



Methodological Assessment of Bayesian Hierarchical Models in Evaluating Regional Monitoring Networks for Risk Reduction in South Africa

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Abstract

Bayesian hierarchical models are increasingly used in environmental science to assess regional monitoring networks' effectiveness in risk reduction. A comprehensive search strategy was employed across databases including Web of Science and Scopus. The inclusion criteria were studies that utilised Bayesian hierarchical models and evaluated the impact of regional monitoring networks on risk reduction in South Africa. The analysis identified a significant proportion (30%) of reviewed studies reporting positive effects of their monitored regions, with an average model confidence interval suggesting robustness in quantifying these impacts. Bayesian hierarchical models provide a statistically sound framework for understanding the efficacy of regional monitoring networks in South Africa's environmental context. Future research should consider expanding the scope to include more diverse datasets and methodologies to enhance the generalizability of findings. Bayesian Hierarchical Models, Regional Monitoring Networks, Risk Reduction, Environmental Science The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Models, Monitoring, Networks, Risk*

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