Journal of Environmental Management 286 (2021) 112251

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: http://www.elsevier.com/locate/jenvman

Research article

Perceptions from non-governmental actors on forest and landscape restoration, challenges and strategies for successful implementation across Asia, Africa and Latin America

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ARTICLE INFO

Keywords:
FLR
Governance
Finance
Challenges
Strategies

ABSTRACT

Forest and Landscape Restoration (FLR) has been defined as a planned process that aims to regain ecological functionality and enhance human well-being in degraded landscapes. Several governments and organizations worldwide rose to the challenge of halting degradation and restoring landscapes. Commitments are ambitious, thus a synthesis of current experiences with and strategies for implementation is important to inform future actions. To guide successful implementation, the Global Partnership on FLR put forward six principles, namely, the conservation and enhancement of ecosystems at landscape scales, the restoration of multiple functions, the engagement of multiple stakeholders, with allowances for context dependency and adaptive management. Non-governmental organizations, acting globally, regionally and (or) at national and local scales, play a fundamental role in supporting governments fulfill their commitments. Therefore, we gathered the perceptions of actors within non-governmental organizations engaged in FLR across countries in Asia, Africa and Latin America about what FLR is and their perceived challenges and strategies for implementation. We employed the six principles of FLR to organize and evaluate the responses. Results show that the principles of landscape scale, ecosystem conservation and enhancement, and multi stakeholder engagement are all considered by interviewees as core components of an FLR program. Yet several restoration projects shared by interviewees still required further evidence of a landscape vision, and the integration of actors beyond local communities and the environmental government sectors. Context dependency was evident in the clear incorporation of local natural resource governance norms, such as tribal and community management in project structure, yet few projects appeared to be designed by local actors. The principle of "adaptive management" was mostly missing from the responses, perhaps because most projects had not had sufficient time to learn from intervention outcomes. Key financial challenges for FLR implementation were the short duration and availability of funding, high-up front costs and few short-term returns. To overcome these challenges, promising strategies relate to the development of tangible economic returns for local actors engaged in productive restorative actions that are planned alongside conservation and ecological restoration actions in the landscape. The challenges of negotiating actions with a multitude of actors and the lack of supportive policies highlighted in the interviews require organizations to focus efforts on leveraging the enactment and enforcement of legislations that look beyond jurisdictional boundaries and support landscape management with clear, long term incentive mechanisms and cross-sectoral collaboration. In addition, implementation can be further supported with the scientifically robust sharing of results on how different FLR projects move forward in meeting the social and environmental objectives of a successful, integrative restoration of degraded landscapes.

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https://doi.org/10.1016/j.jenvman.2021.112251
Received 25 August 2020; Received in revised form 11 February 2021; Accepted 19 February 2021
Available online 4 March 2021

1. Introduction

Forest and Landscape Restoration (FLR), defined as "a planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded landscapes'' (WWF. and IUCN., 2000) is a key land intervention for achieving various Sustainable Development Goals, such as poverty reduction, climate change mitigation, and water and biodiversity conservation (IUCN, 2019). Globally, countries have to date pledged to restore around 210 million hectares of degraded lands (www.bonnchallenge.org, accessed 02 of December, 2020) by 2030, in response to the Bonn Challenge target of 350 million hectares. Further impetus for restoration is given by the "United Nations Decade on Ecosystem Restoration (2021–2030)" (Pistorius and Freiberg, 2014). These goals remain ambitious, and progress on implementation has been limited (Dave et al., 2019). It is therefore important to evaluate the current understanding of FLR implementation among practitioners, and consider the main challenges and implementation strategies for success in continued and future restoration.

FLR aims to incorporate ecological, social and economic considerations while recovering multiple functions in a landscape (Sabogal et al., 2015; Brancalion and Chazdon, 2017). To guide the implementation and evaluation of such multidimensional FLR programmes, the International Union for the Conservation of Nature (IUCN) and the Global Partnership on FLR (https://www.forestlandscaperestoration.org/) published a series of principles summarized in Table 1. These principles imply the need to deploy a family of forest restorative actions, from silviculture to ecological restoration, across the landscape (Guariguata and Brancalion, 2014; Aronson et al., 2017; Chazdon and Brancalion, 2019). Operationalizing FLR in a way that increases synergies and minimizes trade-offs among actions across the landscape is, however, challenging, especially given a wide range of stakeholder interests in landscapes (Brancalion and Chazdon, 2017; Temperton et al., 2019). FLR interventions have, for example, been interpreted as the planting of extensive monocultures of fast growing, exotic species solely for the purpose of carbon sequestration (Lewis et al., 2019; Heilmayr et al., 2020). Such actions would miss the opportunity that lies in managing whole landscapes for multiple benefits, including both productive and conservation outcomes.

Recent academic syntheses highlight governance, capacity, and funding challenges for implementation of integrated landscape restoration (Brand, 2018; Mansourian et al., 2018, 2020; Höhl et al., 2020; Stanturf et al., 2020). The large scale and long-term nature of landscape restoration interventions require the "buy-in" of local actors, which in turn depends on their engagement in restoration planning and implementation. Practitioners directly engaged in implementing restoration projects have direct experience with such issues, and learning from their experiences will complement academic evaluations of how FLR might be successfully implemented in the future.

In the present study we used semi-structured interviews to gather and analyse the perceptions on FLR of non-governmental actors engaged in planning and implementing FLR in countries across Asia, Africa, and Latin America. We sought to answer two overarching questions: (1) How do non-governmental actors engaged in FLR planning and implementation perceive FLR? (2) What are the main barriers to implementation, and what strategies are used to overcome them? We use the six principles of FLR (Table 1) as evaluation criteria. We hypothesise that not all principles would be considered equally by actors, nor equally operationalized in FLR projects. We expect that this might be due to the prevalence of top-down governance of natural resource management, or lack of funding hampering large scale implementation.

