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Predicting the Stability and Erodibility of Humid Tropical Soils under Intense Rainfall

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Abstract
Direct impact of intense tropical rainfall on exposed bare soil surface following deforestation and other deleterious land practices is one of the major causes of land degradation in the Caribbean. The disruptive forces of rapid wetting and raindrop impact of the intense rainfall break down aggregates, cause earlier onset of seals, reduce hydraulic conductivity and cause rapid decline in infiltration rate leading to increased runoff production and soil erosion. The magnitude of disruption caused by the disruptive forces produced by the rainfall is, however, a function of the cohesive strength of soil binding factors holding soil particles together within the aggregate. In our research, we investigate the structural stability of 23 agriculturally important humid tropical Trinidad soils with varying clay content, mineralogy and organic mater (OM) content in the presence and in the absence of intense simulated rainfall (120 mm h-1). A simple mathematical model that provides a rapid assessment of slaking sensitivity was also developed using readily available soil data of 14 out of the 23 soils and subsequently tested on the remaining nine soils. We found that under intense tropical rainfall, the impact of OM on structural stability is more profound at the medium (20 - 45 %) to high (>45 %) clay content and clay mineralogy is an important modifier of this effect. The model result suggests that approximately 80 % of the soils are highly sensitive to slaking pressures, highly vulnerable to degradation and require management practices that reduce the rate of wetting and thus degradation of aggregates under intense rainfall.