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Assessing the Role of Soil Management Practices in Mitigating Soil Erosion Risks: A Literature Review

Melanie S. Ebol[1], Emmylou A. Borja[2]
[1]Surigao Norte State University
[2]Surigao Norte State University

Abstract*—Soil erosion remains a critical environmental concern that threatens agricultural productivity, water quality, and ecosystem stability worldwide. This literature review examines the role of soil management practices in mitigating soil erosion risks, drawing from a wide range of global studies. It explores the effectiveness of techniques such as mulching, conservation tillage, terracing, reforestation, and community-based watershed management. The findings indicate that integrated approaches combining biophysical and socio-economic strategies are most effective in controlling erosion. Moreover, the review highlights the importance of community perception, participatory decision-making, and policy support in the successful adoption of soil conservation practices. The synthesis of evidence underscores that sustainable soil management not only reduces erosion but also enhances soil health, agricultural resilience, and climate change adaptation. This review provides a comprehensive framework for assessing, implementing, and scaling up soil conservation measures to support sustainable land use*.

***Keywords*—** *Soil Management, Mitigation, Soil Erosion, Risks*.

I. INTRODUCTION

Soil erosion is a widespread environmental issue that poses significant challenges to sustainable land use and agricultural productivity across the globe. It involves the displacement of the upper layer of soil, primarily caused by water, wind, and human activities such as deforestation, overgrazing, and improper farming methods [1], [2]. The degradation of soil through erosion not only reduces its fertility but also contributes to water pollution, sedimentation of water bodies, and loss of biodiversity [3]. These impacts are particularly concerning in regions that rely heavily on agriculture for livelihoods, where soil erosion undermines food security, economic stability, and long-term environmental sustainability [4].

Over the years, numerous soil management practices have been developed and implemented to combat the adverse effects of soil erosion. These include both traditional and modern approaches such as conservation tillage, contour farming, mulching, reforestation, and the use of erosion control structures [5], [6], [7]. Scientific research has emphasized the need for site-specific and integrated soil management strategies tailored to different geographic, climatic, and socio-economic contexts [8]. Moreover, participatory approaches involving local communities, especially in developing countries, have been recognized as essential for the success of conservation efforts [9], [10]. The role of education and perception in promoting soil conservation behaviors has also gained attention in recent years [11].

Despite advances in soil conservation technologies and increased awareness of the consequences of soil erosion, the problem persists in many parts of the world. Climate change, population growth, and land use pressures continue to exacerbate the risk of soil degradation [12]. In this context, assessing the effectiveness of various soil management practices becomes crucial for developing resilient and adaptive land management strategies. This literature review aims to synthesize current knowledge and research findings on the role of soil management in mitigating erosion risks. By evaluating a diverse array of studies across different regions, this review provides insights into best practices, challenges, and opportunities for sustainable soil conservation.

II. METHODS

This literature review synthesizes findings from over 30 peer-reviewed articles and reports published between 2002 and 2023. Databases such as ScienceDirect, Springer, IOP, and MDPI were used to access sources related to soil conservation, erosion risk assessment, and sustainable land management. Inclusion criteria required that studies present empirical or model-based data on soil erosion mitigation strategies across diverse geographic locations, including Africa, Asia, and Latin America. Qualitative studies on community participation and socio-economic determinants were also included to provide a holistic view of soil management impacts.

III. RESULTS AND DISCUSSION

A. Soil Management Techniques and Effectiveness

Multiple soil management techniques have proven effective in reducing erosion, including contour plowing, mulching, cover cropping, and terracing [27], [28]. Tillage practices, particularly conservation tillage, significantly reduce runoff and sediment loss by maintaining soil structure and moisture [30]. Lal et al. [3] and Milgroom et al. [5] found that organic farming systems, especially in olive orchards, not only enhance soil organic matter but also reduce erosion compared to conventional methods.

Studies by Mandal and Sharda [4] in the Eastern Himalayan region highlighted the utility of spatial risk assessment for targeted intervention. Meanwhile, conservation structures like tied ridges and check dams have demonstrated success in minimizing surface water flow and gully formation in semi-arid and sub-humid areas [39], [44].

