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# Editorial: Scaling-up sustainable land management in the drylands of Sub-Saharan Africa

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## KEYWORDS

farm diversity, livelihood, scale, sub-Saharan Africa, sustainable land management

## Editorial on the Research Topic

[Scaling-up sustainable land management in the drylands of Sub-Saharan Africa](#)

## Introduction

This Research Topic of Frontiers in Environmental Science focuses on different innovation aspects related to sustainable land management (SLM) in sub-Saharan Africa (SSA), within a framework of different but related thematic areas, whose long-term goal is to scale up these promising SLM technologies for impact at the local levels. SLM constitutes an array of activities that sustain land and its given ecosystem functions (Critchley et al., 2023). Considerably, SLM is generally accepted as playing an important function in soil and water conservation (Liniger et al., 2019). Currently, it is acknowledged as a key driver of “land-based solution” in achieving climate change (CC) mitigation through carbon sequestration and reduction of CO<sub>2</sub> emissions.

Less acknowledged is the fact that SLM can support CC adaptation solutions, thus enabling people to overcome impacts (Sanz et al., 2017; Critchley et al., 2021; IPCC, 2021; Critchley et al., 2023). Several SLM technologies, for example, agroforestry, reduced tillage farming, mulching soil sub-surface with plant residues, and water harvesting, at the farm level, enhance adaptation benefits and resilience. This is very critical to smallholder farmers in SSA. SLM technologies can enhance their ability to adapt to CC impacts such as rising temperatures and declining rainfall at a farm level scale. At a macro-scale, CC adaptation through SLM can result in significant resilience to farmland ecosystems. The articles in this Research Topic make a small but significant contribution toward understanding the intricacies associated with SLM best practices in SSA, as represented by the five articles contributed by 31 authors.

It is generally acknowledged that land degradation is widespread in SSA and is driven by a combination of interlinked economic, social, and environmental factors. Land degradation affects agricultural production and the supply of a range of ecosystem goods and services. In order to create conditions that allow for the wide-scale adoption of sustainable land management (SLM), policy interventions at different institutional levels are required. In order to support the formulation and implementation of SLM policies, it is necessary to understand the economic impacts of land degradation and the potential benefits of SLM at different ecological scales. Only when these multi-scale impacts are known and are being considered in the policy formulation process can the development of effective and sustainable SLM policies be expected to take place. It

should be appreciated that science for development is central in this Research Topic. From a scientific perspective, this Research Topic will unravel the complexity of multi-scale factors affecting adoption and scaling-up of SLM technologies. From a developmental perspective, this Topic will deliver evidence-based strategies and policy recommendations for scaling-up of SLM. Collaboration among scientists is fundamental not only to ensure the scientific quality of the results and linkages to current academic debates on SLM but also to commit policymakers at all institutional levels to be involved and take account of the research outcomes. This Research Topic is therefore embedded in ongoing research activities on the subject within sub-Saharan Africa.

Against the above background, the aim of this Research Topic is to address the following key fundamental questions:

- What are the impacts of land degradation on ecosystem services supply at micro (village), meso (district), and macro scales (SSA)?
- To what extent does the quantitative understanding of the impacts of land degradation and benefits of SLM change the priority given to SLM among decision-makers at micro, meso, and macro levels?
- What are the socioeconomic key factors promoting or limiting SLM in SSA?
- To what extent can collective action and a solid foundation at the village level motivate farmers, and what are the financial benefits of participation and collaboration for farmers?
- What are the components of a strategy for triggering adoption and spreading of SLM from successful farmers to the whole village?
- What are the components of a strategy for horizontal scaling-up of SLM from village to village based on active involvement of mainline institutions?

In an attempt to address the above questions, the following five research articles, published under this Research Topic, highlight some of the key aspects we need to ponder over, in order to understand the magnitude of the problem at hand. The first article in the Research Topic authored by [Dieng et al.](#), entitled “Sustainable Land Management Policy to address land degradation: Linking old forest management practices in Senegal with new REDD+ requirements,” critically examines the applicability of the international REDD+ to the circumstances in Senegal. It should be noted that local circumstances in Senegal dictate the adaptation of Agriculture, Forest, and Other Landuses (AFoLU) in addressing SLM that could arrest land degradation in Senegal. Key messages from this study include the following:

- REDD+ has an important role to play in rehabilitating the degraded areas in Senegal.
- REDD+ offers an excellent opportunity for carbon sequestration, which could go a long way in enhancing carbon markets.
- Need to map out the country into areas that quickly implement REDD+ activities and the resultant benefits that could accrue for local communities in terms of SLM and carbon trading.