We focused on non-governmental actors as these play a key role in supporting governments to move from pledges into action, and also because they span local to global scales. We focused on countries in Africa, Asia, and Latin America, where the large majority of Bonn Challenge pledges have been made. We focused on forest restoration at landscape scales, as forests lie at the core of global climate politics and policies (Arts and Buizer, 2009; Buizer et al., 2014; Pistorius and Freiberg, 2014; Temperton et al., 2019).

Table 1
Core principles of Forest and Landscape Restoration (Modified from IUCN https://www.iucn.org/theme/forests/our-work/forest-landscape-restoration, accessed 20 March 2020).

Principles	Detail
Focus on landscapes	-Different actions are planned across the landscape.
Conserve and enhance ecosystems	-Conserve existing forests and increase forested and non-forested ecosystems in the landscape, which should be managed sustainably
Restore for multiple functions and multiple needs	-Mix a variety of productive and ecological restoration interventions that can enhance livelihoods alongside biodiversity.
Multi stakeholder engagement	-Engage stakeholders across local, national and global scales in the planning, implementation and monitoring of restorative actions.
Context dependency	-FLR interventions are adapted to the social, economic, ecological and cultural realities of each landscape.
Manage adaptively	-Integrate the information from medium- and long-term monitoring to improve the management of the restored landscapes, minimize uncertainty about trade-offs, and adapt to changes in the biophysical and social environment.

2. Methodology

We used a snowball sampling approach to select interviewees. We began interviewing our contacts within organizations that belong to the Global Partnership for FLR (GPFLR) and are active in the planning and implementation of FLR projects in countries in Asia, Africa and Latin America. These interviewees then indicated other potential interviewees, within or outside their organization. In addition, we reached out to existing contacts from previous studies (Schweizer et al., 2019a, 2019b) and conducted on-line searches for contacts within existing FLR initiatives. We focused our interviews towards restoration practitioners, and when we interviewed researchers we ensure they were engaged with non-governmental organizations on FLR implementation. Everyone contacted agreed to participate in the study. The research methodology was approved by the Ethics Commission of ETH Zurich under approval number EK 2019-N-89. All interviewees mentioned in this paper gave their permission to be identified by their name.

We conducted semi-structured interviews using leading questions (Table 2). The questions were open-ended to give freedom to interviewees to share information, and allow for two-way communication (Lamarque et al., 2011). Most interviewees shared a specific perspective from either a single project or country, while key interviewees from headquarter offices shared regional or global perspectives. We categorised project-specific information according to: region, country, specific landscape, objectives, project leader, partners, area impacted, history of degradation, restoration method, land tenure, and achieved or expected results. We excluded three interviews that did not provide a clear indication of their perceptions on FLR.

Interviews were recorded and transcribed using the MAXQDA

Table 2
Leading questions for interview.

Themes	Questions
Overview	At what scales have you conducted restoration projects? What were (are) the main objectives and methods of your projects? Was (is) your organization working alone or in collaboration? With whom? What does Forest and Landscape Restoration mean for you/your organization?
Challenges	What challenges do you perceive for implementing FLR?
Strategies	What strategies do you use or see for FLR implementation?

qualitative analysis software (VERBI Software—Consult—Sozialforschung GmbH, Berlin, Germany). We coded the interviews according to pre-defined key themes (Table 3) arranged in two thematic categories. The "overview" category included interview segments where respondents talked about FLR, either from a theoretical or project-based perspective. The "challenges and strategies" category contained segments where respondents spoke about these two topics. These segments were organized based on themes recurrently mentioned in environmental discourses (Adger et al., 2001), namely, finance, governance and capacity building. We used lexical search to code segments of the interviews where the themes were mentioned. Coding allows the reduction of large amount of interview transcripts into manageable, organized, focused data (Alexander et al., 2013). We extracted the coded segments from the interviews to excel tables that formed the basis of the qualitative analysis. We used percent coded segments to systematically analyse interview responses based on how often interviewees referred to the themes highlighted in Table 3. We included verbatim quotes in the results section that illustrate a pattern emerging from the interviews (Corden and Sainsbury, 2006).

We were limited in our ability to conduct a statistically representative sample of the practitioners' communities due to the geographical breadth of our study, with interviewees from Asia, Africa and Latin America, as well as a few being active at regional and global scales. Instead, we chose to conduct a qualitative analysis of the interview data. Our sample does, however, represent the perceptions of staff who work for some of the main global organizations pushing forward the implementation of Bonn Challenge commitments, as such, their responses exemplify overarching visions, challenges and strategies undertaken across countries. In addition, the wide variety of contexts encompassed by our study allowed us to draw from both generalities and particularities on FLR to reflect on core aspects required for the successful implementation of FLR alongside its six principles across countries.

3. Results

We interviewed 46 actors, mainly project managers and program directors, within non-governmental organizations (Table S2). Interviewees work in 23 different countries across Latin America, Africa and Asia (Fig. 1 and Table S2). Some interviewees shared specific project information which we summarized in Table S3.

3.1. Perceptions on forest and landscape restoration

The results of the interviews were organized based on the six FLR principles, used as evaluation criteria of the perceptions of respondents on what FLR is in comparison to other, site-specific, ecosystem restoration projects conducted by them.

