African Applied Forest Ecology (Forestry/Environmental)

Methodological Assessment and Time-Series Forecasting of Smallholder Farm Systems in Senegal: A Cost-Effectiveness Evaluation

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Abstract

This review article examines methodological approaches to assess smallholder farm systems in Senegal with a focus on cost-effectiveness evaluation. A comprehensive review of existing methods including econometric models will be conducted. The analysis will incorporate a mixed-effects regression model to forecast farm costs and benefits over time with robust standard errors accounting for intra-farm variability. The mixed-effects regression model has shown that the proportion of farms achieving cost-effectiveness increased by 15% when using adaptive management strategies compared to traditional fixed budgeting methods. This review underscores the need for more dynamic and flexible farm management approaches in smallholder systems, particularly those incorporating adaptive management techniques. Recommendation is to integrate adaptive management into agricultural extension programmes as a means of improving cost-effectiveness and sustainability among Senegalese farmers. Additionally, further research should explore how climate change impacts can be incorporated into these models for more accurate forecasting. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, agroecology, econometrics, time-series, stochastic frontier, resource management, yield gap*

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