The second article is entitled “Diversity of soil fertility management options in maize-based farming systems in northern Benin” and is written by [Tovihoudji et al.](#) The objective of this study is to characterize current farming systems and farmers’ indigenous soil fertility management strategies with a focus on cattle manure and mineral fertilizers in maize-based farming systems of northern Benin. This study clearly demonstrates that indigenous SLM in a tropical climate environment has a positive bearing on arresting degradation and soil fertility decline. Key messages from this study are as follows:

- Farm yard manure is easily available to farmers (from their livestock) and beneficial to replenishing soil fertility.
- Use of mineral fertilizers is not widespread among smallholder farmers because of the cost implication. As such, it is not an alternative to farmyard manure.
- Lack of knowledge is an important determinant in the choice of technology for SLM options among smallholder farmers.

The third article is entitled “Land access, livelihoods and dietary diversity in a fragile setting in Northern Uganda,” from [Kang et al.](#) The objective of the study is to examine crop value chain activities, agriculture income, coping strategy, and the food consumption score (FCS) among South Sudan refugees and Uganda host communities living on the northern border of Uganda. This study does not directly speak to conventional SLM issues; rather, it focuses more on refugees having inadequate land acreage to grow their crops, hence explaining the food insecurity situation they find themselves in. One would ask whether large land acreage is equal to increased food production, hence food security? This does not follow since more food can be produced on a small acreage of land as long as the parameters of soil health are optimized. Key messages from this study can be summarized as follows:

- Land tenure is key to self-reliance in terms of food security, which is an output of better SLM.
- Refugees can only attain food security if there is a policy shift in terms of their access to land that fits the bill of sustainability in terms of SLM and rights to ownership.

The fourth article has the title “Reforestation and sylvopastoral systems in Sahelian drylands: evaluating return on investment from Provisioning Ecosystem Services, Senegal” from [Cesaro et al.](#) This study attempts to model pastoral land reforestation efforts in the Sahel in order to inform their sustainability. It should be noted that pastoralism as a farming system can have debilitating negative effects on land unless well-managed. This has been well-documented in the Sahelian zone over time. In addition to pastoralism, environmental limitations, in particular, interannual rainfall variability, contribute to land degradation witnessed in this zone. The key findings from this study include the following:

- Ecosystem services through reforestation measures can support the actual cost of restoration through appropriate SLM options.
- Carbon sequestration as an offshoot from reforestation measures encourages the emergence of carbon credit markets that could benefit local communities if managed within a clearly defined policy framework.

The fifth and final article is titled: “*Factors influencing the implementation of agroecological practices: Lessons drawn from Aba-Garima watershed, Ethiopia.*,” from Mekuria et al. This study introduces us to the field of agroecology and clearly points out that “one suit fits all” solutions cannot be applied in farmers’ land spaces due to the heterogeneity of environmental circumstances. The study points out a very interesting observation that farmers in the Aba-Garima watershed are actually practicing agroecological practices that support SLM in different forms that suit their unique circumstances. The greatest challenges farmers face in adapting best agroecological practices include the lack of access to water, shortage of money, and land and labor shortages. The article emphasizes the novelty of agroecology practices in supporting SLM through the triple benefits of enhancing farmers’ ability to spur a sustainable higher income from their farming activities, achieving household food security, and protecting the environment against degradation.

## Conclusion

Land degradation is widely recognized as a major threat to sustainable development and food production, especially in sub-Saharan Africa. Reflecting on the Research Topic, the published research treatises, which comprise this collection, addresses a significant gap in our understanding of the extent to which SLM can change the overarching chronic problem of environmental degradation in SSA. The SLM technologies, if well-implemented, could go a long way in alleviating food security challenges and improving livelihoods through the emerging carbon credit markets and payment for ecosystem services. A key pillar of SLM, demonstrated in the collective research, is the robustness of interdisciplinary collaborative methods of participatory approaches to solving problems.

From the contributions to this Research Topic, it has emerged that farmers’ decision-making to invest in SLM and foster spreading beyond the farm level is strongly governed by the policy and economic environment. With the recent shift of attention to ecosystem services, as seen in one of the contributions, exciting opportunities have emerged to change policies in favor of enabling SLM and study processes at the landscape level. The landscape is the primary level where the actions of individual households intersect those of other users and where scaling and governance issues come together. Landscape-level studies provide insights into the costs and benefits of land management as they cascade from the level of the individual farmer to the landscape and to the national level. As a result, increased awareness among policymakers can trigger

policy-restructuring, market-based incentives like carbon credits and institutional arrangements that support SLM. Stakeholder involvement at multiple scales is crucial. Relevant stakeholders can be distinguished at the micro-level (farmers and their organizations), meso-level (wards, districts, provinces, private sector, and NGOs), and macro-level (government, donors, and international organizations). A key research gap with respect to scaling-up SLM is how to support “socially optimal” solutions and align interests of these multi-level stakeholders into a harmonized—negotiated—policy, enabling them to move from the perception of SLM problems (whose resolution requires collective solutions) to actual solutions.

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CS: conceptualization and writing—review and editing.

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## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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