3.1.1. Landscape focus principle

Over 70% of interviewees mentioned a focus on landscapes as part of FLR (Fig. 2) and referred to FLR as an integrated landscape management approach. These interviewees considered FLR to be a process of recovery of the ecological functionality in the landscape for environmental and socioeconomic benefits. The following quote illustrates this: "*FLR for us is about a holistic model that delivers inspirational, social, natural and financial returns, within a landscape zoning approach…*" (Ferwerda, W., Commonland Global).

Some respondents shared how their projects explicitly implement a landscape approach. For example, the WWF-led projects in Tanzania, Brazil and in the Nepalese Terai Arcs landscape aim at reconnecting forest fragments in the landscape via corridors that include productive agroforestry systems alongside restored forests. With a similar corridor approach, projects led by CIPAV and Instituto Sinchi in Colombia and Condesan in Ecuador aim at connecting forest fragments through the productive and environmental restoration of private farms. A coalition of organizations, that include the Nature Conservancy, in Vale do Paraiba, Brazil, aim at increasing multifunctionality across the landscape supporting land use transitions from cattle farming to agroforestry (Table S3). Other projects, like Bukit Python Orangutan habitat project from WWF in Malaysia, traditionally focused on specific protected areas, expect to implement a landscape approach through engaging with other non governmental organizations thus expanding actions beyond the protected area.

3.1.2. Conservation and enhancement of ecosystems principle

Over 80% of respondents considered the main objective of FLR to be the conservation and/or enhancement of forest ecosystems (Fig. 2). The

Table 3
Key themes coded in the interviews.

	Themes	Codes
Overview	FLR principles	Landscape focus, conservation, productivity, multifunctionality, multi-stakeholder, context, adaptive management
	Drivers of restoration	Biodiversity, climate, international commitments, water, legislation
	Restoration method	Silviculture, agroforestry, natural regeneration, planting
	Project partners	Communities, government, NGOs, rural landowners, investors
Challenges and strategies	Finances, governance and capacity building,	Specific codes appear in Table S1

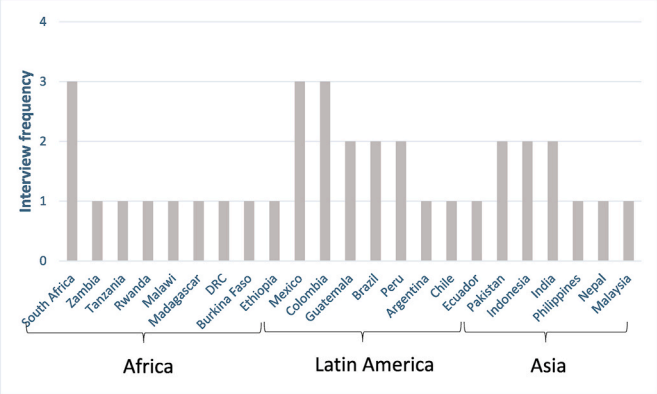

Fig. 1. Countries and World Regions where respondents work (The map in Fig. S 1 highlights the approximate location and title of projects shared by some interviewees). **Note:** Eleven respondents that work at regional or global level, such as those in the headquarters of organizations (Table S2), do not appear in this graph.

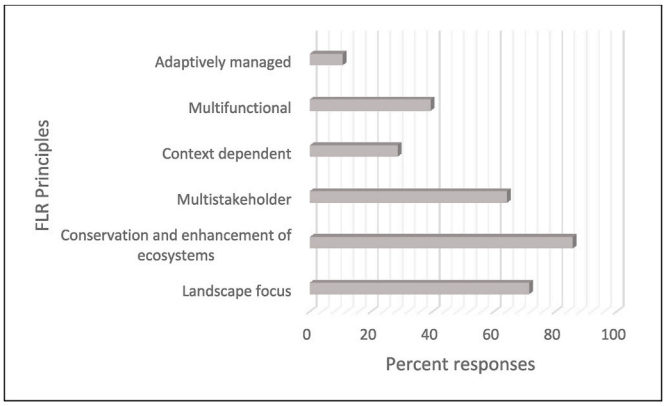

Fig. 2. Proportion in which the various FLR principles were mentioned by interview respondents.

emphasis on conservation versus ecosystem enhancement varied depending on the mission of the organization leading the project. For example, staff from WWF offices in Indonesia and the DRC conducted productive restorative actions, such as agroforestry, in the buffer areas around National Parks as side projects to reach their primary goal of biodiversity conservation inside the park. On the other hand, respondents from international organizations like FAO placed more emphasis on ecosystem enhancement for livelihood improvement: "*FLR is linked to food and agriculture …but also looking at the main aspect of addressing land degradation with a focus on agroforestry*…" (Joseph, A., FAO Rwanda).

3.1.3. Multifunctionality principle

Linked to the principle above, around 39% percent of people interviewed perceive FLR as a multifunctional, holistic landscape management process to recover both ecological integrity and economic productivity (Fig. 2). Nestor Gregorio, a researcher working on FLR in the Philippines, stated that their project can be considered FLR because "*it is systemic and looks at improving the sustainability of existing land uses*". Bari Faizul from the "Restoration Initiative (TRI) Programme" from FAO, Pakistan, states that the differentiating aspect of the FLR programme they currently conduct is that "… *is not only talking about the trees, but also talks about agriculture and livestock systems in a particular catchment…*" (Faizul, B., FAO Pakistan).

