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Review

From addressing symptoms to tackling the illness: Reversing forest loss and degradation

Stephanie Mansourian[a,b,*], John Parrotta[c,d]

[a] University of Geneva, Geneva, Switzerland
[b] Mansourian.org, Gingins, Switzerland
[c] US Forest Service, Washington DC, USA
[d] IUFRO, Vienna, Austria

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ABSTRACT

Our planet is changing rapidly, with large scale forest loss and degradation occurring. Forest restoration has taken place in the last century, generally with a limited focus on a handful of benefits. Efforts to scale up forest restoration, while meeting multiple benefits, have been expanded recently, notably through global targets and massive government commitments towards forest landscape restoration (FLR). Yet while much political will has been generated for FLR, action on the ground remains limited. We propose six types of integration that can help truly scale up FLR efforts, namely: 1. across spatial scales, 2. across timescales, 3. across-sectors, 4. across governance systems, 5. between social and ecological systems, and 6. between Traditional and Western knowledge systems. While in different contexts, one or the other of these types of integration may play a predominant role, the additive effect of these six types of integration strengthens effective FLR implementation.

1. Introduction

Our planet's forests are being lost, degraded and replaced with trees that often do not fulfil the spectrum of vital functions that intact or natural forests can provide (Watson et al., 2018). Reversing these trends will require both addressing the underlying drivers that contribute to this change (the 'illness') and actively increasing valuable tree cover (the 'remedy'). Tackling agricultural expansion, infrastructure development, mining and urbanization is essential to reverse forest loss and degradation (Melo et al., 2013; IPBES, 2018). Forest restoration (used here as a generic term for returning trees to previously forested landscapes - i.e. recognising that other ecosystems such as grasslands may predominate in many landscapes - hereon termed 'restoration' for short) can not only reverse these trends but also contribute to mitigating climate change, reducing biodiversity loss, improving soil and water quality, among others, thus generating multiple values (IPBES, 2018). Restoration can be achieved through a variety of approaches, frequently associated with an equally diverse range of names such as rehabilitation, reclamation, ecosystem repair, or forest landscape restoration (Mansourian, 2018). Options include the passive or active management of natural regeneration, establishment of single- or mixed-species' planted forests using indigenous or exotic tree species, or agroforestry systems (Lamb et al., 2005). Questions remain on what determines the best approaches, where and how forest restoration can be applied in different contexts. Lessons from past restoration measures may be helpful (Melo et al., 2013; Carmenta and Vira, 2018).

Some 'restoration' efforts since the middle of the 20th century have focused on vast expanses of single species of exotic trees (Lamb et al., 2005). These were lauded as a solution to timber security and were seen as easily manageable, yet, they failed to provide many social and ecological benefits increasingly expected of forests (Watson et al., 2018). Other efforts to recreate original or 'reference' ecosystems, were necessarily small scale and often failed to consider human expectations from the forest and landscape (Melo et al., 2013; Murcia et al., 2016). These extreme examples have taught us that approaches with limited objectives are unlikely to succeed in the long run and/or at larger scale.

Restoration efforts have not been without their political, social and economic challenges. Power struggles and exclusions have plagued many large-scale forest restoration interventions. Dispossessions in the name of restoration projects, have led many to associate restoration with the loss of control over land (Kanowski et al., 2011; Larson et al., 2013; Rai et al., 2018). Narrow sectoral interventions have exposed contradictions between political sectors that often jeopardize the sustainability of restoration (Suding et al., 2015; Carmenta and Vira, 2018). Despite decades of different activities under the umbrella of restoration, our planet continues to lose forests and overall, the

* Corresponding author at: University of Geneva, Geneva, Switzerland.
E-mail address: stephanie@mansourian.org (S. Mansourian).

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condition of forests continues to worsen.

