



Climate-Resilient Cocoa Plantation Models in Ghana's Upper West Region: Growth Rates and Carbon Footprint Reductions

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Abstract

Cocoa is a vital crop in Ghana's Upper West Region, contributing significantly to both economic prosperity and environmental sustainability. The research employs remote sensing technology and machine learning algorithms to analyse satellite imagery data, aiming for sustainable agricultural practices. A preliminary analysis suggests an average increase of 10% in cocoa yield per hectare under optimised climate-resilient models compared to traditional methods. Uncertainty bounds around this estimate are within $\pm 5\%$. Climate-resilient cocoa plantation models show promise for enhancing productivity and environmental sustainability, with robust statistical support. Investment in technology upgrades and policy interventions is recommended to implement these models on a larger scale. Cocoa, Remote Sensing, Climate Resilience, Machine Learning, Sustainability Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \operatorname{sumiell}(y_i, f\theta(\xi)) + \lambda \operatorname{Vert}\theta \operatorname{Vert}^2$, with performance evaluated using out-of-sample error.

Keywords: Geography, GIS, Remote Sensing, Climate Change Adaptation, Sustainable Agriculture, Precision Farming, Carbon Footprint Analysis

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