Interviewees mentioned the use of mixed restorative actions to achieve multiple project outcomes in FLR, both social, economic and environmental (Fig. 3), with tree planting and agroforestry being the most common methods mentioned (Fig. S2). WWF Madagascar, for example, planted fast-growing *Eucalyptus* trees across areas of the landscape to provide short term income to the communities until the benefits from other longer-term restoration actions are realised. The WWF project in Tanzania sought to create "Village Forest Reserves" to support not only tree planting but also butterfly farming and ecotourism for communities.

3.1.4. Multi-stakeholder engagement principle

The importance of including multiple stakeholders in projects was mentioned by 64% of interview responses (Fig. 2). In addition, interviewees mentioned the need to reach out to partners they do not normally engage with. As the following quotes show: *"If we want to have a wider impact, we need a wider perspective for the wider landscape… We defined work with the government, with the private sector, the palm oil concessions and the agriculture holders…*" (Simon, O., WWF Indonesia).

Commonly mentioned partners included private landowners, governments, local NGOs and communities (Fig. S3). Conservation organizations sometimes partner with more socially oriented NGOs to create microfinancing projects to support the livelihood dimension of their projects. However, private firms were not often mentioned. One clear example of integrating corporations into restoration came from the interview by Stafford Louise from The Nature Conservancy, South Africa, who referred to engaging private sector actors, such as Coca Cola, interested in the conservation of water for their operations. Companies were engaged through the implementation of a "Water Fund" to conduct watershed forest restoration.

3.1.5. Context dependency principle

Twenty-eight percent of responses showed that projects adapt to local contexts. In African countries including Burkina Faso, DRC, Malawi, and Zambia, emphasis was placed on arrangements and negotiations with tribal leaders for project success, and on traditional cultural and social laws, even if these changed the restoration objectives. For example, the success of fencing for natural regeneration in Burkina Faso was negatively affected by land and tree tribal tenure rules, which forbids migrants from owning trees on land given to them by the tribal chief, and the lack of decision-making power given to women, who currently tend to stay on and care for the land while the men go to the cities to work.

Respondents from India, Pakistan, Nepal and the Philippines mentioned the importance of embedding restoration actions within the pre-established norms and arrangements of community managed forests. Differences and complexities in land tenure regimes across countries and regions means that restoration interventions often take place mainly on private lands (42%), especially in Latin American countries, as opposed to community owned lands (23%), which was more prevalent in Asia and Africa. These differences affect the type of actors and organizations most commonly engaged in projects.

3.1.6. Adaptive management principle

The inclusion of adaptive management strategies in restoration projects was explicitly mentioned in around 10% of the responses and appeared, explicitly, in less than 20% of the projects shared. Some respondents explained how they had adapted their objectives to social, environmental, political and economic changes, and even scale, with increased focus on larger landscapes. For example, Ananta Bhandari from WWF Nepal stated that WWF, which has been working in the Terai Arcs landscape for over 10 years, had adapted its approaches to the transition of governance from a centralized to a federal system. When projects end, as in the case of projects shared by interviewees from WWF Madagascar and Tanzania, the hope is that the training provided to communities plus the embedding of restorative actions as part of local management plans can ensure a continuation of adaptive management.

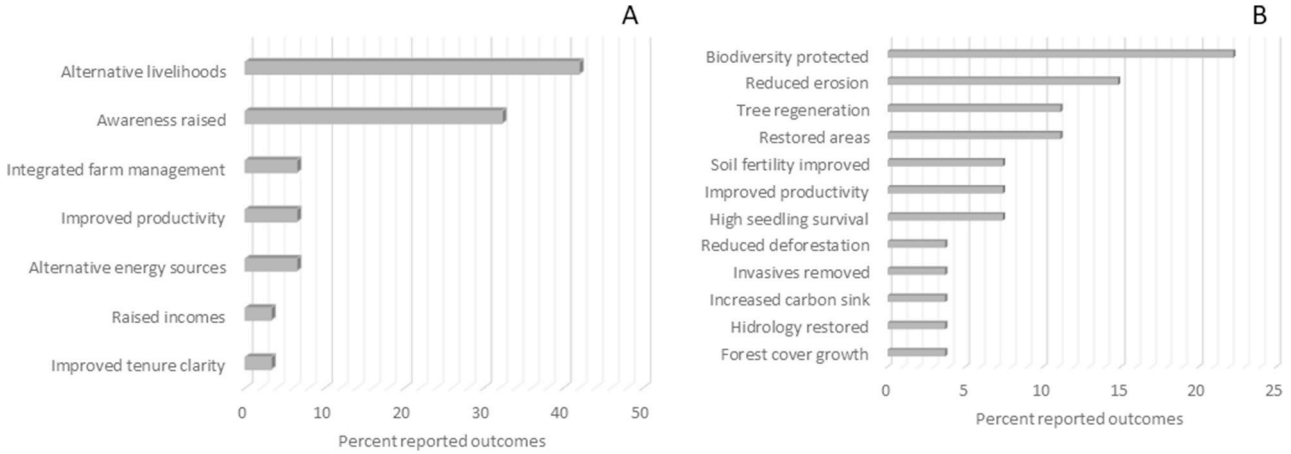

Fig. 3. Stated social (A) and environmental (B) outcomes from FLR projects shared by interviewees.

3.2. Challenges and strategies to implement forest and landscape restoration

Below we describe the challenges and strategies perceived by actors implementing FLR under the lenses of the six theoretical principles shown in Table 1 and highlighted in the text below.

3.2.1. Financial

The availability and sustainability of funding are clearly challenges for implementing FLR (70% coded segments) (Table 4). Interviewees mentioned that projects led by NGOs tend to be short to medium term, which, "*may be enough for setting a protected area but not for the sustainable transformation and the **adaptive management** of a degraded landscape*" (Alexandre, N., Conservation International). Interviewees referred frequently to the need of sustained funding to support governance platforms and **engage all actors** in the landscape.

