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A framework for scaling sustainable land management options

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Abstract

Improvements in land use and management are needed at a global scale to tackle interconnected global challenges of population growth, poverty, migration, climate change, biodiversity loss, and degrading land and water resources. There are hundreds of technical options for improving the sustainability of land management and preventing or reversing degradation, but there are many sociocultural, institutional, economic, and policy barriers hindering their adoption at large scale. To tackle this challenge, the Dryland Systems Program of the Consultative Group for International Agricultural Research and the UN Convention to Combat Desertification convened an expert group to consider barriers and incentives to scaling technologies, processes, policies, or institutional arrangements. The group reviewed existing frameworks for scaling sustainable land management (SLM) interventions across a range of contexts and identified eight critical actions for success: (a) plan iteratively; (b) consistently fund; (c) select SLM options for scaling based on best available evidence; (d) identify and engage with stakeholders at all scales; (e) build capacity for scaling; (f) foster

institutional leadership and policy change to support scaling; (g) achieve early benefits and incentives for as many stakeholders as possible; and (h) monitor, evaluate, and communicate. Incentives for scaling were identified for the private sector, farmers and their communities, and policy makers. Based on these findings, a new action framework for scaling is presented that analyses the contexts where specific SLM interventions can be scaled, so that SLM options can be screened and adapted to these contexts, piloted and disseminated. The framework can help countries achieve land degradation neutrality.

KEYWORDS

land, management, options, scaling, sustainable

1 | INTRODUCTION

Both developing and developed countries are facing the interconnected challenges of population growth, poverty and migration, climate change, loss of biodiversity, and degrading land and water resources. Approaches are needed to achieve the grand goals of living within planetary boundaries, alleviating poverty, enhancing livelihoods, securing food and water supplies, and protecting the natural resource base (Rockström et al., 2009; Steffen et al., 2015). These goals formed the basis of the Millennium Development Goals and their successors, the Sustainable Development Goals (SDGs; United Nations [UN], 2016a).

A key factor to achieve many of the SDGs is the improvement of land use and management, reversing the current trend of increasing land degradation, and preventing further degradation (Cowie, Schneider, & Montanarella, 2007). Some 169 out of the 194 countries that are parties to the United Nations Convention to Combat Desertification (UNCCD) report that they are affected by land degradation (Wischnewski, 2015). With current rates of global land degradation of as much as 10 to 12 million hectare per year and the fact that there is a need to increase terrestrial food production by some 70% by 2050 to satisfy demands of a growing population (Food and Agriculture Organization [FAO], 2009), there is an urgent need for widespread dissemination and adoption of successful, profitable, and resource-efficient sustainable land management (SLM) practices without degrading the natural resource base that humans depend on for life.

Widespread dissemination and adoption or going to scale in this article refers to both scaling out, meaning the adoption of SLM practices by an increasing number and range of stakeholders, for example, farmers and communities (Douthwaite et al., 2007), and to scaling up, meaning the vertical scaling of SLM policies and practice at increasingly high levels in institutions responsible for the promotion of SLM practices (cf. Pacheco & Fujisaka, 2004; Wigboldus & Leeuwis, 2013; Hermans, Stuiver, Beers, & Kok, 2013; Cooly & Linn, 2014; IFAD, 2015). For clarity, we specify the use of scaling up and out where relevant in the text based on the above definitions or otherwise use scaling to mean both.

As much as 500 million out of 2 billion hectare of global degraded land has the potential for restoration mainly in developing countries (UNCCD, 2016a). There is recognition that the public and private sector need to work together with land users (World Economic Forum, 2012) in order to bring about the transformation in land use and management needed to achieve the goals of land restoration. Land is now receiving long overdue attention under the SDGs and in particular SDG 15 that aims to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" (UN, 2016).

There are hundreds of examples of interventions to improve land management and prevent or reverse land degradation at the scale of farms, villages, communities, or watersheds (e.g., WOCAT, 2007). However, our inability to scale technological, institutional, and policy solutions to regional, national, and international scales severely restricts our capacity to address the global challenge of preventing and reversing land degradation (Pretty, 1995; Zucca, Bautista, Orr, & Previtali, 2013).

The concept of SLM is a unifying theme for global efforts on combating desertification, drought and land degradation, climate change, and loss of biodiversity (Reed & Stringer, 2016; Thomas, 2008; World Bank, 2008). SLM combines technologies, policies, and activities aimed at integrating socioeconomic principles with environmental concerns in order to maintain or enhance production, increase the resilience of ecosystem services, and be economically viable and socially acceptable (FAO/FESLM, 1993; Marques et al., 2016).

This paper specifically examines how SLM can go to scale (up and out) as part of the international community's efforts to avoid reaching our planetary boundaries. We first review existing frameworks for scaling from the literature, identifying key elements that can explain how and why SLM policies and practices are adopted by institutions and land managers. Then, based on the findings of an international expert workshop,[1] we consider barriers and success factors,

[1]This work is the result of a write shop held in Amman, Jordan, April 11–13, 2016, involving participants from six CGIAR centers; Bioversity, International Potato Center, International Center for Agricultural Research in Dry Areas, International Crop Research Institute for the Semi-Arid Tropics, International Livestock Research Institute, and International Water Management Institute; the Consultative Group for International Agricultural Research Program on Dryland Systems, FAO, International Union for the Conservation of Nature, the African Union, the NGOs; C4 EcoSolutions, iMMAP, Royal Tropical Institute (KIT), Amsterdam and Sustainability Lab; and UNCCD, UNDP, UNEP, UN Habitat, World Resource Institute, the Universities of Mekelle, Kenya, Stellenbosch, South Africa, and Newcastle, United Kingdom. A condensed version of this paper is part of the UNCCD's Global Land Outlook, published on June 17, 2017. A report of the methods and discussion of the write shop is available at http://repo.mel.cgiar.org/handle/20.500.11766/4812.

identifying eight actions for successfully scaling SLM and discuss incentives for the private, farming, and policy communities to scale SLM. Finally, the paper brings together insights from the literature and the expert workshop to develop a practical framework for scaling SLM to help meet the UNCCD's objectives to achieve land degradation neutrality and sustainable land management (UNCCD, 2012, 2014).

