**Advancing Post-Mining Rehabilitation: Utilizing Rainfall Simulators to Enhance Erosional Stability and Landform Design**

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**Abstract**

The mining industry plays a vital role in economic development, yet it faces challenges in designing stable post-mining landforms. Rainfall simulators have emerged as essential tools for understanding and mitigating soil erosion, enabling the design of effective landform cover systems to ensure long-term stability. This study explores the development, calibration, and application of rainfall simulators to assess soil erodibility and erosion rates in rehabilitated mining landscapes. Through experiments conducted with portable rainfall simulators, calibrated using Christiansen's uniformity coefficient and raindrop kinetic energy, the findings demonstrate their effectiveness in sourcing data for more accurately modelling erosion processes. Data generated from these simulators have been integrated with numerical models, such as MINErosion, to predict and optimize landform stability. Case studies in Queensland illustrate the role of rainfall simulators in meeting regulatory requirements and designing sustainable post-mining landforms. The results highlight the potential of combining field measurements and modeling to guide rehabilitation practices and achieve long-term environmental sustainability.