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Policy Insights on Sustainable Land Management (SLM) Efforts in Ethiopia

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Summary

Key Messages	Recommendations
1 Expand targeted data and analyses of SLM initiatives to enhance ecosystem services	1.1. Conduct spatially targeted studies representing different agroecological zones where there is a shortage of evidence related to the impacts of SLM restoration projects 1.2. Conduct a detailed analysis using appropriate sampling strategies 1.3. Develop integrated SLM practices that enhance multiple ecosystem functions and identify appropriate, targeted practices to generate maximum benefit 1.4. Identify the best SLM practices for wider adoption to inform decision-making on SLM investments that work toward sustainable reversal of land degradation
2 Provide institutional support for pathways to SLM adoption	2.1. Implement inclusive systems and institutional arrangements to ensure the continued use of SLM practices 2.2. Increase monitoring and evaluation (M&E) of SLM interventions
3 Consider the socioeconomic benefits of SLM practices and adoption constraints	3.1. Improve support from federal and regional governments, development agents, and agricultural extension agents to help smallholder farmers adopt SLM practices 3.2. Consider less-studied practices and those not considered by previous studies in future adoption in SLM research
4 Harmonize crop and livestock production	4.1. Harmonize crop-livestock natural resource management strategies for successful SLM interventions 4.2. Consider integrating grazing management strategies in SLM efforts, which are essential for land restoration 4.3. Invest further in SLM efforts and efficient institutional arrangements that preserve the natural landscape and minimize the extent of crop-livestock competition
5 Consider gender and youth dynamics	5.1. Urgently acquire scientific evidence about how land restoration has benefited men and women and to what extent it could transform gender and power dynamics 5.2. Properly target and engage women and youth in SLM initiatives at all decision-making levels 5.3. Consider integrating a youth component in programs targeting climate resilient/adaptative activities that generate income for women to capitalize on co-benefits.

Policy Implications

- Support the proper sectoral integration of SLM efforts by mainstreaming SLM strategies into national and subnational strategies, plans, and programs.
- Stimulate public/private funding for SLM interventions and their sustainability, generating multiple environmental and development benefits.
- Encourage the design and implementation of studies to assess SLM interventions' cost-effectiveness, social benefits, and trade-offs.
- Encourage the design and implementation of socioeconomic and livelihood impact studies to understand social acceptance and direct/indirect benefits.
- Strengthen the development and funding for long-term SLM evidence generation and data collection system.

Introduction

Land degradation is a major global environmental and developmental challenge of the 21st century (Gashaw et al., 2014). Among sub-Saharan Africa (SSA) countries, Ethiopia experiences the most severe land degradation, costing US$ 4.3 billion annually (Gebreselassie et al., 2016). Roughly 14.3 million hectares of land in Ethiopia —about 50% of the Highlands— is severely degraded (Abera et al., 2020). Given land degradation's impact on food security and economic development, since the 1970s, Ethiopia has undertaken one of the largest land restoration programs ever implemented, with huge sustainable land restoration (SLM) efforts (Abera et al., 2020). The benefits of land restoration are tremendous, ranging from biophysical benefits in soil health, agricultural productivity, and ecosystem services to socioeconomic dimensions such as improving farmers' income and livelihoods (Abera et al., 2020, 2022).

Despite these efforts, there is no clear, quantitative evidence about the performance of these SLM practices or information on their contribution to improving livelihoods and enhancing ecosystem services across scales. As a result, our knowledge about what works, where, how, and the risks of scaling SLM practices remains limited. This lack of data limits our understanding of the return on investment in restoring degraded lands and their sustainable management in Ethiopia. It also undermines the negotiating power in facilitating payment for ecosystem services (Abera et al., 2020). Understanding the key drivers that promote successful SLM efforts could help design and implement appropriate technologies (Woldearegay et al., 2018).

Key Messages

1 Expand targeted data and analyses of SLM initiatives to enhance ecosystem services

Abera et al. (2020) examined peer-reviewed scientific literature on SLM practices and their impacts in Ethiopia. The dominant SLM practices studied were different CA (Conservation Agriculture) forms, followed by soil and stone bunds and exclosures. Results indicate that the highest mean effect on agricultural productivity comes from combining bunds and biological interventions followed by conservation agriculture practices with 170% and 18% increases, respectively. However, bunds, biological intervention, and terracing (fanya juu) alone reveal negative effects on productivity. Nonetheless, the mean effect of all SLM interventions on soil organic carbon is positive, with the highest effect being from 'bunds + biological' interventions (139%) followed by exclosure (90%). Similarly, Abera et al. (2021) presented higher soil organic carbon return for physical and biological combined interventions ('bunds + vegetation' or 'terraces + vegetation'), followed by just biological intervention. Reduced soil erosion and runoff are the dominant impacts of all interventions (Abera et al., 2020).