2 | FRAMEWORKS FOR SCALING UP AND OUT FROM THE LITERATURE

Following Rogers' (2003) diffusion of innovations framework, there is a rich literature on the adoption and diffusion of innovations by farmers, which is pertinent to scaling SLM. Rogers' framework considers the characteristics of innovations that make them more or less adoptable, as well as the characteristics of farmers that make them more or less likely to adopt the innovations. In parallel with this, a broader literature has developed to explain barriers to the adoption of innovations that benefit the environment. Early frameworks focused on providing information about the negative impacts of current practices, assuming that increased awareness and understanding of the benefits of SLM would promote uptake (e.g., Burgess, Harrison, & Filius, 1998). More recently, it has been recognized that there is a range of factors that influence the adoption of innovations, which can be summarized as

1 External, contextual factors including demographic (e.g., age and gender), sociocultural (e.g., prevailing norms), economic (e.g., incentives or disincentives), and political and institutional factors (e.g., infrastructure to enable the adoption of SLM); and
2 Internal, individual factors including attitudes, values, and beliefs relating to the environment, personal capabilities (e.g., knowledge and skills, disabilities), resources (e.g., time and money), habits, emotional involvement with environmental problems, and a belief that it is possible to bring about change through an individual's action.

Taken together, these factors may be viewed as part of a nested hierarchy of at least three levels: relatively fast-changing microlevel factors (individuals, land users), slower changing mechanisms at the mesolevel (communities, local and regional authorities), and even slower changing macrolevel of policy and national and international arenas that usually cannot be influenced by individuals (Geels, 2002; Hermans et al., 2013).

To date, there has been limited application of this broader literature on technological transitions and diffusion to SLM. However, a number of operational frameworks have been developed by organizations working directly with land managers. Designed to facilitate scaling on the ground, these frameworks are informed more by experiential knowledge than academic theory, and yet they resonate with the theoretical literature in a number of ways. We discuss three of these frameworks below, which all strongly emphasize learning processes.

First, the International Fund for Agricultural Development (IFAD) scaling up framework is presented in Figure 1 showing the central role of learning in scaling up innovations (IFAD, 2015; Linn, Hartmann, Kharas, Kohl, & Massler, 2010). In this framework lessons from successful interventions, derived from monitoring and evaluation usually at a small or pilot scale, are used to scale through expansion, replication, and adaptation. The framework emphasizes the need for a scaling strategy from the beginning, identifying the extent of scaling in terms of the area and numbers of people to be targeted and the financial, policy, institutional, and cultural barriers to scaling that may need to be overcome. It suggests that the main drivers of scaling are sound intervention that has worked at a small scale; vision and leadership that recognizes the scope and feasibility of scaling and pulls other parties along; external factors that encourage scaling including donors, communities, and international agreements; and finally, incentives that reward practitioners for implementing land use changes.

Second, the Management Systems International (MSI) framework consists of three steps with 10 tasks (MSI, 2012): Step 1 involves creating a vision, assessing scalability, filling information gaps, and preparing a scaling plan; Step 2 involves establishing the preconditions for scaling, legitimizing change, building a constituency, and realigning and mobilizing the needed resources; and Step 3 involves implementing the scaling process, modifying organizational structures, coordinating action, tracking performance, and maintaining momentum (see Cooly, Ved, & Fehlenberg, 2012 for a manual of tools and techniques for practitioners). Figure 2 summarizes the issues involved in scaling indicating where the three overlapping steps are required. This framework is the most comprehensive in terms of outlining methodological steps; distinguishing between what is being scaled, that is, a technology, process, policy, or institutional arrangement; and the best scaling methods that are appropriate for the type of intervention proposed. The MSI identifies three types of scaling methods (for the expansion phase in Figure 2): (a) expansion, involving growth, restructuring or decentralization, franchising, and spin-offs, usually via an increase in the scope of operations of the organization that originally developed and piloted the innovation; (b) replication, involving policy adoption, diffusion, and spillover, usually done by others including the public sector and can involve chains of organizations such as nongovernmental organization (NGO)-to-NGO

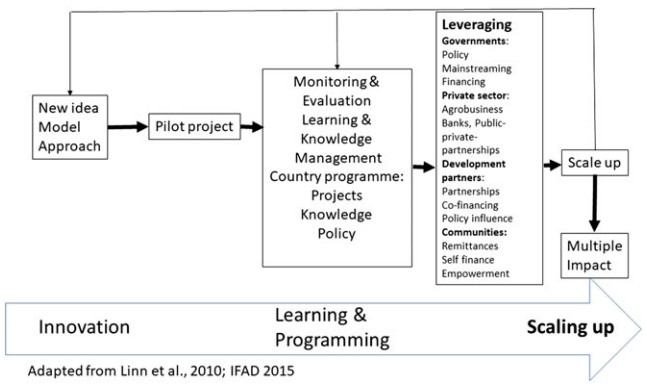

FIGURE 1 The International Fund for Agricultural Development framework for scaling. Adapted from Linn et al. (2010) and IFAD (2015) [Colour figure can be viewed at wileyonlinelibrary.com]

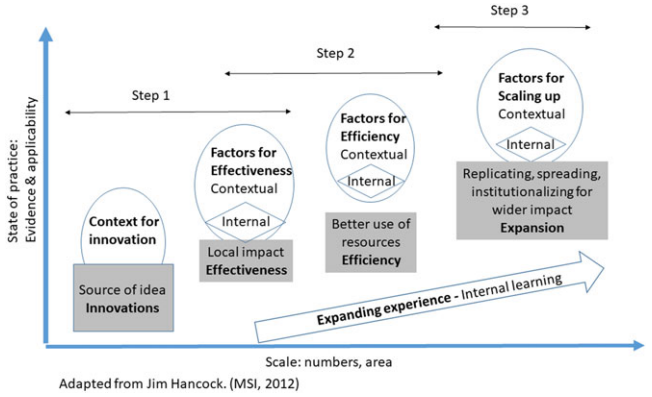

FIGURE 2 The issues involved in scaling. Adapted from MSI (2012) [Colour figure can be viewed at wileyonlinelibrary.com]

transfer; and (c) collaboration, involving formal partnerships, joint venture and strategic alliances, networks, and coalitions, for example, via public–private partnerships and formal and informal networks based on varying degrees of collaborative agreements ranging from memoranda of understandings to formal contractual obligations of each participating partner.