Scaling-up site projects to the **landscape** scale was considered to depend on engaging private investors, either companies or private investors. As such, non-governmental organizations are trying to insert restorative actions within the productive activities of the targeted landscape or else to develop a market for products or services coming from the restorative actions (37% coded segments) (Table 4). However, 20% of interviewees mentioned the challenge of demonstrating financial returns sufficient to attract investors, who generally perceive projects as too high risk. For example, Marina Campos from The Nature Conservancy in Brazil shared the challenges faced in consolidating a restoration economy based on native fruit and timber species, due to the high upfront costs incurred by farmers who wish to convert their land uses, and who have little to no access to credit.

An example of including restoration in the productive activities of farmers came from the work of the CIPAV on silvopastoral systems in Colombia. The project showed cattle ranchers how planting trees and improving plot management through animal rotation improved the productivity of the farm by 44% thus freeing marginal areas to do ecological restoration.

Initiative 20 × 20 in Latin America is developing a pre-investment facility to provide resources to prepare projects for investment: "*The central idea is that If there is a good project that is not ready for investment, Initiative 20x20 partners can help to prepare it and present it to the investor, if the investor takes it then he needs to pay for those preparation costs*" (Zamora, R., WRI Latin America).

Finally, there was a perception among several interviewees that large multilateral funders such as the Global Environmental Facility (GEF) placed land restoration as a priority area of investment, thereby creating the perception of large funding opportunities for FLR.

Table 4
Summary of main challenges and related strategies for FLR implementation as indicated by the interviewees and corroborated by project reports when available.

Theme	Challenges	Strategies
Financial	Availability and sustainability of funding	Creation of trust funds, like water funds, availability of large funds (e.g. GEF), public-private partnerships
	Financial returns and high risk	Build a restoration economy
	High upfront costs	Finance upfront costs, facilitate access to credit
	Land opportunity costs	Create a restoration economy
Socio cultural	Change traditional land uses	Awareness raising and capacity building
	Need for fast returns	Integrate fast and slow growing species and embed restoration within farm productivity
	Lack of awareness	Awareness raising and capacity building
	Unwillingness to restore	Relate restoration to water provision and productive actions
Governance	Actor articulation	Community engagement and governance platforms
	Institutional coordination	Development of multistakeholder platforms
	Land tenure	Improved land registration systems
	Lack of policies for restoration	Global commitments as levers to create policies
	Conflicting policy mandates	National restoration plans as roadmaps for the harmonizing of policies
	Poor enforcement and corruption	Increase political will and transparency mechanisms
Capacity	Lack of capacities in governments, local NGOs, local communities and private sector actors	Capacity building on restorative practices, and more sustainable land use alternatives
		Improve extension services and FLR facilitators
Other	Spatial and temporal scale	Integrate restoration to land production. Search/lobby for longer funding options. Embed FLR in government land management plans
	Lack of maintenance and monitoring	Improve project planning and adaptive management*

3.2.2. Socio-cultural norms

The second most commonly mentioned challenge related to socio-cultural aspects that limit the **engagement of actors** in the landscape. Interviewees often expressed the difficulties communities and individuals face in changing their traditional ways of using the land: *"Coming back to cattle ranching, we are talking around 50 years of economic development around cattle, with veterinaries, meat processing, and all."* (Pacheco, M., WWF Colombia). In the establishment of Water Funds, Louise Stafford from TNC in South Africa mentioned there is certain unwillingness among people to pay into a water fund that will restore the watershed when they already pay for water.

Awareness raising activities, in the form of workshops, capacity trainings or by using pilot areas that show the benefits of forest restorative actions were identified by interviewees as important strategies to overcome socio-cultural challenges for engagement. The effects of climate change in certain regions were perceived as a potential opportunity to raise awareness of the importance of restoration efforts. As the following quote clearly states: "… *In Latin America there are millions of hectares of low productivity cattle ranching, and producers are facing a marked reduction in the rentability of their production system due to climate change, so the same crisis is an opportunity*" (Calle, Z., CIPAV Colombia).

3.2.3. Governance

Interviewees highlighted difficulties with **engaging actors, fostering effective cross sectorial collaboration and institutional coordination** to work on a common, sustainable vision of the landscape. As the following quote illustrates: *"Even at the village level they need to bring together the households in a landscape to have a similar standing when restoring the landscape… we lack the tools, the methods or the logistics to do this"* (Makungwa, S., IUFRO Malawi).

Trees and land tenure insecurity were mentioned by several interviewees as affecting the engagement in restoration. Barbara Vinceti, from Bioversity International, talking about a natural regeneration project in Burkina Faso mentioned that access rights to trees and land are handled separately in some contexts. Some farmers who do not hold customary right to the land usually are concerned about having trees in their agriculture plots because they compete with crops and they do not perceive them as theirs but as belonging to the customary owner of the land. Similarly, in Brazil, Marina Campos from TNC faces the challenge that some rural landowners still perceive that, if they plant native species for timber, the government may not allow to cut them later.

The establishment of community managed arrangements, mainly in the Asian region, was commonly mentioned as a governance strategy for FLR. As the following quote illustrates: "… *we are very strong at*

community based natural resource management, the engagement of communities is an opportunity to work with." (Bhandari, A., WWF Nepal). Similarly, multi-stakeholder platforms such as "The Mesa de la Restauración" in Guatemala and the "Pacto Coalition for the Restoration of the Atlantic Forest", gather actors, governmental, non governmental and private, to harmonize efforts and funds around national or regional restoration plans.