Faced with this reality, the German government and IUCN launched in 2011 the Bonn Challenge on Forest Landscape Restoration, an attempt to raise the profile of forest landscape restoration (FLR) as a proposed solution to the state of our forest landscapes (Aronson and Alexander, 2013). The original definition of FLR agreed by experts convened by WWF and IUCN in 2000 is that it is a "planned process that aims to regain ecological integrity and enhance human wellbeing in deforested or degraded landscapes" (WWF and IUCN, 2000). In the last 19 years, FLR has been defined in many different ways (e.g. Lamb et al., 2012; Sabogal et al., 2015), but fundamentally, all definitions agree on the long-term nature of FLR, its scale, and its dual dimension, both ecological and social. To date, close to 50 governments have committed to restoring over 170 million ha, but in most cases, a detailed and viable plan of how to meet these commitments is lacking.

Intended to harmonize ecological and human objectives at large spatial scales, the FLR approach builds on a diversity of existing tools. What differentiates it from other restoration approaches is the attempt to plan within a larger scale, and to ensure that the return of trees within that landscape is optimized in such a way that it can provide multiple ecological and social benefits across space and time (Mansourian and Parrotta, 2018).

In practice, while good intentions abound, there are still several obstacles that appear to limit implementation of FLR nearly 20 years after it was first defined. These include cross-sectoral conflicts for example between agricultural subsidies and restoration efforts, or time lags between political manifestos and the time to re-create a viable forest. At multiple levels, the lack of integration may represent key obstacles to successful FLR.

In an attempt to provide guidance to FLR practitioners on ways to approach integration in FLR, we brought together 33 scientists from different disciplines to explore related fields of practice for integration lessons applicable to FLR. The results have been published in a book (Mansourian and Parrotta, 2018) which provides specific lessons from frameworks related to land use that could be of use to FLR: social-ecological systems (SES), landscape approaches, cross-sectoral approaches, polycentric governance, land sparing/land sharing, and agroecological systems. These frameworks were selected because of their relevance to current research on land use and their relevance to FLR. Extrapolating from the findings from this book, we present here six specific areas of integration that we feel FLR practitioners and policymakers should include in the design, planning and implementation of FLR.

2. Multiple integrations

Integration is interpreted as a means to bridge and fuse specific subjects (adapted from Tress et al., 2005). Our analysis of the review of related literature suggests that policymakers and practitioners interested in FLR should consider at least the six areas of integration presented below for successful FLR implementation (Fig. 1). That does not mean to say that all will be relevant to all landscapes, or carry equal weight in different contexts, nor are we suggesting that these are the only challenges, but they should at least all be taken into consideration as they may otherwise constitute an obstacle to successful implementation. Some integration areas have been discussed in more detail in the context of other environmental issues (e.g. sectoral integration in Ravikumar et al., 2018; integration between Indigenous and Western knowledge in Bohensky and Maru, 2011). However, to our knowledge, nowhere have these six areas been discussed together or in the context of FLR.

2.1. Integration across spatial scales

If restoration is to meet both social and ecological objectives across vast areas of the globe it needs to fit within the wider land uses demanded by society (Lazos-Chavero et al., 2016; Chazdon et al., 2017). Achieving optimal biodiversity and livelihood outcomes is unlikely and understanding and negotiating trade-offs (IPBES, 2018) is at the heart of FLR. The return of trees to the landscape should contribute to a mosaic of different land uses within a large spatial area so that they can yield benefits across the entire landscape (Sayer and Boedhihartono, 2018). A land sharing approach – where protected trees are interspersed among other land uses - rather than a land sparing approach (where protection and use are clearly divided in the landscape) may in some contexts be an option to maximize benefits of different interventions across the landscape (Latawiec et al., 2018). For example, the land sharing agroforestry system in São Miguel do Iguaçu, (Paraná State, Brazil) where shaded coffee is cultivated under the canopy of native tree species provides both biodiversity and livelihood benefits (Latawiec et al., 2018). Effective integration across spatial scales also requires flexibility in governance arrangements. Polycentric governance recognizes the influence of decision-making centres at different spatial scales that influence the landscape (Nagendra and Ostrom, 2012; Bixler et al., 2018).