Third, the World Resources Institute (WRI) produced a framework that focuses on a pragmatic approach to forest and landscape restoration (Reij & Winterbottom, 2015). Six steps are involved that the authors state are not necessarily sequential: (a) identify and analyze successes; (b) work at grass roots level via farmer-to-farmer visits, peer-to-peer training, training of trainers, development of community-based institutions, and best practice competitions; (c) create enabling policies and legislation for scaling involving policymakers; (d) develop a communication strategy for increasing public awareness and successfully reaching target groups; (e) develop value chains of marketable products so that land users can capitalize on markets; and (f) develop research to fill gaps in knowledge about multiple impacts of interventions and costs or benefits. The first step was subsequently expanded by WRI through its application of the framework to climate change adaptation in India (Appadural et al., 2015), suggesting that identifying and analyzing success could consist of identifying good practice indicators, identifying readiness to scale (equivalent to "assessing scalability" of the MSI framework), and understanding scaling pathways (equivalent to MSI's scaling up methods) and conditions of scaling, such as resources, partnerships and networks, local contexts, and knowledge management (equivalent to Step 2 of the MSI framework on establishing the preconditions for scaling). In contrast to the MSI scaling methods, which focus on expansion, replication, and collaboration, WRI identify four scaling pathways that focus on who drives the processes: (a) centralized scaling (government); (b) multiactor driven, for example, government, NGOs, and farmers; (c) NGO driven; and (d) spontaneous scaling by individuals or informal practice.

A comparison of these three operational frameworks for scaling reveals that the IFAD framework focuses on processes of innovation, learning, and scaling and emphasizes the role of learning. The MSI framework provides more structured methodological guidance, emphasizing the need for collaborative approaches. The WRI framework focuses more on agency, emphasizing how scaling up and out can be driven differently by different actors. All three operational frameworks focus more on the characteristics of SLM innovations themselves and on the external factors than they do on internal individual factors such as values and beliefs (as described above). Despite these broad differences, and the order in which steps are presented, the three operational frameworks have much in common with each other and the literature. All three operational frameworks

- draw on diffusion theory and reflect the external, contextual factors identified elsewhere in the literature as being important in determining the adoption of innovations;
- identify a successful intervention, defining what is to be scaled, which is usually either a technology, a process, or organizational innovation;
- select a scaling method from the range available;
- develop a vision and assessment of the scalability of the intervention or innovation through a diagnosis that is inclusive of all actors and is interactive, multidisciplinary, and multisectoral;
- identify barriers or constraints to scaling and solutions to remove them, perhaps using a theory of change process that results in a favorable enabling environment;
- develop a communication and constituency building process for increasing public and stakeholder awareness; and
- track performance through a monitoring and evaluation process that also helps to quickly identify bottlenecks and to suggest course changes in the process and provide feedback for modifications, innovations, and so forth.

3 | BARRIERS AND SUCCESS FACTORS FOR SCALING

To explore barriers and success factors for scaling up and out, 30 experts in SLM from international agencies, NGOs, the Consultative Group for International Agricultural Research (CGIAR), and universities were invited to a professionally facilitated expert workshop in Jordan, on April 11–13, 2016, by the CGIAR Dryland Systems Research Program. The workshop identified key success and failure factors in scaling best SLM practices, lessons learned, and the barriers and incentives for scaling at the levels of farmers or communities, policy makers, and the private sector. Barriers to scaling SLM differ between contexts and over time. Identifying the main barriers or drivers in any particular context from an array of contributing factors is a key first step to avoid getting entangled in the seemingly endless complexity of socioecological systems. Campbell, Hagmann, Stroud, Thomas, and Wollenberg (2006) provide a guidance on how to simplify complexity through iterative learning processes, systems approaches, and organizational frameworks. In addition, scaling may be more challenging in particularly diverse or unique agroecosystems and sociocultural settings, where SLM technologies and approaches have to be significantly adapted to work in each setting. Key barriers to scaling SLM identified by workshop participants included a lack of

- technical options for the specific need and context considered and/or awareness of them by land users;

- adequate institutional human and financial resources for capacity building and extension services;
- finance at macrolevel and microlevel within public government budgets, local organizations, and individuals and aversion of private sector investments for smallholders;
- political will to address problems of mainly marginal areas; and
- awareness of innovative approaches to incentivize SLM such as payments for ecosystem services and insurances.

Additional barriers included

- conflict amongst actors over resources such as access to and availability of land and water;
- high investment risk for individuals and the private sector; and
- loss or turnover of individual "champions" that drive the interest and processes in specific situations.

Despite these contextual challenges, workshop participants identified eight critical success factors that should be incorporated into scaling up strategies. The rest of this section considers each of these factors in turn and considers how they can contribute to successful scaling of SLM in the widest possible range of international contexts. Table 1 illustrates the success factors in four selected case studies. Further case studies are presented in Figure S1.

3.1 | Plan iteratively

Workshop participants emphasized the need to incorporate scaling into projects from the outset. The majority of SLM research to date has been conducted at case study scales, ranging from villages to water basins and landscapes. Scaling is typically considered when SLM technologies and approaches have been demonstrated to work at local spatial scales. Much less research and practice has explicitly considered the design and adoption of SLM at national and international scales. Limited understanding of the ecological and sociocultural contexts that differ from the original contexts where options were developed makes it difficult to design scaling processes. However, without planning for scalability, opportunities to scale SLM may be missed (e.g., Campbell et al., 2006; Reed, 2016).

There are a number of approaches available to help plan for scaling SLM, for example, logical framework analysis (Hersoug, 1996), theory of change (Quinn, 1988), and impact planning (Reed, 2016). Each of these approaches attempts to link broad SLM scaling goals to specific objectives and key messages and activities that can be used to achieve these objectives. They also emphasize the identification of risks (and risk mitigation strategies) and use milestones and/or indicators to monitor progress towards goals. By identifying barriers to scaling SLM, these approaches seek to mitigate these risks and overcome barriers as part of the design process from the outset. Many of these approaches combine top-down approaches (e.g., via national and international policy processes such as UNCCD National Action Plans and Land Degradation Neutrality Plans to achieve the SDGs) with bottom-up approaches (e.g., via local stakeholder networks). Setting clear milestones that relate to scaling via a well-defined theory of change and impact pathway helps to bring divergent views and options together cementing a joint understanding and vision of the objectives of scaling.

