African Urban-Rural Linkages (Interdisciplinary - Social/Geography/Policy)

Bayesian Hierarchical Model Assessment for Risk Reduction in Rwanda's Regional Monitoring Networks System

Nyamwiza Mushimbi[1], **Tahinda Bizumuremye**[2,3], **Kizito Musoni**[4,5], **Gaterwa Nkubiti**[4]

[1] Department of Research, Rwanda Environment Management Authority (REMA)

[2] Department of Advanced Studies, Rwanda Environment Management Authority (REMA)

[3] Department of Interdisciplinary Studies, Rwanda Environment Management Authority (REMA)

[4] African Leadership University (ALU), Kigali

[5] Rwanda Environment Management Authority (REMA)

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Correspondence: nmushimbi@hotmail.com

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Author notes

Nyamwiza Mushimbi is affiliated with Department of Research, Rwanda Environment Management Authority (REMA) and focuses on Environmental Science research in Africa.

Tahinda Bizumuremye is affiliated with Department of Advanced Studies, Rwanda Environment Management Authority (REMA) and focuses on Environmental Science research in Africa.

Kizito Musoni is affiliated with African Leadership University (ALU), Kigali and focuses on Environmental Science research in Africa.

Gaterwa Nkubiti is affiliated with African Leadership University (ALU), Kigali and focuses on Environmental Science research in Africa.

Abstract

Rwanda's regional monitoring networks aim to assess environmental risks across diverse landscapes, necessitating robust methodologies for risk assessment and reduction. A Bayesian hierarchical model was implemented to analyse data from multiple sites, integrating spatial and temporal variability. Model parameters were estimated using Markov Chain Monte Carlo (MCMC) methods with robust standard errors provided by the software. The analysis revealed a significant reduction in environmental risk across monitored regions, particularly in areas with high population density where interventions showed notable effectiveness. Bayesian hierarchical modelling proved effective for quantifying and targeting regional environmental risks, offering a nuanced understanding of risk distribution across Rwanda’s varied landscapes. Further research should focus on validating these findings through real-world implementation and assessing the scalability of the model to larger geographical scales. Rwanda, Bayesian Hierarchical Model, Risk Reduction, Environmental Monitoring, MCMC The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Bayesian statistics, Hierarchical modelling, Markov chain Monte Carlo, Spatial analysis, Environmental risk assessment, Quantile regression, Gaussian processes*

ABSTRACT-ONLY PUBLICATION

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