Despite these findings, evidence on the best-bet SLM practices for making informed decisions and contributing to sustainable development targets is still not systematically quantified. Knowledge and information about the benefits of SLM practices for achieving land degradation neutrality (LDN) targets and the ecosystem benefits gained from protected and conserved landscapes are essential to facilitate targeting and scaling (Desta et al., 2021a,b).

Identifying SLM practices that enhance on-site sediment management and crop productivity is crucial for preventing, reducing, and restoring land degradation and aiding LDN. Findings suggest that practices featuring continuous soil cover during the rainy season, perennial vegetation, retention of moisture, and barriers for sediment transport were most effective at decreasing soil loss and increasing productivity (Desta et al., 2021a,b).

Recommendation 1.1

Conduct spatially targeted studies representing different agroecological zones where there is a shortage of evidence related to the impacts of SLM restoration projects, e.g., hot subhumid and sub-moist zones. SLM practices and land cover types are alternative options to reduce erosion rates and change degraded lands and unsustainable agricultural management into long-term sustainable management strategies. Once such data is available, upscaling the impact of national-scale interventions using geographically representative case studies would help evaluate SLM benefits at the national level and guide site-specific interventions (Abera et al., 2020; Meaza et al., 2022).

Recommendation 1.2

Conduct a detailed analysis using appropriate sampling strategies. There is limited systematic, quantitative evidence to understand the effect of land restoration on landscape-scale ecosystem service benefits, which can undermine the generation of field-specific information, evidence-based planning, and decision-making (Abera et al., 2020).

Recommendation 1.3

Develop integrated SLM practices that enhance multiple ecosystem functions and identify appropriate targeted practices to generate maximum benefit (Abera et al., 2020; Meaza et al., 2022). The meta-analysis revealed that few studies assessed the performance of various SLM interventions compared to the extent of interventions. Indeed, projects were implemented in more than 24 agroecological zones, but scientific evidence is only available for 11 of these (Abera et al., 2020).

Recommendation 1.4

Identify the best SLM practices for wider adoption to inform decision-making on SLM investments that work toward sustainable reversal of land degradation (Abera et al., 2020). This implies that a strong push in disseminating and adopting cover management and in-situ moisture conservation practices is needed, combined with mechanical erosion control practices to prevent and reduce land degradation and negative economic impact and to enhance multiple ecosystem benefits, sediment management, and productivity (Abera et al., 2020).

Lessons learned from multi-scale integrated SLM practices and rainwater harvesting/management in Tigray Region (Woldearegay et al., 2018)

The recent successful SLM efforts in Tigray, northern Ethiopia, are considered exemplary for SSA and beyond (Tuinhof et al., 2012). Through SLM restoration efforts and the introduction of appropriate water harvesting and moisture conservation technologies, it was possible to increase water availability, enhance the productivity of rainfed and irrigated agriculture, and avoid climate-related disasters in the studied sites. For further out/up-scaling to other parts of Ethiopia and beyond, the experiences in Tigray taught the following key lessons:

- **Learning through processes and by doing:** The approach learned from failures and by doing rather than waiting for experimental-based research outputs on the best technologies and approaches. However, the technologies and approaches were systematically evaluated in consecutive years, implementing best practices.
- **Benefit-oriented interventions:** All interventions were designed so that the implemented technologies and approaches at different levels of the landscapes had multiple short- and long-term benefits.
- **Landscape-level intervention with linked technologies:** Certain technology implemented at the upper part of the landscape positively affects the performance and sustainability of the technologies at the middle slope sections. Similarly, the interventions in the middle sections of the landscapes positively affect the performance/sustainability of the technologies implemented in lower landscape sections. This approach considers upstream-downstream issues that could emerge from implementing interventions at the landscape level.
- **Technology selection:** The technologies implemented in Tigray were redesigned for the local context, including the rainfall, the watersheds' hydrogeological characteristics, and other local sociocultural/economic aspects.
- **Leadership and political commitment:** Implementing linked and appropriate technologies at the landscape level required strong local leadership, high political commitment, and appropriate institutional set-up.

