



# Regional Monitoring Networks in Rwanda: Methodological Evaluation and Yield Improvement Analysis Using Multilevel Regression Models,

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### Abstract

This study examines regional monitoring networks in Rwanda to evaluate their effectiveness and identify areas for improvement. Regional monitoring networks were assessed using multilevel regression models. The study employed mixed-effects linear regression ( $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon$ ), where  $Y$  represents the yield improvement,  $X_1 \wedge X_2$  are predictor variables,  $\wedge \epsilon$  are error terms at different levels. The analysis revealed a significant positive correlation between network density and yield improvement ( $\beta_1 = 0.85$  with 95% confidence interval: [0.73, 0.97]). The findings suggest that denser monitoring networks are associated with greater yield improvements in Rwanda’s agricultural sector. Enhancing network density is recommended to achieve optimal yield improvement.

**Keywords:** African geography, multilevel modelling, spatial analysis, environmental indicators, regression diagnostics, data quality assessment, ecological monitoring systems

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