2.2. Integration across timescales

Restoration requires time as it takes at best 10–15 years to yield visible results in most biomes (Stanturf et al., 2019). Forests span generations and intergenerational equity needs to be considered as decisions to set land aside for restoration or natural regeneration today impact future generations. Both the past and the future represent relevant milestones for forests: the past for inspiration and guidance, and the future for resilience (Harris et al., 2006; Jacobs et al., 2015). For example, in Chile, massive and intense forest fires in 2017 disproportionately occurred in monospecific plantations of pine and eucalyptus established in the 1970s which failed to take into account both the historic vegetation which these plantations replaced and the future risks of a warming climate (Bowman et al., 2018). While some focus on recreating historical ecosystems, others seek to anticipate future changes, and design restoration measures that can be resilient to anticipated new conditions, particularly under climate change (Holl, 2017; Spathelf et al., 2018). Learning from the past is also of relevance to shape future interventions.

2.3. Cross-sectoral integration

Diverse sectors intervene within a forested landscape: environment, agriculture, forestry, infrastructure, tourism, among others. All too often restoration is considered a forestry-based intervention or an environment one, with limited attention paid to the influence of other related sectors such as agriculture or infrastructure (Reed et al., 2016; IPBES, 2018; van Dexter and Visseren-Hamakers, 2018). Conflicting interventions may hamper durable results (Carmenta and Vira, 2018). For example, van Oosten et al. (2018) highlight the lack of policy coherence related to FLR implementation in Rwanda because of reforestation falling under the responsibility of the Ministry of Natural Resources, while the Ministry of Land focused on land registration and the Ministry of Agriculture promoted policies related to agricultural productivity. Cross-sectoral approaches can help to better plan interventions within the landscape so that restoration efforts are not undermined by other sectoral interventions. The Global Landscapes Forum (GLF, see website: https://www.globallandscapesforum.org/) has been calling for such integration across sectors for several years.

2.4. Integration between formal and informal governance systems

Important decision-making processes affecting restoration include institutions and tenure. Formal (de jure) and informal (de facto) tenure rights are often distinct and even conflicting. Informal institutions situated inside the landscape may have less official power, but more

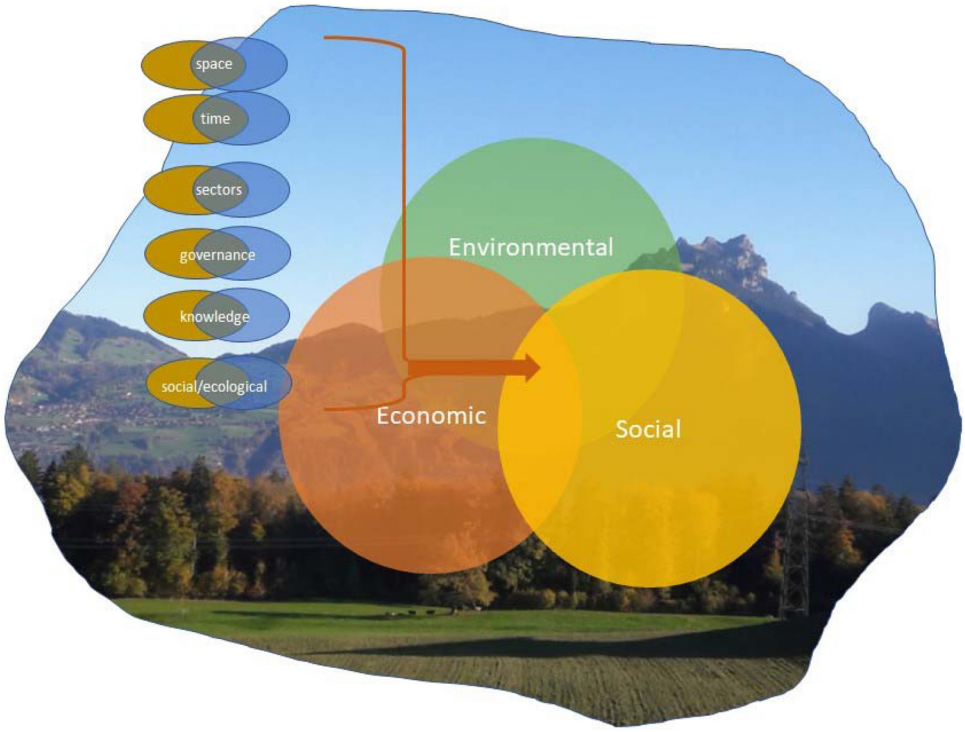

Fig. 1. Integration across six areas to scale up restoration for sustainable development (authors' figure).