3.2 | Consistently fund

The costs of restoring degraded land are estimated to be in the billions of US dollars: far greater than is available from public funds (Sewell, Bouma, & Esch, 2016). Scaling SLM requires consistent funding, and UNCCD has historically been the least funded of the Rio Conventions. To overcome this constraint, it may be necessary to consider alternative funding models. However, the approach to scaling will typically need to be adapted to the funding model, for example,

- payments for ecosystem services schemes may preferentially promote scaling of SLM technologies that deliver measurable improvements in climate change mitigation (carbon sequestration and capture), water quality, and biodiversity benefits. In privately financed schemes, scaling may prioritize locations or systems where benefits can be delivered most cost effectively, whereas public schemes may prioritize locations where the greatest public benefits can be derived, whether or not these are cost-effective in terms of ecosystem markets (Reed et al., 2017). Ideally, these different aims need to be brought together to develop a solid investment case for public–private partnerships in place-based schemes that are adapted to local needs and priorities (Reed et al., 2017);
- international donors each have different priorities, which will influence the selection of SLM technologies and approaches likely to be promoted in scaling;
- national development and land use planning can be a useful vehicle for scaling SLM, but depending on the policy framework, may be top-down or more bottom-up. Table 1 and Figure S1 provide an example of SLM being promoted via community development planning in Morocco, which combined both top-down and bottom-up approaches to scaling;
- corporate social responsibility (CSR) or shared value funds (Porter & Kramer, 2011) from multinational corporations may fund SLM scaling and, depending on the priorities of the company, may shape the scaling process in different ways. For example, for some companies that depend on agricultural commodities, CSR may focus on creating sustainable value chains, which may prioritize SLM options that provide clearly measurable environmental sustainability outcomes (Syngenta, 2016). Other companies measure CSR outcomes in the number of "lives changed" and may be more interested in SLM options that provide measurable social and economic sustainability outcomes; and
- derisking investments remains a concern for the private sector no matter what their objectives are (Cornell et al., 2016). Strategies to reducing risk for investors requires working with finance experts, for example, by combining both private and public funding (e.g., the sort of place-based scheme proposed by Reed et al., 2017).

3.3 | Select SLM options for scaling based on best available evidence

There are many types of evidence that may be used to select the most relevant SLM options for scaling. Workshop participants emphasized the importance of economic evidence to help convince both policy

TABLE 1 Matrix of success factors for scaling up in selected case studies

Key success factor	Case Study 1 "Programme Oasis Sud," Morocco	Case Study 2 Project Wadi Attir, Israel	Case Study 3 Western Rajasthan, India	Case Study 4 ALTAGRO project in Peruvian altiplano, Peru
1 and 2. Plan iteratively and consistently fund	Achieved financing of 46 district development plans from national budget. Budget increased from a US$3 million program to a cumulative budget of US $77 after 9 years	Donations and government support, growing income generation from agricultural, educational, and tourist activities	Limited to a research grant	Long-term research and development grant from several donors and a successful revolving fund
3. Select SLM options for scaling up and out, based on best available evidence	SLM practices selected and spread across 195,000 ha included the promotion of sustainable water management, erosion control, and sand dune fixation	Perennial plant cover with native and agroforestry trees, construction of catchments and terraces, and soil conservation practices	Drought proofing via tolerant varieties, soil and water conservation, integration of perennials, rain water harvesting, diversification, and inclusive value chains	Quinoa cropping, dairy farming, and trout farming and their value chains
4. Identify and engage with stakeholders at all relevant scales, recognizing and appealing to the motives of different groups	Includes wide variety of development actors and empowerment of women	Developed by the Sustainability Laboratory, Hura Municipal Council, the local community, and supported technically by university scientists	Recognition of household heterogeneity, creation of multistakeholder innovation platforms and village development committees	129 rural communities engaged
5. Build capacity for scaling up and out	Intercommunity collaboration is facilitated	Operation of a regional education center with training programs for all age groups	Capacity to self-organize through village development committees and innovation platforms	Training of 84 families in seven groups for tout farming as a new enterprise. Training of 1,175 and 563 families in quinoa cropping and dairy production, respectively
6. Lead: Foster institutional leadership and policy change to support scaling up and out	Facilitated community development plans	Involvement of national and local policy makers, academics, SMEs, and NGOs in planning and execution from the beginning of the project	Nurtured institutional mechanisms at village to regional level	Organized producer groups
7. Mobilize: Achieve early, tangible benefits and incentives for as many stakeholders as possible to engage in activities to scale up and out	11 urban municipalities and 45 rural districts reached	Creating income streams and employment in agriculture, educational activities, and tourism within 3 years		Availability of credit to switch practices was crucial
8. Reflect and communicate	Project needs a strategic socioeconomic vision	Wide ranging dissemination activities via site tours, web site (http://www.sustainabilitylabs.org/ecosystem-restoration), publications, and press releases	Participatory agroecosystem analysis facilitated cooperation and willingness to adopt SLM practices	

Note. SME: small-medium enterprises; SLM: sustainable land management.

makers and land managers to invest and redirect policy and practice towards financially viable SLM options. Economics can become a common language to help establish meaningful dialogues around land use issues. Establishing the economic value of land and the economic benefits of restoration and sustainable management can help position SLM as a competing priority with other development needs.[2]

However, while economics can be a powerful driver of decisions, the social and cultural dimensions of land use change should not be overlooked when introducing new SLM options (see next section). A range of nonmonetary valuation techniques have been developed to capture collective meanings and significance ascribed to natural environments. These techniques are often participatory and deliberative, in order to include multiple perspectives and dimensions of value (Kenter et al., 2015). Taking this more pluralistic approach to the benefits (or otherwise) of SLM recognizes that evidence is rarely clear-cut or uncontested. Rather, increasingly diverse knowledge claims need to be evaluated as part of decision-making processes (e.g., Crilly, Jashapara, & Ferlie, 2010; Sanderson, 2006).