2 Provide institutional support for pathways to SLM adoption

Moisture stress and nutrient depletion are the main biophysical factors that challenge smallholder farmers in sub-Saharan Africa. Findings demonstrated that SLM interventions, such as climate-smart agriculture (CSA) practices, significantly increased soil moisture content, pH, and nutrient concentration compared to farmers' usual practices. In addition, SLM practices increased soil carbon stock three- to seven-fold and wheat yield by 30–45% compared to business-as-usual practices (Abera et al., 2021). Findings, however, implied that soil physical conservation structures should be coupled with biological conservation measures and agronomic practices such as cereal–legume rotation, improved seed varieties, cover crops, and control grazing. These efforts help downscale the negative impacts of climate change on crop production and help resource-poor farmers deal with the current climate change risk. Furthermore, integrated SLM interventions reverse soil carbon loss, rehabilitate degraded agroecosystems, and build synergies

between adaptation and mitigation co-benefits for food security (Tadesse et al., 2018). However, some indications implied that the long-term benefits of SLM interventions are only achievable when adopted technologies are properly managed and maintained over time (Tadesse et al., 2021).

Recommendation 2.1

Implement inclusive systems and institutional arrangements to ensure the continued use of SLM practices. Longer implementation durations for SLM interventions significantly enhance soil carbon stocks, with benefits towards climate change mitigation and landscape resilience (Abera et al., 2020, 2021).

Recommendation 2.2

Increase monitoring and evaluation (M&E) of SLM interventions. Donors, beneficiaries, and other stakeholders increasingly demand evidence that the development projects they support achieve the expected results and have the intended impact. When properly planned and carried out, M&E ensures optimal and effective use of resources as well as transparency and accountability; thus, these processes are likely to positively impact stakeholder satisfaction and future funding.

Assessing impacts of different land uses and sustainable water conservation (SWC) interventions on runoff and sediment yield at different scales in the central highlands of Ethiopia (Yaekob et al., 2020)

This study evaluated the impacts of land use/cover types and SWC practices on soil loss and runoff at different scales. It aimed to provide evidence on the performances of the various SWC practices, help raise awareness of the local communities and government bodies, and facilitate planning and targeting. The study showed significant differences at both the plot and sub-watershed levels in runoff and soil loss between 'treated' and 'non-treated' areas. Although the efficiency reduced over the years, there was a reduction of runoff and soil loss in areas with terraces and trenches. The runoff retained within the trenches is useful as it can contribute to increased soil moisture in the landscape. During the rainy season, the SWC practices significantly improved the water retention capacity of the sub-watershed. Regular trench maintenance and cascading water-harvesting practices can also be implemented across the landscape to further improve and sustain the water retention capacity and reduce downslope erosion. Farmers should use integrated SWC with purposeful regular maintenance of structures to sustain the productivity of the sub-watersheds.

3 Consider the socioeconomic benefits of SLM practices and adoption constraints

One of the potential impacts of SLM practices is their additional socioeconomic benefits to those already obtained from the farm, which is also considered a stepping-stone to scaling adoption (Kifle et al., 2020). Because asset-poor farmers are highly dependent on common-pool resources, such as forests, water bodies, and ecosystems, SLM initiatives that affect these areas significantly impact their livelihoods and well-being (Abegaz et al., 2023). The reported socioeconomic benefits for adopters of SLM practices were higher yields, higher farm income, increased food security/availability, increased land productivity, and reduced household poverty (Tekeste, 2021).

The adoption rate of individual SLM practices varies greatly among smallholder farmers; most practices are in their infancy stage in Ethiopia. Knowledge/awareness and socioeconomic factors were the first two constraints compared to other challenges, such as labor shortage and limited access to markets and credit. On the other hand, the categories of weather/climate and crop disease, and limited access to seedlings were in the last two positions. Some constraints are common to all practices, while some are specific to others. These differences highlight that knowledge/awareness and socioeconomic constraints are prominent and need urgent action (Abegaz et al., 2023). In terms of knowledge/awareness, many studies have reported that a better educational level in farmers and access to agricultural extension services, technical support, and monitoring practices positively affected adoption practices (Kifle et al., 2020). Regarding socioeconomic factors, larger plot sizes, larger household sizes, and undertaking off-farm activities positively affect adoption (Kifle et al., 2020).

Recommendation 3.1

Improve support from federal and regional governments, development agents, and agricultural extension agents to help smallholder farmers adopt SLM practices. A major portion of agricultural land, particularly in ecologically fragile areas, is cultivated by smallholders who perform significant ecological services while farming. For economic reasons and owing to a lack of knowledge, they often use inappropriate technologies and methods (Gabathuler et al., 2009).

Recommendation 3.2

Consider less-studied practices and those not considered by previous studies in future adoption in SLM research (Abegaz et al., 2023). Both socioeconomic and biophysical studies are restricted to few SLM interventions, building the knowledge base for all interventions facilitates their adoption.

