African Environmental Contamination (Environmental Science)

Bayesian Hierarchical Model for Assessing Risk Reduction in Smallholder Farm Systems, Uganda

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Abstract

This study focuses on assessing risk reduction in smallholder farm systems within Uganda's agricultural sector. A Bayesian hierarchical statistical framework was employed to analyse data collected from multiple farms over two years. The model accounts for spatial and temporal variability, incorporating site-specific environmental conditions and farmer practices as random effects within a larger structured hierarchy of risk factors. The analysis revealed significant reductions in soil erosion rates (up to 30%) when integrated farming techniques were implemented, with robust standard errors indicating the reliability of these findings across different farm sizes and locations. This study provides evidence for the effectiveness of targeted interventions in reducing environmental risks associated with smallholder farms in Uganda. The Bayesian hierarchical model offers a nuanced understanding of risk reduction impacts at various scales. Policy recommendations include scaling up successful intervention programmes based on this model and further research to identify additional cost-effective measures that enhance soil health and water management practices among smallholders. The empirical specification follows $Y = \vec{\beta_{0+\beta}} \, p \, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African, Bayesian, Hierarchical, Risk, Modelling, Smallholder, Agriculture*

ABSTRACT-ONLY PUBLICATION

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