When scaling, biophysical, socioeconomic, and institutional context becomes particularly important to ensure SLM technologies and restoration protocols are appropriate for the specific ecosystem or

[2]For a more detailed discussion of the economic aspects, we refer the reader to the publications from the Economics of Land Degradation (ELD, 2013, 2015a) Initiative and its webpages at www.eld-initiative.org. Although this work demonstrated the net benefits of SLM practices, there remains a need for detailed estimates of the costs SLM interventions.

landscape. Workshop participants pointed out that management and decision-making needs to interpret evidence in context. Land managers continuously adapt to changing conditions but need to be aware of new findings and evidence as it emerges.

Many SLM options can also improve the resilience of production systems and livelihoods to perturbations from markets, trade, and environmental changes such as climate change. For example, SLM options such as conservation tillage, soil, and water conservation measures can simultaneously increase adaptation and mitigation of climate change via so-called "climate smart agriculture" (Dinseh, 2016; FAO, 2017; Jat et al., 2016; Reed & Stringer, 2015). Hence, consideration of which SLM option to select should involve multiple objectives that can stabilize production under stressful conditions.

3.4 | Identify and engage with stakeholders at all relevant spatial and institutional scales, recognizing and appealing to the motives of different groups

Effective engagement of stakeholders across multiple spatial and institutional scales is critical for scaling SLM. Workshop participants described examples of SLM technologies and approaches that are not scalable because they do not translate into sustainable or profitable systems when applied in different biophysical contexts and scales. Scalability may also be limited if SLM technologies and approaches are not socially or culturally appropriate when applied beyond the context they were developed in. To overcome these challenges at local scales, SLM technologies and approaches are increasingly being codeveloped with land managers and other stakeholders, to ensure that they are acceptable and adapted to local needs. However, codesigning SLM at regional, national, and international scales is a significant logistical challenge, and there are few examples of SLM technologies and approaches that have been codesigned a priori with stakeholders at these scales, with scaling in mind (Liniger, Mekdaschi Studer, Hauert, & Gurtner, 2011). Instead, SLM technologies and approaches tend to be adapted ad hoc as they spread to new locations (cf. Rogers, 2003).

Workshop participants identified three steps to integrate stakeholder engagement into the scaling process. The first step is to systematically identify stakeholders in SLM from local to national and international scales, characterizing their relative influence and interest in SLM and identifying how any barriers to engagement may be overcome. This should include the identification of both winners and losers and those who can facilitate and block scaling (Reed et al., 2009). The second step is to engage at the highest possible levels with members of the policy community, from junior and senior civil servants to government ministers. Although rare, there are persuasive examples where SLM has been scaled via national policy processes that connect to local community engagement. For example, in Morocco, SLM was integrated into a national community development planning process, providing resources for community engagement at local levels while promoting SLM nationally (see Table 1 and Figure S1). Once stakeholders have been identified and engaged, the third step is to select and adapt appropriate SLM options for scaling, including the identification of extrapolation domains. Taking this approach, the emphasis of scaling shifts from geographical to social scales, targeting different technologies and approaches to different social groups, based on their needs, constraints and livelihood strategies.

3.5 | Build capacity for scaling

Scaling SLM practices requires capacity building across all scales from farmers, the corporate private sector to national and international policy makers. Once a decision is taken that an intervention indeed has potential for scaling, the limits or boundaries need to be defined, for example, at watershed, national, or international scale. Similarly, as scaling can take significant time (often more than 10 years) it is important that institutional capacity and incentives are built to maintain scaling beyond the tenure of any individual within an organization. As interventions are highly context dependent, disseminating the factors for successful scaling may be more important than a specific option thought to fit a particular context. For example, the CASCAPE project, supported by the Netherlands and part of its Agricultural Growth Program of Ethiopia, aims to strengthen the capacity of stakeholders to scale best practices for improving agricultural production (CASCAPE, 2015). Similarly, the WRI framework relies on capacity building at grass roots level (Reij & Winterbottom, 2015). Multi-institutional projects and programs are also a means to ensure capacity is built across the range of actors involved.

3.6 | Lead: Foster institutional leadership and policy change to support scaling

Workshop participants identified the need to engage a champion from one or more of the actor groups who can lead and link different interests. This may be an enthusiastic NGO leader, member of a farmer group, politician, financier, or a research team leader.

It is possible to work with champions to develop an influencing or engagement strategy with key stakeholders, working where necessary with influential intermediaries, to build momentum for changes in policy or practice. There is a rich literature on the role of opinion leaders in the diffusion of agricultural innovations, based on Rogers' (1976, 2003) work. Techniques such as social network analysis have been used to identify opinion leaders and predict the speed and pattern of diffusion of innovations (Valente, 1996). These methods have shown how the structure of an entire social network (e.g., the density of relationships, their cohesiveness, and interconnectivity) can influence decisions to adopt more sustainable land management options (Bodin & Crona, 2009).

3.7 | Mobilize: Achieve early, tangible benefits and incentives for as many stakeholders as possible to engage in activities to scale SLM

Scaling up and out processes can require sustained inputs from a range of stakeholders including land managers, NGOs, research and business communities, donor, and policy makers who can facilitate or hinder attempts to go to scale. Therefore, to both mobilize and retain stakeholder engagement, it is necessary to provide tangible, early benefits that generate meaningful value for those involved (Campbell et al., 2006; Reed, 2016). In addition to incentivizing the process of scaling SLM, it is important to identify disincentives or perverse

incentives that may slow the pace at which SLM may be scaled and lead to disengagement from stakeholders. Examples of factors that may delay stakeholders from benefiting from scaling include policy targets or carbon markets that promote long-term afforestation of agricultural land and tax breaks and market stimuli that promote unsustainable intensification of agricultural systems. It can be difficult to predict or control these factors, so to retain stakeholder engagement, it is important to avoid raising false expectations of the degree and speed with which benefits may accrue and to constantly manage expectations during the process of scaling.