B. Socioeconomic and Perceptual Factors

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Community awareness and participation are crucial for the sustainability of erosion control efforts. Díaz-Rodríguez et al. [1] emphasized the importance of integrating local knowledge and perception indicators into soil conservation programs. Similarly, Ofgeha [6] and Karlen and Rice [2] stressed that education and socio-economic incentives strongly influence the adoption of soil management practices.

C. Technological and Policy Integration

GIS-based modeling, remote sensing, and participatory monitoring tools have enhanced erosion risk mapping and facilitated policy planning [24], [36]. For instance, a 2022 study in Kenya used multi-criteria evaluation to prioritize conservation zones [24], while a separate study in China utilized 137Cs techniques to evaluate long-term soil loss [23]. Policy reviews, such as those in Indonesia, underscore the need for long-term commitment and institutional support to maintain erosion control infrastructure [31].

D. Challenges and Limitations

Despite progress, obstacles remain due to climate variability, land tenure concerns, and inadequate access to resources. Many studies noted the inconsistency in adoption of recommended practices due to economic constraints and cultural resistance [42], [43]. Furthermore, results from regions such as Ethiopia and Pakistan showed that lack of maintenance and technical knowledge often lead to degradation of installed conservation structures [20], [33].

IV. Conclusion

Soil erosion mitigation relies heavily on the effective application of integrated soil management strategies tailored to local biophysical and socio-economic contexts. Practices like conservation tillage, organic farming, and community-driven interventions have demonstrated measurable success in reducing erosion risks. However, challenges such as limited resources, inadequate policy implementation, and varying stakeholder perceptions must be addressed. Enhancing education, strengthening participatory approaches, and adopting geospatial technologies will be vital in scaling up successful models. Continued interdisciplinary research is essential to support adaptive soil management practices that align with climate resilience and sustainable agriculture goals.

References

[1] A. Díaz-Rodríguez et al., "Exploring relationship between perception indicators and mitigation behaviors of soil erosion in undergraduate students in Sonora, Mexico," Sustainability, vol. 13, no. 16, 2021.
[2] D. Karlen and C. Rice, "Soil degradation: Will humankind ever learn?," Sustainability, vol. 7, no. 9, pp. 12490–12501, 2015.
[3] R. Lal et al., "Management to mitigate and adapt to climate change," J. Soil Water Conserv., vol. 66, no. 4, pp. 276–285, 2011.
[4] D. Mandal and V. Sharda, "Appraisal of soil erosion risk in the Eastern Himalayan region of India," Land Degrad. Dev., vol. 24, no. 5, pp. 430–437, 2011.
[5] J. Milgroom et al., "From experimental research to an on-farm tool for participatory monitoring and evaluation," Land Degrad. Dev., vol. 18, no. 4, pp. 397–411, 2007.
[6] G. Ofgeha, "Community's perception on soil erosion and participation in conservation," J. Soil Sci. Environ. Manage., vol. 8, no. 2, pp. 17–24, 2017.
[24] "GIS-based multi-criteria evaluation to identify areas for soil and water conservation," J. Geosci. Environ. Prot., vol. 10, no. 11, pp. 64–92, 2022.
[27] "Impacts of soil conservation techniques on soil erodibility on an Alfisol," Heliyon, vol. 9, no. 3, e13768, 2023.
[28] "Mulching techniques to conserve the soil water and advance the crop production – A review," Curr. World Environ., Special Issue, 2020.
[30] "Water erosion reduction using different soil tillage approaches," Land, vol. 9, no. 10, p. 358, 2020.
[31] "Forty years of soil and water conservation policy in Indonesia: A review," Sustainability, vol. 14, no. 5, 2972, 2022.
[36] "Assessment of the effectiveness of biophysical soil and water conservation structures," Appl. Environ. Soil Sci., 2022.
[39] "Effects of soil and water conservation techniques on crop yield and soil loss," Agric. Water Manage., vol. 207, pp. 67–79, 2018.
[42] "Soil conservation techniques among arable crop farmers in Odo Otin, Nigeria," J. Soil Sci. Environ. Manage., vol. 11, no. 2, pp. 50–56, 2020.
[43] "Use of soil conservation practices for climate change adaptation," Asian J. Agric. Rural Dev., vol. 8, no. 1, pp. 16–27, 2018.

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