medical Research Institute, Nairobi, Kenya;
⁴Center for African Bio-Entrepreneurship (CABE), Nairobi, Kenya; ⁵Institute of Crop Science and Resource Conservation, University of Bonn, Bonn, Germany

Background and Aim

- Climate change poses a significant threat to global food security.
- Home gardens are promoted as a climate change adaptation strategy due to their potential contributions to horticultural diversity and thus, dietary diversification and resilience.
- The study is embedded in a cluster-randomized controlled trial (c-RCT) on the effects of an integrated agro-biodiversification and nutrition counselling program in Siaya county, Kenya.

Aim

- To characterize horticultural diversity of farming households upon a home gardening intervention in Siaya county, Kenya.

Methods

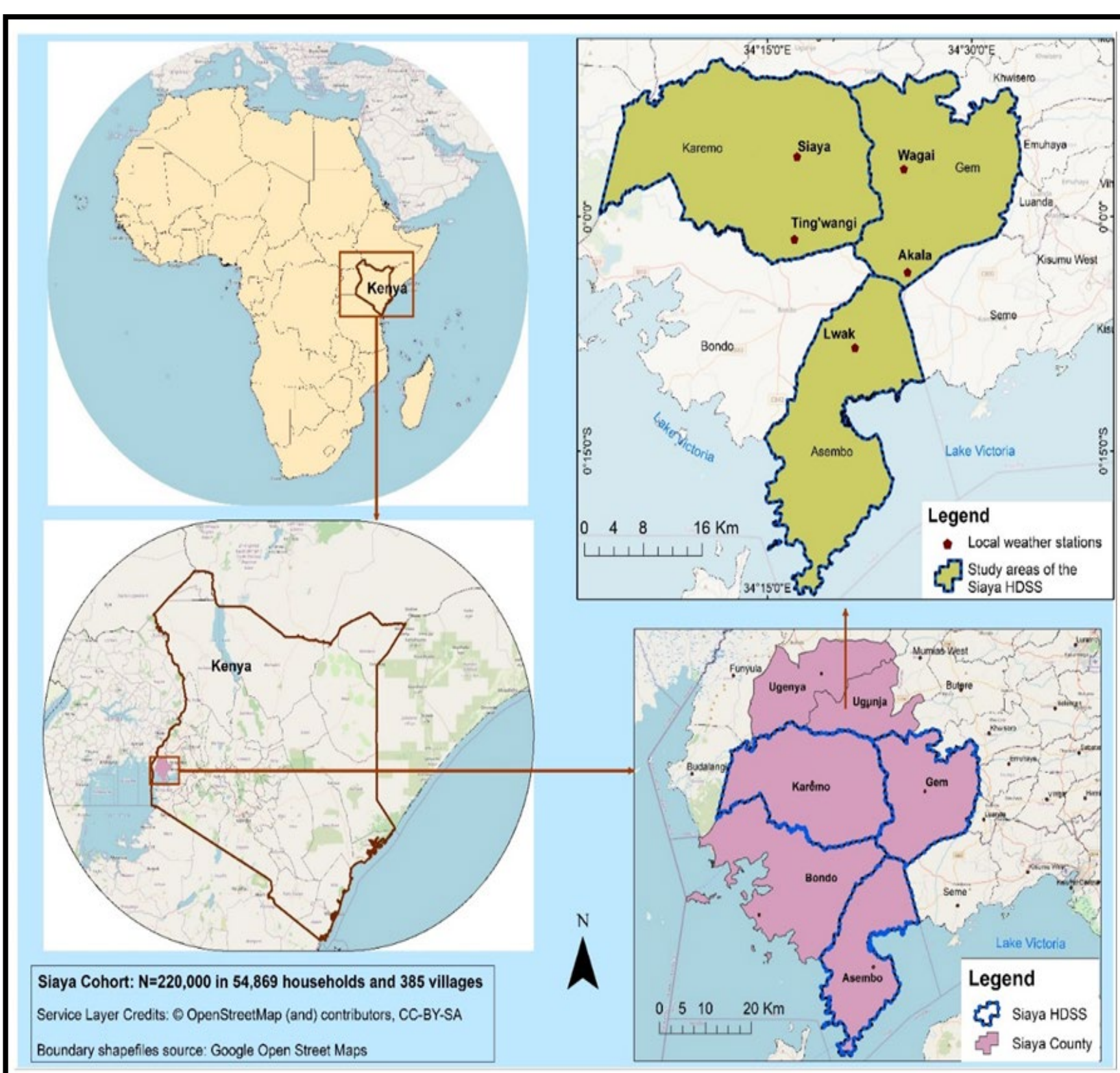


Figure 1: Map of the study area

Intervention:

- April 2022 – June 2024
- 15 garden leaders, each responsible for 20 beneficiaries
- Organic pesticide & manure production
- Composting & nursery establishment
- Land preparation, construction & planting
- Weeding & plant protection
- Harvesting, preservation training & storage
- Garden maintenance



Figure 2: Leaders of home garden implementation.
left to right: Nicholas Okoyo (NGO CABE), Erick Agure (PhD candidate), Jackson Achuti (Siaya Ministry of Agriculture)

Data analysis:

Horticultural Indices

Shannon-Wiener Index (H'):

$$H' = - \sum_{i=1}^S (p_i \ln p_i)$$

Simpson Index (D):

$$D = 1 - \sum_{i=1}^S p_i^2$$

Evenness Index (E):

$$E = \frac{H'}{\ln(S)}$$