direct clout to effect changes in the landscape. In many countries, traditional or customary rights held informally for generations have been replaced with formal, often colonially-inspired, rights systems. Yet, for many communities, recognition of their informal institutions and rights is paramount to any successful land-based intervention such as FLR (Nagendra, 2007). For example, steps towards integrating the voice of the indigenous Kanak people in decision-making in the Pacific island of New Caledonia are being made with the establishment in 1998 of the "Senat Coutumier" (customary senate), a traditional consultative body (Mansourian et al., 2019) Although formalization may not necessarily be the solution, a recognition and acceptance of these different institutions, systems of rights and tenure is an essential precondition to ensuring appropriate long-term FLR interventions

2.5. Integration between social and ecological systems

Restoration takes place within a biophysical system, but it is a profoundly social and human intervention in nature with impacts on both the social and the ecological systems (Ostrom, 2009; Yang et al., 2018). Expertise in ecology and forestry have dominated ecological restoration and larger scale plantation establishment respectively. However, social, economic, political and cultural influences affecting choices related to forests and restoration are equally important. For example, in north-central Vietnam, government schemes to plant what they saw as 'bare hills' did not take into account community preferences and resulted in loss of access to land and to essential local non-timber forest products (McElwee, 2009). An understanding of the social system and the interplay between both systems is therefore equally necessary to ensure resilience of the whole.

2.6. Integration between Traditional and Western knowledge systems

Western knowledge and science have been deployed in many restoration attempts, often at the expense of local Traditional knowledge. Yet, Traditional knowledge benefits from centuries of local understanding of the natural and social systems in a way that many Western scientific approaches simply do not. For example, the Western Klamath Restoration Partnership (WKRP), in northern California, formally established in 2013 and based on 20 years of collaboration between Tribal, Federal, and Non-Governmental stakeholders, integrates Traditional and Western scientific knowledge and practices related to fire management to restore ecosystem resilience and diverse ecological, economic, social and cultural values to fire-prone forest landscapes. (Lake et al., 2018). Combining both approaches, wherever appropriate and relevant, can lead to locally-rooted and acceptable, scientifically sound restoration interventions.

3. Discussion and conclusion

We are facing massive and unprecedented changes to our planet, including loss of natural forests and degradation of remaining forests. Past restoration efforts have not been sufficiently ambitious to tackle the extent of the problem, or have focused on just a few benefits rather than seeking to optimize the mix of potential benefits restored forests can provide within a landscape. We have proposed six categories of integration that can help to truly scale up restoration efforts if we are to address the current state of our forests and our planet more generally. Integration can achieve a depth and coherence that uni-dimensional thinking and approaches simply cannot. Considered together these six integration challenges can provide new avenues for FLR implementation. The six areas of integration we propose combine and build on each other in an additive manner. For instance, sectoral integration makes most sense and becomes more realistic when temporal integration is considered; in other words, when short term interests are weighed against longer term ones. Equally, governance integration will benefit from and will support the integration between Western and Indigenous knowledges, as well as influencing spatial integration of FLR decisions. In practice, contextual factors will differ and will signify that a different integration challenge may carry more weight than another. For example, in Canada, the integration of Indigenous and Western knowledge in forestry is particularly important (Lake et al., 2018). Importantly, power is a mediating factor that influences how and whether these integration areas are effectively considered (Ravikumar et al., 2018).

Restoration that considers these different types of integration can address more effectively the underlying drivers of forest loss (the 'illness') rather than simply treating the 'symptoms' to achieve sustainable development.

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