



Bayesian Hierarchical Model for Measuring System Reliability in Smallholder Farms Systems, Kenya 2012

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Abstract

Smallholder farming systems in Kenya face challenges related to system reliability due to limited resources and environmental variability. A Bayesian hierarchical model was developed to assess the reliability of smallholder farm systems. This model accounts for spatial and temporal variations using a Gaussian process prior with hyperparameters estimated through Markov Chain Monte Carlo (MCMC) methods. The Bayesian hierarchical model demonstrated improved accuracy in predicting system reliability across different farms, particularly in regions characterized by high rainfall variability. This study advances the use of Bayesian hierarchical models for evaluating smallholder farm systems, offering a robust method to address reliability issues within resource-limited environments. Further research should explore how these methods can be integrated into existing agricultural support programmes and policy frameworks. Bayesian Hierarchical Model, Smallholder Farms, System Reliability, Markov Chain Monte Carlo (MCMC), Gaussian Process Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \operatorname{sumiell}(y_i, f\theta(\xi)) + \lambda \operatorname{Vert}\theta \operatorname{rVert} 2^2$, with performance evaluated using out-of-sample error.

Keywords: African Geographic Data Analysis, Bayesian Hierarchical Modelling, Monte Carlo Simulation, Spatial Statistics, Reliability Theory, Smallholder Farming Systems, Variability Analysis

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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