Legislation issues related to either a lack of policies to foster restoration, to the presence of policies that incentivize deforestation or to the lack of enforcement were mentioned as governance challenges in around 40% of the interviews. Illegal activities such as deforestation for timber, cattle ranching, or agriculture, were commonly mentioned, and were related to the perception that governments are not fully committed to forest protection and FLR. Dr. Cristian Echeverria from Chile stated that sometimes there are strong interests against restoration: *"Now they (the government) are working on a restoration and climate change law…and there are people lobbying that monoculture plantations of exotic species be included as forests to capture carbon."* (Echeverria, C., Universidad de la Concepcion, Chile).

Despite existing legislation challenges, interviewees identified several political and legislative opportunities for FLR. Global commitments were perceived as common grounds to communicate and engage with governments. Interviewees mentioned several countries have National Restoration Plans, interpreted as roadmaps to implement restoration actions. In addition to the national restoration plans, countries such as Guatemala have public incentive programs that finance diverse restorative interventions.

3.2.4. Capacity

Capacity issues related to individuals lacking the knowledge to implement restorative actions and sustainably use their land, but also to capacity issues within organizations that affect the implementation of interventions were mentioned in the interviews. As the following quote illustrates: *"Many of our staff are trained biologists, and are good at restoring sites…But when we think about integrative restoration approaches where we have to think about socioecological and financial aspects then it becomes more challenging"* (Alexander, N., Conservation International). Technical capacity challenges that related to lack of knowledge on the genetics of seed selection, on forestry aspects of native timber species, or to aspects of seedling species selection were also mentioned.

To overcome these challenges, capacity building was commonly perceived as a fundamental aspect for the sustainability of project outcomes. Projects shared included building capacities in bee keeping, seedling production and planting, regenerative agriculture, and butterfly farming (Table S3). FLR training also needs to focus on the social processes and interactions among stakeholders. To this end, IUFRO leads a training program of FLR facilitators within countries "…. *people are needed who understand the FLR concept promoted at the global level… but who are able to translate this into the local context ….and mainly play the role of brining stakeholders together*" (Kleine, M., IUFRO Headquarters).

4. Discussion

This study provides a pantropical overview and synthesis of perceptions about the concept of FLR, its planning and implementation, the challenges faced and the strategies employed analysed using the six principles of FLR as evaluation criteria. As hypothesized not all principles were equally considered by the interviewees when talking about and implementing FLR. Nonetheless, the challenges and barriers of implementing an FLR project considered by interviewees touched, directly or indirectly, upon the different principles.

The multiple dimensions implied in FLR are adequately captured in the principles, which should be used as evaluation criteria in FLR project planning and monitoring as they provide a roadmap to ensure that social and environmental aspects, their synergies and trade-offs are considered and evaluated in projects. The fact that not all principles are equally considered by interviewees suggests where focus needs to be placed to improve multi-dimensionality in current and future FLR. We elaborate below on our findings, aiming to inform FLR implementation globally.

4.1. Perceptions on the concept of forest and landscape restoration

Most respondents highlighted that the key difference between FLR and former site-specific restoration projects is an increasing emphasis on whole **landscapes**, where people live and grow their food. This implies a need to deploy multiple conservation- and production-oriented actions, that range from ecological restoration to regenerative agriculture in restoration projects. As stated in the literature, successful FLR requires an integrated landscape management approach (Sabogal et al., 2015). Yet, it was not clear from most projects as to the extent to which restoration in interventions had actually followed a landscape planning approach. The projects we investigated encompassed hundreds to thousands of hectares (Table S3), but only a few of them explicitly promoted interventions, such as corridors, relevant to landscape scale processes. There is clearly more scope for the consideration of landscape scale patterns and processes in many FLR projects.

The principle of **multifunctionality** was illustrated by the multiple objectives of projects shared by the interviewees. The employment of a variety of interventions across an area align with the mosaic nature of FLR expressed by Holl (2017), and can contribute to the delivery of landscape multifunctionality. Some projects shared by interviewees sought to improve landscape productivity and livelihoods through regenerative agriculture, silvopastoral systems or agroforestry, coupled with the ecological restoration of marginal agriculture areas for environmental protection. Other projects focused more on environmental and biodiversity goals, biodiversity conservation being a key component of the **conservation and enhancement of ecosystems** principle, and of resilient ecosystems (Webb et al., 2017). It is important, however, to develop frameworks to monitor and resolve trade-offs among these different restorative objectives, as a production oriented restorative actions, such as silvicultural systems of non-native species may achieve low native species restoration, yet improve local livelihoods and vice versa an ecological restoration intervention may achieve high biodiversity but provide little products to the local economy. Important is to note that integrative landscape planning allows accommodating different actions to maximize synergies and minimize trade-offs (Stanturf et al., 2019).

At the core of FLR implementation must lie the fact that landscape scale restoration goes beyond one simple restorative action (i.e., ecological restoration) and aims for the sustainable management of entire landscapes, including multiple uses and stakeholder types. This should embrace both conservation and production-oriented restoration interventions in a way that is participatory and, so far as is possible, negotiates trade-offs among potential interventions (Aronson et al., 2017; Mansourian et al., 2020). Most landscapes in need of restoration are a mosaic of different uses, and as such require the balancing of productive and conservation oriented restorative practices, for example the planting of non-native species to meet fuelwood needs (Stanturf et al., 2019). Projects share use fast growing exotic species, such as Eucalyptus and Teak, but usually to provide income for landowners while waiting on the slower return from the timber of native species. Many common metrics of restoration success, such as number and survival of trees planted, fail to address whether multiple landscape processes and patterns, as relevant to different landscape actors, are being considered (Stürck and Verburg, 2017). More data and research in this regard is fundamental to support further FLR implementation.