3.8 | Monitor, evaluate, and communicate

Finally, it is essential to learn from success and failure alike, to develop best practices in scaling SLM. To do this, it is necessary to monitor progress towards SLM targets and evaluate the impacts of SLM against measures of sustainability, including sustainable livelihoods. The UNCCD's first scientific conference proposed a knowledge management framework for SLM that involved participatory development of indicators (Reed et al., 2011), and SLM indicators have been proposed to monitor progress towards the SDGs (UNCCD, 2015). Such approaches do more than simply provide a measure of progress. They facilitate learning between different stakeholder groups across scales, and if designed and implemented in collaboration with stakeholders, they can enable continuous learning to improve SLM practice and ensure more effective scaling. Where good practice is identified, this needs to be communicated globally to build expertise in scaling across different contexts. Such communication needs to be strategic and targeted, tailoring messages to different stakeholders who can play different roles in the process of scaling.

4 | INCENTIVES FOR SCALING

Building on the barriers and success factors in the previous section, expert workshop participants considered incentives for scaling. Some land degradation can be considered to be a result of the lack of incentives for better land stewardship, epitomized by the concepts behind the “tragedy of the commons” (Hardin, 1968). The transaction costs to design and implement SLM are often inhibitory and are often considered high risk for resource-poor smallholders and the private sector in particular. However, as practices are adopted and spread, there may be an inverse relationship between scaling and risk (Cornell et al., 2016). As SLM practices move beyond first adopters and scaling increases, risks to individual land users may decrease as a result of, for example, sharing costly machinery. Furthermore, the enabling environment in terms of access to land and markets, financial credit, extension services, and input supplies is often limiting to rural communities.

Incentives aimed at scaling SLM need to be designed based on a thorough assessment of stakeholder needs, their local or traditional knowledge, and a critical appraisal of existing incentives and their impacts, both negative (perverse) and positive (enabling). Often incentives are not harmonized to encourage multiple benefits to individuals and society and are sometimes conflicting (e.g., agricultural subsidies that encourage an over production through intensification but that result in greater environmental damage from land degradation and fertilizer contamination of waters). For SLM, which often requires long-term implementation periods to realize benefits, there is a particular challenge to align incentives for short-term private and local benefits, often within one growing season, with long-term public benefits.

4.1 | Private sector incentives

With few exceptions, the private sector and especially large multinational agricultural conglomerates, have yet to exploit the provision of input supplies, technologies, market chains, and other products and services for SLM on smallholder farms. This neglects the fact that the small holder farming sector produces much of the world's food, for example, 70%–80% in Asia and Africa (International Assessment of Agricultural Knowledge, Science and Technology for Development [IAASTD], 2009; IFAD, 2011) and will need to feed growing populations. Reasons for this include lack of financing, inhibitory laws and regulations, weak distribution channels, and insufficient labor (Kohl, Hegde, & Karamchandani, 2014). Opportunities have been identified for private sector involvement via new technology services and payment schemes. These include much more accurate location analyses such as road infrastructure, cellular phone coverage, internet presence, distances to banks or finance, availability of electricity, and the presence or absence of market barriers. New geographic information systems and spatial analyses can now be used to easily generate maps of populations, markets, and risks that can help target SLM practices.

Advances in the private sector development of new information and communication technology such as advanced soil and water sensors and monitoring equipment will allow farmers to monitor soils and crops more accurately, build on farmers' abilities to use resources efficiently, and monitor animal health. These technologies are likely to be central to farmers of the future including smallholders and should appeal to young farmers who already use mobile devices. Thus, not only efficiencies can be improved but also social benefits through increased interest in farming and business development in rural and peri-urban environments along with increased financial benefits (Deloitte Review, 2016).

The private sector can target existing retailers rather than smallholders directly and thereby improve their distribution channels and can access information held predominantly by the public sector given incentives. A particular target could be retailers who not only sell products but who can also offer advisory services that governments are unable to offer. Thus, coupled packages of products and advice from retailers could provide greater growth opportunities especially in areas where digital and advisory capacities are poor. Care would need to be taken to ensure that options are offered and not one particular commercial product. Here, hubs of new economic activities in small to medium-size towns (Hesse, Anderson, Coutla, Skinner, & Toulmin, 2013; INTELI, 2011) may offer the required scales to attract the private sector and create jobs in the agricultural and service sectors. The provision of information, better management, and productivity can be expected to result in trust and repeat customers.

Innovative payment methods will also help attract the private sector. Here awareness, advantage, affordability, and access to payment methods have been identified as key determinants for adoption and

scaling (Tam et al., 2014). The retail sector has worked to develop payment schemes designed for cash-poor consumers who may not have access to banks. These include mobile money, escrow services, small loans and mobile vouchers (Martin, Harihareswara, Diebod, Kodali, & Averch, 2016), for example, AntFinancial. Alifinance has developed a scoring model in China based on online activity for 16 million small microenterprise vendors showing the scope of such schemes (Hanouch & Kumar, 2013). Much can be learned from the general retail sector and how to apply this to small holder farmers and the promotion of SLM.

Private sector flexibility in the timing of sales can greatly help smallholders via sales of input vouchers for seeds, fertilizers, and so forth when farmers have available cash and can receive products when needed as this can significantly increase use and productivity (Carter, Laajaj, & Yang, 2013). Mobile banking will help better use of the vast amounts of remittances from abroad avoiding high interest rates on international transfer by other means.

Retailers, smallholders, and entrepreneurs can help by becoming involved in multiple services via cloud sourcing and e-commerce on weather forecasts, insurances, crop purchasing prices in different markets, soil maps, recommended crops, and varieties for their locations, water availability, interactive mobile applications and videos on crop, pest and disease management, and so forth. Dissemination of farmer practices can now be promoted by the farmers themselves through activities such as Digital Green participatory videos (Gandhi, Veeraraghavan, Toyama, & Ramprasad, 2007), thereby creating greater demand for farm products.

