African Glacial Studies (where applicable - Earth Science)

Bayesian Hierarchical Model for Assessing Risk Reduction in Smallholder Farms Systems of Tanzania: A Systematic Literature Review

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Abstract

Smallholder farms in Tanzania face significant environmental risks such as climate change impacts and agricultural pests. This systematic literature review employed comprehensive search strategies across databases including Web of Science, Scopus, and Google Scholar. Studies were screened using predefined inclusion criteria based on relevance to smallholder farms and risk assessment methodologies. A key finding was the consistent use of Bayesian hierarchical models in estimating farm-level risks with varying degrees of precision, often achieving reductions in uncertainty by integrating spatial and temporal data. Bayesian hierarchical models provide a robust framework for understanding and mitigating environmental risks in smallholder farming systems. They offer improved accuracy in risk prediction through their ability to incorporate multiple sources of information. Further research should focus on validating the applicability of these models across diverse geographical regions and contexts, and explore potential integration with adaptive management practices. Bayesian hierarchical model, smallholder farms, Tanzania, environmental risks, risk reduction The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, Bayesian statistics, Hierarchical modelling, Smallholder farming, Risk assessment, Sustainability, Climate change mitigation*

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