We did not encounter projects using monoculture plantations as restoration actions. Such approaches respond largely to single project objectives, such as carbon sequestration or improved income generation. They are not favoured by those who advocate multi-functional forest and landscape restoration, on account of the limited range of benefits and the potential disbenefits in terms of biodiversity and,

arguably, long-term carbon sequestration (i.e. Chazdon and Brancalion 2019). Seddon et al. (2019) caution that a strictly trees focused approach can lead to the afforestation of natural grassland ecosystems, thus causing more harm than good.

Multistakeholder engagement is a core aspect of FLR. Interviewees generally perceived that FLR requires cross-sectorial collaboration, especially between productive and environmental sectors. In the case of projects that prioritised conservation, a shift to landscape scales was reflected by a continued focus on biodiversity in protected areas, with a broader inclusion of a variety of stakeholders in buffer areas. This aspect has been highlighted several times in the literature as key for successful FLR implementation (Mansourian, 2016, 2017; Stanturf et al., 2017). IUFRO's guide to FLR implementation emphasizes careful and negotiated planning of the different restorative actions across a landscape (Stanturf et al., 2017).

The creation of partnerships and alliances was perceived as a fundamental component of FLR. The work of WWF Nepal on the Terai Arc Landscape involves working closely with the government and alongside communities to advance their objective of connecting forest patches. Our interviewee from the organization Commonland emphasizes their long-term social capital development program that includes the co-creation of a landscape plan with the landscape actors. However, top-down projects with weak participatory processes are still common. In Colombia, top down approaches are perceived to challenge the sustainability and knowledge sharing potential of restoration projects (Murcia et al., 2016). For the creation of a corridor in the East Usambara mountains, the government of Tanzania evicted people from the land in exchange for compensation, which caused inevitable tensions that challenged and still challenge the sustainability of the corridor (Miller, 2013).

Projects were clearly **context dependent**. Projects in many African landscapes, where communal or tribal ruling is still prevalent, were shaped by those tribal rules, whereas in countries with strong private land tenure regimes, such as Brazil, project implementation was focused on private properties.

Most respondents did not specifically mention **adaptive management** when discussing FLR. Adaptive management in FLR implies learning lessons stemming from implementation so as to reduce the likelihood of trade-offs and of not meeting multiple objectives set forth. We found evidence of this principle in projects that have been present in landscapes for 10 years or more, such as the Terai Arc project in Nepal which has gone through different phases linked to changes in legislations and governmental configurations. Key to longer term success and flexibility is the integration of locally supported and implementable monitoring systems.

4.2. FLR challenges and strategies

Financial. Responses by most actors highlight that non-governmental organizations are still limited by short-to medium-term project cycles. In traditional ecological restoration projects, when the funded project ends and is not endorsed by the regional and national governments, the restored forests are under the risk of being degraded again, as has been documented in the case of Costa Rica (Reid et al., 2018). As such, the involvement of the public sector in the form of, for example, incentives, credit lines and public-private partnerships can help to increase the time frame of restorative projects, overcome the initial costs and perceived risks of restoration oriented investments (Chazdon et al., 2017). Global ccommitments, however, are not yet supported by sound financial mechanisms from governments in most countries assessed. To date, only 2% of climate related finance funds (around 2 billion USD) goes to forests as natural climate solutions. Some countries spend over 100 times as much as this on agricultural commodities (i.e. Brazil) (Veldman et al., 2015). This must change to be able to scale up the restoration of habitats and ecosystems at **landscape** scales.

The development of business cases for FLR and the embedding of restorative practices in the local landscape economy also appeared as strategies to overcome those challenges. A recent article highlights private investment as fundamental for scaling up restoration actions (Löfqvist and Ghazoul, 2019) with the development of hybrid financial tools, being those that mix payment for ecosystem services with productive restoration, as interesting strategies to achieve the sustained restoration of a landscape (Holl, 2017). Although several respondents echoed the need to involve private investors, others expressed concern that pressure from donors for bankable projects might undermine the environmental and social objectives by focusing too much on short term gains. Nonetheless, if the **landscape** is managed as a whole, then sustainable, productive actions on the main agriculture areas of the landscape can coexist alongside conservation actions in the marginal areas (Latawiec et al., 2015).

The general understanding from respondents was that if certain restored areas in the landscape provide income for the local economy this will increase the likelihood of **stakeholder engagement**, and thus of permanence of both the restored productive areas and areas restored for biodiversity. We found that interventions closely tied to increasing the income of the landscape actors were perceived to be successful at achieving the desired social and ecological outcomes. Some productive restoration efforts still face challenges to connect products with markets and finance the initial costs. Respondents emphasize that private investors still perceive great investment risks and high up-front costs for setting restorative interventions with slow returns, including native tree silviculture, that are not covered by traditional lending structures. To overcome this, some organizations, including WRI in Latin America, are planning to establish funding schemes that can prepare projects for investors by covering some of the risks embedded in the launch of new investments.

Opportunities signalled by interviewees for increased and longer-term funding such as current climate change related funding lines and the creation of water funds are interesting avenues that can complement productive restorative options by guaranteeing long term funding and sustainability of FLR without relying on a business case. Attention must be placed at planning the restoration so that it may withstand changes in climate and in socio-political configurations, this may be achieved by incorporating species resilient to expected changes in climate and creating a restorative economy, for example through mixing native and non-native species silvicultural systems alongside conservation areas in the landscape (Stanturf, 2015; Stanturf et al., 2019).