Species richness is the total count of species

- Exploratory cluster analysis using hierarchical clustering
- Descriptive statistics across clusters
- Contribution of nutrients from Kenya Nutrient Database

Results

Table: Demographic and socio-economic characteristics of 300 study participants, by biodiversity clusters

Variables	Total (n=300)	Cluster 1 (n= 183)	Cluster 2 (n=117)
Age of mother (years)	29 (25, 34.5)	29 (25, 34)	30 (27, 35)
Marital status (Married)	244 (81.33)	155 (84.70)	89 (76.07)
No. of under-fives	1 (1, 2)	1 (1, 2)	2 (1, 2)
Ethnicity (Luo)	279 (93.00)	169 (92.35)	110 (94.02)
Religion (Mixed/African traditional religion)	96 (32.00)	65 (35.52)	31 (26.50)
Education (Elementary level)	197 (65.67)	118 (64.48)	79 (67.52)
Occupation (Farming/fishing) *	166 (55.33)	91 (49.73)	75 (64.10)
Household headship (Female headed) *	199 (66.33)	113 (61.75)	86 (73.50%)
Attendance of training (4 sessions)*	222 (74.00)	142 (77.60)	80 (68.38)
Horticultural indices			
Evenness*	0.79 (0.65, 0.85)	0.79 (0.67, 0.85)	0.77 (0.61, 0.84)
Species richness***	7 (6, 8)	6 (6, 7)	8 (8, 9)
Shannon-Wiener Index***	1.51 (1.27, 1.67)	1.45 (1.25, 1.58)	1.63 (1.30, 1.77)
Simpson Index*	0.73 (0.64, 0.79)	0.72 (0.64, 0.77)	0.77 (0.64, 0.80)

Data are expressed as medians (interquartile ranges, IQR) for continuous variables and number (%) for categorical variables. Between-group comparisons were made by Mann-Whitney U-test for continuous variables and Chi-square test for categorical variables. Significance level *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

