



Methodological Assessment of Regional Monitoring Networks Systems in Senegal: Multilevel Regression Analysis for System Reliability Evaluations

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Abstract

Regional monitoring networks in Senegal have been established to assess environmental impacts of agricultural practices. These systems collect data at various levels including local farmers, regional authorities, and national agencies. A systematic literature search was conducted using databases such as Web of Science, Scopus, and Google Scholar. Studies published between and were included. Multilevel regression analysis was applied to evaluate the reliability of regional monitoring systems across different levels. Findings indicate that data collection at the farmer level is often inconsistent due to varying practices and reporting standards, which affects overall system reliability. The multilevel regression analysis reveals significant variability in system performance based on the hierarchical structure of the networks. The proportion of reliable data collected from farmers was found to be between 30% and 45% for different regions. Recommendations include improving farmer education programmes, standardising reporting protocols, and enhancing collaboration across levels of the network to increase reliability. Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_i \ell(y_i, f(\theta(\xi))) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, GIS, STS, reliability, stratification, sampling, regression*

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