Capacity building and awareness raising were mentioned as strategies to achieve **multistakeholder engagement** and overcome sociocultural constraints. For example, landowners in the Brazilian Atlantic Forest have struggle to understand the potential economic benefits of forest restoration as they interpret restoration as a non-productive land use (Schweizer et al., 2019b). This emphasizes that FLR practitioners perceive the restoration process as being more of a social and political process than a technical project (Metcalf et al., 2015; Schweizer et al., 2019b).

Socio-cultural and governance challenges need to be embedded in restorative interventions. Interviewees mentioned the importance of embedding restoration within the cultural and political norms that exist in an area. FLR should use both top-down and bottom up approaches (Holl, 2017) to consider the perspectives of multiple actors and to recognise differences in power, resources, authority and social norms that affect how actors benefit (or not) from restoration (Metcalf et al., 2015). Although implementing **multistakeholder governance** is complex, we found projects from Nepal, the Philippines, Pakistan and India that successfully work through existing community governance structures. The Living Lands organization working with Commonland in South Africa initially co-developed a vision of the restored landscape with local actors, which contributed to the acceptance of the project in the context of the future vision these actors had for their land. These findings underscore the importance of devoting time to building the

necessary social capital for FLR before implementing tree planting or other restorative interventions (Prante et al., 2007).

Despite successes achieved, interviewees shared a series of remaining **governance challenges** related mainly to poor legislation enforcement and lack of political will. Corruption, presence of conflicting policies, and lack of policy enforcement were commonly mentioned across the interviews. The Terai Arc Landscape project faces challenges due to poor intersectoral government coordination, and corruption issues, especially as the main priorities of local governments are on infrastructure development. Pakistan's Billion Tree Tsunami has had implementation difficulties due to corruption, poor extension services, and intersectoral conflicts, as mentioned by our interviewees. Our interviewee from WWF Indonesia expressed that poor law enforcement by local governments, often under pressure from the oil palm sector, results in insufficient resources being allocated for monitoring of peatland restoration.

Inclusive governance platforms that promote engagement and transparency and allow for multi-stakeholder collaboration are needed. The Pacto for the Atlantic Forest in Brazil, and the Mesa de Restauracion in Guatemala, were mentioned as successful examples of such platforms. In both cases, collaborative planning and monitoring allowed a better evaluation of progress which in turn attracted funding and political will for further implementation. The Pacto is a coalition of private and public actors that, under the umbrella of the Brazilian Native Vegetation legislation, engage in the restoration of riparian and marginal agriculture areas of Atlantic Forest vegetation (Brancalion et al., 2013). This coalition met the restoration benchmark of 700 000 ha of native vegetation recovered between 2011 and 2015 (Crouzeilles et al., 2019). The Mesa de Restauración is a government led programme that organizes private and non-profit restoration around the National Restoration Plan so as to harmonize actions and avoid resource waste (Sales et al., 2016). Governance arrangements such as these should be scaled up and replicated across landscapes, countries and regions.

5. Conclusions

Results indicate that in FLR planning, implementation, and management non-governmental organizations do consider several principles of successful FLR, though further monitoring is needed to inform on the success of projects in response to each of the principles. If restorative actions are embedded within a landscape perspective that takes account of multiple land forms, actors, and benefits, then trade-offs among actions and outcomes can be more readily identified and resolved. Doing so will greatly enhance the acceptability of restoration actions across the landscape.

Our results indicate the importance of local and practical knowledge among the community of practitioners for the implementation of restoration, especially pertaining to financial, legislative, governance and capacity challenges. The UN Decade on Ecosystem Restoration sets the stage for renewed momentum on ecosystem restoration at scale. Our study, drawing on the experience of restoration practitioners from projects across the globe, has emphasised that FLR is more of a social and political project than a technical one. Specifically, we conclude that strategies fundamental to scaling-up FLR include:

- Long-term engagement of multiple actors: i.e., rural landowners, private investors, government sectors, research institutions and non governmental organizations. FLR implementation demands the concerted work of a wide variety of actors from a spectrum of knowledge systems (from scientists to tribal leaders).
- Sustainable resource flows for the implementation and permanence of restorative interventions in the form of hybrid finance tools that mix conservation incentives, such as payments for ecosystem services, with income generated from productive restoration actions, such as agroforests, silvicultural or silvopastoral systems.
- Enabling and enforced legislation mechanisms that promote integrated landscape management.

The success of FLR should not be measured by the number of hectares restored, but on the basis of the recovery of landscape functional processes, the provision of multiple benefits for nature and humans, and the acceptability of actions and outcomes across the diversity of stakeholders in the landscape. Achieving this will require shifts towards more inclusive and equitable governance, recognition of the diversity of stakeholder interests and norms, and more creative financing systems that recognise ecosystem and natural capital values.

Credit author statement

Schweizer Daniella, Ghazoul Jaboury: Conceptualization; Schweizer Daniella: Methodology;Schweizer Daniella: Data curation; Schweizer Daniella: Writing- Original draft preparation; Ghazoul Jaboury, van-Kuijk Marijke: Supervision; Schweizer Daniella, Ghazoul Jaboury, van-Kuijk Marijke: Writing- Reviewing and Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to specially thank all of those who accepted the invitation to be interviewed for this research sharing their knowledge and expertise. We would also like to thank the Prince Bernard Chair for International Nature Conservation at Utrecht University and the Chair of Ecosystem Management at ETH for funding this research.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvman.2021.112251.

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