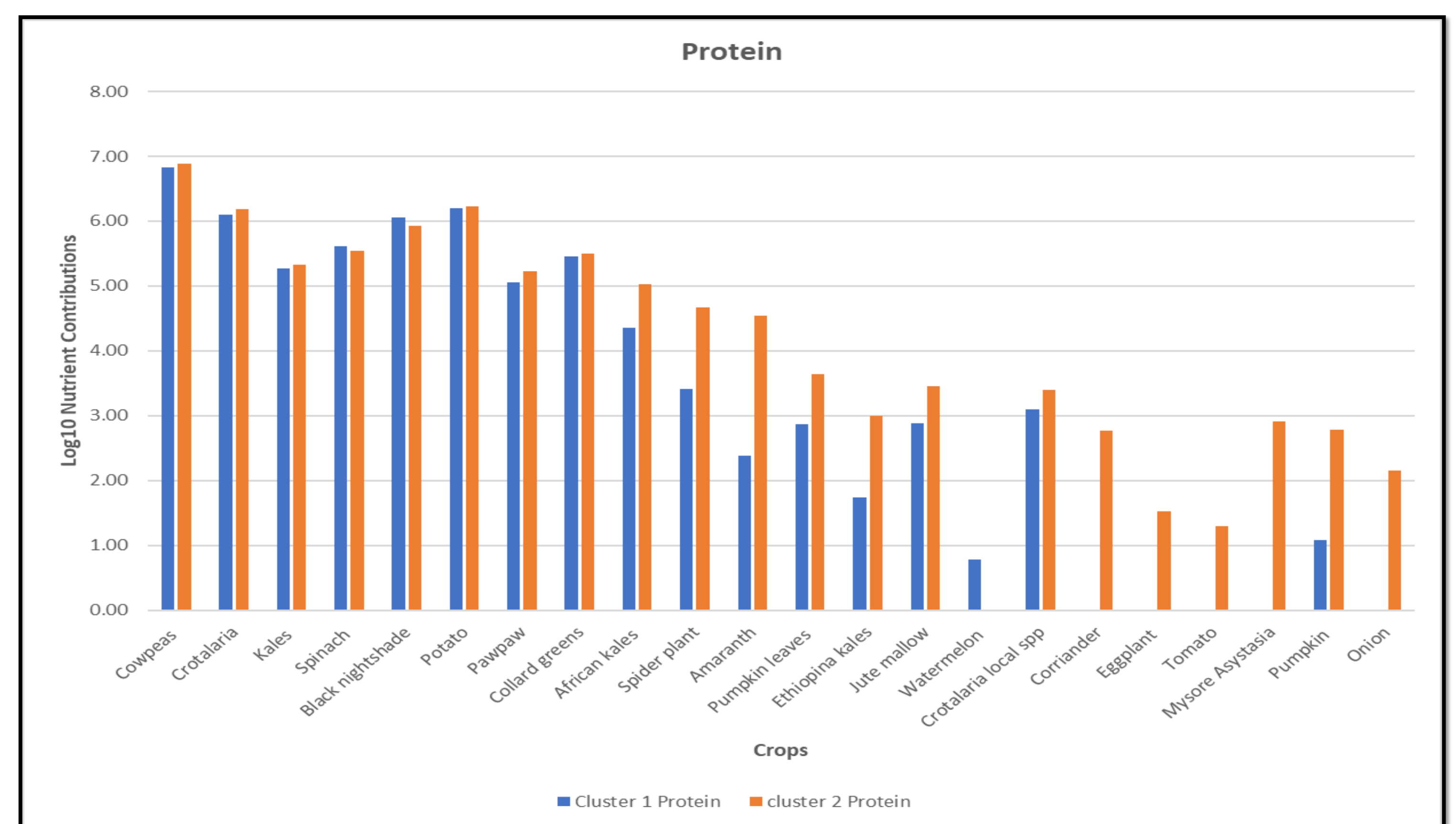


Figure 3: Contributions of 22 horticultural crops to the protein supply among 300 households, by biodiversity cluster

Conclusions

- There are differences in horticultural diversity among households participating in the intervention.
- Experience in home gardening, female household headship and close training compliance appears to improve biodiversity outcomes.
- Higher species richness and horticultural diversity are associated with improved supply of climate-sensitive nutrients.
- The study provide important information to understand the impact pathways of horticultural interventions in this area.