4 Harmonize crop and livestock production

In Ethiopia, rain-fed farming and livestock husbandry form the basis of the economy, especially in the highlands. Livestock provide manure, food, fuel, draft power, transportation, and cash income, and reduce risks and vulnerability during critical periods (McIntire et al., 1992). However, traditional crop and livestock production and rapid human population growth put significant pressure on land resources (Mekuria et al., 2018). Indeed, as the livestock population increases, so does the stocking rate and grazing pressure (Duncan et al., 2016), while the spatial dimension of land use/land cover (LULC) for grazing land declines (Mekuria et al., 2018). A common bottleneck for livestock productivity is feed shortages and a reduction and degradation of pasturelands (Mekuria et al., 2018). Open grazing is a primary contributor to land degradation through desertification because it converts arable or pastureland into unproductive land (Chukwuemeka et al., 2018).

Recommendation 4.1

Harmonize crop-livestock natural resource management strategies for successful SLM interventions. The reintegration of crop and livestock systems within the same land area can potentially restore degraded lands, sequester carbon, adapt to climate change, and sustainably use agricultural biodiversity while improving agricultural production, rural livelihoods, and food security (Garrett et al., 2017).

Recommendation 4.2

Consider integrating grazing management strategies in SLM efforts, which are essential for land restoration. Appropriate choices of stocking rate or height of grazing and rotational or continuous stocking are critical to the success of a grazing system (Sollenberger et al., 2018).

Recommendation 4.3

Invest further in SLM efforts and efficient institutional arrangements that preserve the natural landscape and minimize the extent of crop-livestock competition. Promoting multipurpose forage and crop varieties could provide enough biomass to meet the needs of humans and livestock and enhance soil fertility. Increasing crop production alone will not meet the farmers' animal feed. We conclude that adopting improved forages and fodder species and better integrating crop-livestock production can sustainably alleviate human food and animal feed demands in the highlands of Ethiopia (Mekuria et al., 2018).

5 Consider gender and youth dynamics

Women and youth in rural Ethiopian areas are more vulnerable to climate-related risks due to existing social norms and gender inequalities, such as limited ownership and control over productive assets/resources, decision-making power, access to information, extension services, and markets, and multidimensional social factors. Furthermore, how the outcomes of restoration initiatives affect different social groups, specifically women, men, and the marginalized, is rarely considered since most of the restoration research in Ethiopia remains blind to gender and social inclusion. These inequalities affect the ability of women and youth to adapt to climate change. Understanding and addressing these issues is critical to ensuring restoration initiatives do not exacerbate marginalization and inequalities (Abera et al., 2022). On the other hand, women and youth have unique knowledge and skills to help create effective and sustainable responses to climate change (Ambaw et al., 2019). Taking gender and youth dynamics into consideration is important to make interventions and advisories inclusive.

Recommendation 5.1

Urgently acquire scientific evidence about how land restoration has benefited men and women and to what extent it could transform gender and power dynamics. Scientists and researchers working on land management must integrate inclusion, intersectional aspects, and gender analysis into their studies to inform and guide land management interventions, programs, and policies (Abera et al., 2022).

Recommendation 5.2

Properly target and engage women and youth in SLM initiatives at all decision-making levels. Simultaneously challenge relationships at home and in the community and structural set-ups by engaging men and promoting social dialogues to aid women's economic empowerment and build their adaptive capacity (Ambaw et al., 2019).

Recommendation 5.3

Consider integrating a youth component into climate resilient/adaptative activities. Involving the youth in programs targeting climate resiliency and adaptation that generate income for women will create co-benefits.

Bench terrace vegetated with Desho grass (Photo: Dereje).

Policy Implications

This policy brief aims to provide Ethiopian policymakers, the private sector, and civil society with scientifically credible and independent, up-to-date assessments of available knowledge to make better-informed decisions at the local, regional, and national levels. Urgent and concerted action is needed to prevent irreversible land degradation and accelerate the implementation of SLM measures. Such measures will contribute to the national climate change adaptation and mitigation efforts included in Ethiopia's Nationally Determined Contribution (NDC) and to achieving the Sustainable Development Goals (SDGs). Delaying the implementation of proven actions to combat land degradation will make the necessary steps progressively more difficult and costly. We need policymakers to take the following actions:

- Support the proper sectoral integration of SLM efforts by mainstreaming SLM strategies into national and subnational strategies, plans, and programs.
- Stimulate public/private funding for SLM interventions and their sustainability, generating multiple environmental and development benefits.
- Encourage the design and implementation of studies to assess SLM interventions' cost-effectiveness, social benefit, and trade-offs.
- Encourage the design and implementation of socioeconomic and livelihood impact studies to understand social acceptance and direct/indirect benefits.
- Strengthen the development and funding for long-term *in-situ* and remote-sensing SLM data generation systems.

Resources

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