Review of: "Assessment of soil erosion in the Cesar watershed, an initial step toward the restoration of the Cesar River"

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The present research on assessment of soil erosion in the Cesar watershed (in Cesar River, a critical tributary of the Magdalena River in South America) addresses a significant gap in existing research by presenting the first assessment of soil erosion rates [1]. Using the RUSLE-GGS erosion model at the watershed scale and covering data from 1991 to 2020, the study estimates soil erosion rates and identifies hotspots of erosion using spatial analysis techniques. The findings highlight the alarming levels of soil degradation in the region, with over 80% of soil affected by erosion. Despite previous research indicating the severity of the issue, accurate data on erosion rates at the watershed level have been lacking. The study also discusses potential solutions, including reforestation and conservation practices, while advocating for a comprehensive restoration roadmap from an ecosystem services perspective. It emphasizes the importance of implementing best management practices (BMPs) to control soil erosion and suggests that proper implementation of these strategies [2][3] could aid in restoring the integrity of the Cesar River watershed.

Future research could explore the use of advanced Machine-Learning (ML) algorithms to model soil erosion and sediment yield across various watershed types, even in data-scarce conditions. The Bino watershed study from India demonstrates how ML models like ANFIS (Adaptive Neuro-Fuzzy Inference System) and fuzzy logic (FL) can be useful in hilly terrains with limited data [4]. Similarly, further research in the Cesar watershed can consider using these ML models for estimating sediment yield and identifying high-risk areas, facilitating targeted restoration efforts.

In one of the semi-arid regions of Western India, deforestation for firewood, leading to reduced forest cover, was observed as a primary concern for soil erosion. This reduction in forest cover contributed to increased siltation in water bodies, higher surface runoff, and decreased groundwater percolation [5][6][7][8][9]. A similar scenario can be anticipated in the Cesar watershed, where deforestation might lead to similar soil erosion problems. Both aforementioned studies highlight the socioeconomic consequences of soil erosion. In Western India, unmet drinking water demand forced women to walk long distances to fetch water. Similarly, soil erosion in the Cesar watershed has implications for agricultural productivity and livelihoods. To align the proposals, interventions in both regions could aim to improve access to clean water through effective watershed management and to address soil erosion through sustainable agricultural practices and community-based solutions to ensure socioeconomic stability.

Given the complexity of soil erosion and watershed management, focusing on transdisciplinary collaboration and

adaptive management becomes imperative. Future research can examine how institutional frameworks, governance structures, and community participation contribute to effective watershed management and erosion control [10][11]. Collaborative frameworks among hydrologists, environmentalists, data scientists, and policymakers to address soil erosion and watershed restoration can be explored [12][13]. By aligning these areas of future research, a broader perspective emerges, offering an integrated approach to soil erosion assessment, watershed restoration, and sustainable water resource management in the Cesar watershed. Overall, the present study makes a significant contribution to the understanding of soil erosion dynamics in the Cesar watershed and provides valuable insights for guiding restoration efforts and sustainable water resource management practices.

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