To realize these opportunities, the private sector needs incentives and cofinancing for large scale public–private partnerships. In particular, there needs to be a focus on derisking investments in land-based projects via, for example, guarantees from the public sector if projects fail or tax allowances for investing in restoration projects (Cornell et al., 2016). These future opportunities will require innovative partnerships, greater collaboration, and connectivity amongst stakeholders together with technological innovations along agricultural value chains. These value chains are increasingly being viewed as closed-loop chains rather than the traditional linear chains from production, manufacture, distribution, retail, consumer, and disposal (World Economic Forum, 2010). As profit margins are generally narrow in agriculture, there is increased interest from the private sector in scaling that can stimulate such partnerships, reduce risk, and increase profits. With driving influences from major NGOs for greater engagements of the private sector with small holders, the conditions for opportunities to sustainably produce food while taking good stewardship of the land via innovative partnerships appear promising (Oxfam, 2010).

4.2 | Incentives for farmers and their communities

Farmers often improve conventional "transfer of technology" practices and the efficiency of their operations using natural processes and beneficial on-farm interactions such as nutrient recycling thereby reducing their costs for inputs for example (Pretty, 1995). However, the number of farmers that achieve these benefits are generally small as such changes are not without costs for labor, inputs such as agrochemicals and machinery, and so forth. Engaging with innovative farmers is probably one of the quickest ways to spread innovations. Factors that determine whether or not a farmer can and is willing to innovate include their age and experience, strong personalities, if they are relatively rich, previously exposed to innovation, generally are full-time farmers and involved in integrated farm systems (Reij & Waters-Bayer, 2001). Incentives to encourage such farmers should be designed that enable these innovators to flourish. As part of a general strategy to engage stakeholders (e.g., Economics of Land Degradation [ELD], 2015b; Reed, 2016), there are a number of processes that can encourage innovation and testing of interventions. Farmer field schools (FAO, 2015b) and farmer competitions, for example, bring prestige and can strengthen cultural identities enabling greater knowledge exchange and learning. Alongside this, it is important to avoid the capture of benefits by elites and differentials in power relations, and these need to be handled in transparent ways to ensure trust and commitment. Farmers can be involved in scaling SLM practices by self-organizing into groups and interacting more with public and private sectors.

Resource-poor farmers in particular are unlikely to switch land management practices if there are no rapid returns to their investments usually within one growing season. Any introduced SLM option must add value or make farming easier to be attractive and adopted. For example, options that increase labor requirements without support to hire labor is unlikely to be adopted. Governments need to provide and/or improve on basic services including infrastructure, health, and education to improve the enabling environment for SLM. Incentives for farmers that governments can establish include removal of perverse incentives such as fuel subsidies that encourage unsustainable practices such as excessive tillage (ELD, 2015a).

4.3 | Incentives for policy makers to promote scaling

Policy makers require solutions to the major challenges that their constituents face and that they can be associated with in terms of a legacy of current actions and how the environment would look like with implemented SLM practices. Policy makers will likely respond more readily to evidence that the implementation and scaling of SLM practices will contribute to today's burning agendas such as unemployment, migration from drylands of Africa and West Asia into Europe, food security in fragile states, assurance of future capacities of natural resources to provide goods, and services for society and the private sector. Equally important is evidence that the neglect of the land will result in increasing scarcities of food, water, and employment. Evidence, data, and information expressed in terms of the indicators that are required for SDGs, national development, and action plans and associated reporting for, for example, UN conventions, is likely to receive greater attention than data on areas of land degraded or tons of soil lost by erosion.

Sound business cases are required for the implementation of SLM practices and the multiple benefits obtainable in terms of job creation, income generation, improved productivity, and the provision of other ecosystem services such as opportunities for ecotourism and the retention of cultural identity and customs related to their natural environment. The business case needs to be built on the economic value of the land and benefits of SLM and what is lost when land is degraded or goes out of productive use (ELD, 2015a). SLM needs to

be presented in the context of the multiple sectors that both benefit and lose from good or bad land management, for example, agriculture, environment, water, and energy.

5 | A NEW FRAMEWORK FOR SCALING SLM OPTIONS

Here, we combine common insights and steps from the frameworks in Section 2 with information on barriers, success factors, and incentives for scaling up and out from the expert workshop in Sections 3 and 4 to propose a new framework for scaling SLM. Figure 3 synthesizes the most important steps from each of the previously discussed operational frameworks with additional insights from theory and practice that have the capacity to facilitate more effective scaling. The new framework builds on, and is adapted from, the framework for monitoring and evaluating SLM options that arose from the UNCCD's First Scientific Conference (Reed et al., 2011) and other large multi-institutional projects that offer decision-making tools and guidelines such as DESIRE (Schwilch, Hessel, & Verzandvoort, 2012), FAO (2015a), and FAO-LADA (Liniger et al., 2011). The proposed framework includes new aspects of funding and roles of the private sector adding to the work of previous efforts to be useful across scales from the field, local to national scales, and incorporating multiple knowledge sources for policy makers and land users. Hence, it is considered a more comprehensive framework for use to understand and design scaling procedures.

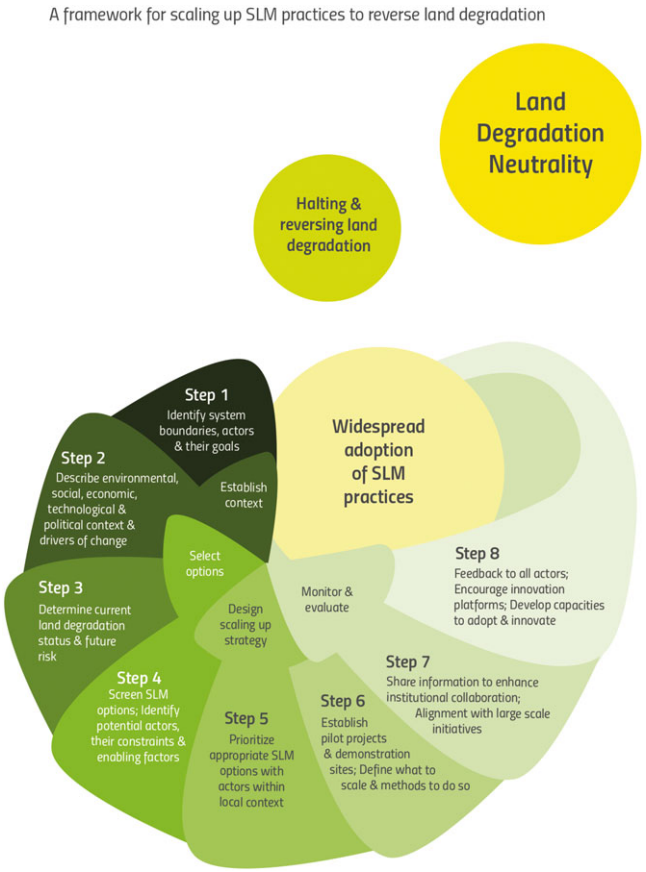

FIGURE 3 A new framework for scaling sustainable land management (SLM) options [Colour figure can be viewed at wileyonlinelibrary.com]

