Modelling agroforestry adoption dynamics among smallholder farmers in rural Zambia: An agent-based approach

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Abstract

Small-scale farming in regions like SSA faces numerous challenges exacerbated by climate change. Among these challenges, erratic weather patterns and limited resources pose significant hurdles to farmers' livelihoods. Agroforestry has emerged as a promising approach, offering benefits such as improved food security, income diversification, and increased resilience against environmental stresses. However, its adoption among smallholders is complex and influenced by various factors.

This study introduces an innovative approach to understanding agroforestry adoption dynamics among smallholder farmers in rural Zambia. Utilizing an agent-based simulation model, we aim to capture the nuanced decision-making processes of farmers within a virtual landscape. Unlike traditional approaches, this model considers individual aspirations, resource availability, and spillover effects from adopters to non-adopters, providing a more comprehensive conception of the adoption dynamics.

Drawing on data from 745 rural Zambian households collected as part of CIFOR-ICRAF's Fruit Tree Portfolio project in early 2022, our simulation model integrates socioeconomic factors, such as land and farm characteristics, as well as cognitive and institutional factors. This methodological framework allows for the exploration of various scenarios and policy interventions, aiding in the design of targeted approaches to promote agroforestry adoption. By incorporating decision theories like the 'Capability approach' and 'Theory of planned behaviour', we enhance the model's realism and applicability.

This study contributes to both academic research and practical interventions in sustainable agriculture. By identifying key drivers and barriers to agroforestry adoption, we aim to inform policymakers and practitioners about effective strategies to improve smallholder livelihoods. Moreover, the agent-based modelling approach holds promise for future research in understanding complex agricultural livelihoods, offering a valuable tool for decision-making and policy formulation in agricultural development contexts.

Keywords: Agent-based modelling, agroforestry, aspirations, decision-making, resilience