The extrapolation domains of scaling need to be determined at the outset setting the boundaries as either biophysical or administrative (Step 1, Figure 3). Similarly, an inclusive process is required for all stakeholders or actors that have an influence on how land is used. Through the identified actors, a thorough diagnosis of the cultural, social, economic, technological, political, and environmental context and the main drivers of change can be identified (Step 2). Using the indicators proposed by the UNCCD and others (UNCCD, 2015; United Nations University [UNU], 2011), the baseline state of land degradation needs to be defined (Step 3). This is followed by a screening of potential SLM options from various perspectives including improvements in crop or biomass productivity, economic cost or benefits, social and cultural acceptance, the identification of potential adopters, their constraints, and prerequisite conditions as described in the list of features common to frameworks for scaling at the end of Section 2 (Step 4). Step 5 represents a parallel process that ensures that the potential SLM options fit to the context and constraints of the adopters, particularly in relation to the factors identified at the end of Section 2. Next on the ground trials of prioritized options are established through pilot and demonstration sites (Step 6) with a clear idea on what is being scaled (a technology, process or organizational component, or a combination of these). Assuming that the interventions have already a sound base of success or not, a dissemination strategy (Step 7) begins in parallel to Step 6. The four inner sections of Figure 3 represent overlapping activities of some steps. These include establishing the context, selecting options, designing the scaling strategy, and monitoring and evaluation (Reed et al., 2011).

Whether or not there is a sound basis for success depends on the range of evidence that exists. In practice, "evidence" can range from an innovation with minimal objective evidence, a promising practice with anecdotal reports, a technical, process, or institutional component that has positive evidence in a few cases, good practice with clear evidence from several cases, best practice with evidence of impact from multiple contexts (including through meta-analyses and systematic reviews), and finally, a policy principle that has been proven in practice (MSI, 2012). In addition to such evidence, the promotion of an innovation or intervention may also rely on what is referred to as "knowledge politics" that transform sometimes relatively weak evidence into persuasive narratives to gain both political and financial support, often driven by "champions of the cause" (Grundmann, 2007). This is part of the communication and constituency building for public awareness. Whitfield et al. (2015) provide a good example of this with respect to the SLM practice of conservation agriculture and caution that critical reflection is needed when "bandwagons" are created that drive the promotion of interventions. Here, science has a major role to play in understanding under what contexts (biophysical, socioeconomic, cultural, political, financial, etc.) a particular SLM option is likely to be adopted and scaled. Such an analysis can achieve better results and avoid disappointments often associated when development projects run their course with the lack of follow up resulting in the discontinuation of interventions that are meant to be self-sustaining.

The roles of interacting and interconnected agencies assume increasing importance in this regard (Step 7) emphasizing where roles can be allocated and/or shared amongst the participating

actors (farmers, NGOs extension agencies, government agencies, private sector, donors, and research organizations). Such interactions however are needed from Steps 4–7. Step 7 is particularly relevant to address so-called "wicked problems" such as land degradation that require a broad network of agencies including research institutes, government and nongovernment organizations, civil society organizations, and the private sector. These agencies play different roles from promoting the intervention or innovation to acting as brokers that bring agencies together and form networks, change institutional arrangements, and help raise the resources required (see Hermans et al., 2013 and references therein for further discussion on roles and functions of these agents). The dissemination strategy should ensure alignment with larger scale initiatives such as the UNCCD National Action Programmes. Missing often in programs and projects to introduce SLM options are adequate processes of monitoring and evaluation that give feedback to all actors, that encourage more innovation platforms or other arrangements, and that allow space for changes and introductions of new or alternative options into the framework (Step 8). The role that multistakeholder mechanisms play and their increasing importance in achieving scaling is well recognized in this framework. The advantage of multistakeholder arrangements is that they can be vehicles for further adaptation and innovation that move beyond a simple scaling up and out of a particular intervention. Further discussions are available from Wigboldus and Leeuwis (2013).

6 | CONCLUSION

This paper reviews the state of the art with respect to scaling successful SLM practices drawing on information from the literature and the practical experience from a range of experts in the field. Incentives to scale SLM options are proposed that benefit land users, the private sector, and policy makers. Lessons from the retail sector should be further researched and tested for use in promoting SLM practices. In particular, there is a need to research how to develop effective public–private partnerships for scaling SLM drawing on bankers, finance, and insurance professionals that are generally outside the realm of land management. Another challenge is how to use monitoring and evaluation feedbacks more effectively to ensure a flexible, iterative approach to achieving SLM.

SLM practices need to be followed in terms of how they adapt to dynamic changes both environmental, such as climate change, and to social benefits that influence decision making on scaling SLM.

Land users, researchers, extension agents and policy makers can use the new comprehensive framework as a guide to the achievement of scaling of SLM options that are necessary to obtain a land degradation neutral world. Scaling requires coordinated planning and multistakeholder engagement across scales and sectors. Each separate SLM practice or intervention needs to be linked with the efforts and framework being promoted to achieve land degradation neutrality at local up to national-scale. Linkages or nodes that bring the different levels together are key to successful scaling via knowledge exchange and learning processes. Often the promoter of a technology requires another actor to foster collaboration between the different agencies and networks, acting as knowledge brokers or champions.

The guiding framework developed here is based on an eight-step iterative process that will complement work being done by the UNCCD to achieve land degradation neutrality under the SDGs (UNCCD, 2016b). The framework provides guidance to those seeking to achieve SLM at local to international scales by systematically understanding the biophysical and socioeconomic contexts in which there is evidence that specific SLM interventions can be scaled so that SLM options can be screened and adapted to these contexts, piloted and disseminated.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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