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Reconciling global and local benefits of forest restoration: A shared interdisciplinary perspective

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Abstract

Restoring ecosystems, and forests in particular, has become a global priority. At larger scales, forest restoration must necessarily reconcile the needs and priorities of multiple stakeholders and, in doing so, raises several governance challenges. Approaching governance in the context of forest restoration through an interdisciplinary lens provides a complex picture consistent with the multiple factors that impact forest restoration. Focusing on one specific governance challenge, namely, how to balance global to local benefits of forest restoration, serves to demonstrate the complexity and value of approaching these challenges with an interdisciplinary lens. This paper presents several options, including: the need for a multi-scale and functioning governance structures or mechanisms involving decision-makers from local to national and international scales; considering multiple brokers (or "intermediaries") as important leverage points; sharing tools with national governments that help to ensure that restoration brings a balanced flow of benefits to their citizens; redressing power imbalances by strengthening social capital and building the capacity of community-level

organizations; recognizing rights (to land or forest tenure rights – whether to communities or privately to local community members); creating a dedicated funding stream for restoration; changing the focus from quantitative targets for tree planting/restoration to more multiobjective based approaches; acknowledging and emphasizing that forest restoration can yield multiple benefits for many individuals or groups, and ensuring that these can be realized.

1. Introduction

The last 10–15 years have seen a proliferation of multi-million hectare forest restoration targets around the world (Stanturf and Mansourian, 2020) which have overshadowed in many cases the need to protect existing forest. The Rio conventions all have restoration targets. Many multinational companies are financing tree planting for various reasons other than timber such as for communications purposes or carbon offsets (Mansourian and Vallauri, 2023) and there is a booming business of intermediaries around tree planting (Holl and Brancalion, 2022; Schubert et al., 2024). Martin et al. (2021) found that 1.4 billion trees had been planted in the tropics and neotropics since 1961 by 118 organizations and Mansourian and Vallauri (2023) found that since 2000 an estimated 500 million trees had been planted by Fortune 500 companies based in three countries alone (France, Switzerland and the UK). How many of these trees survive, and how they might meet local needs is unclear.

Inevitably, externally-driven restoration will affect the lives of local people who live in the areas concerned (Erbaugh and Oldekop, 2018; Erbaugh et al., 2020; Mansourian et al., 2024). Although forests are clearly important for local livelihoods (e.g., IPBES, 2018; Miller et al., 2020), research has also highlighted how local communities and land users have been displaced or seen their rights curtailed by restoration or reforestation projects (e.g.; Rai et al., 2018; Fleischman et al., 2020). The way trees are planted, which tree species are selected, and under what institutional arrangements all determine whether these trees and forests fulfill the needs of local communities (Barr and Sayer, 2012; Elias et al., 2021; Kull et al., 2024). In this paper we take an interdisciplinary lens to identify potential governance intervention points to address the frequent contradictions between global and local benefits of forest restoration.

2. Transitioning from a disciplinary to an interdisciplinary perspective

Some of the criticism levelled at forest restoration initiatives (e.g., Veldman et al., 2015; Bond et al., 2019; Lewis et al., 2019; Parr et al., 2024) can be traced back to narrow interpretations and approaches to forest restoration - for example, lack of species diversity (Lewis et al., 2019), or lack of integration across sectors (Carmenta and Vira, 2018) or across scientific disciplines (Mansourian, 2018, 2021).

Natural sciences (including applied sciences such as forestry) have overshadowed social sciences when it comes to research and practice in forest restoration (and ecological restoration more generally) (Fleischman et al., 2020), with a resulting emphasis on environmental or ecological factors (such as species selection, genetics and planting patterns, e.g., Lindenmayer et al., 2010; Brockerhoff et al., 2017; Elliott et al., 2023), and minimal consideration of human dimensions (Djenontin et al., 2022; Tedesco et al., 2023; Mansourian et al., 2024). Interdisciplinary approaches more broadly provide a bridge between social and natural sciences that enables a more comprehensive analysis of

actors' decisions and their implementation (Giessen and Buttoud, 2014), in this case, in the forest restoration space.

The result is that while the forest landscape restoration (FLR) discourse emphasizes multiple benefits (Besseau et al., 2018), in practice some benefits often fail to materialize (Elias et al., 2021). Furthermore, the likelihood of success and sustainability of FLR efforts may be compromised by narrow disciplinary approaches (Langston et al., 2019), thereby squandering very real opportunities for poverty alleviation, biodiversity conservation, land improvement and sustainable landbased solutions to major global crises. A narrow vision also makes it difficult to incorporate the priorities and knowledge of indigenous or traditional communities.

In December 2023 we formed an interdisciplinary group made up of 13 senior (minimum over 15 years of experience) social and natural scientists and practitioners representing a range of disciplines (e.g., agroforestry, anthropology, botany, conservation, economics, forestry, geography etc.) sharing a common interest in forest restoration. We also have expertise in different regions, connecting diverse social, political and economic conditions through different networks and collaborating with many groups, all of which contributes to the diverse perspectives we bring to our common research priority. Through discussions among the group, a number of governance challenges emerged that we approached from our different disciplines, backgrounds, regions and organizational contexts.

In this article we focus on one of these governance challenges, namely: *How can large-scale political processes promoting forest restoration/tree planting (*e.g*., Bonn Challenge, AFR100* etc.*) and large-scale investments (*e.g*., large multinationals offsetting their emissions through tree planting) contribute to the needs of local people so that benefits can accrue at all spatial scales, from global to local?*

We posit that an interdisciplinary approach can contribute to improving the science, practice and policies around forest restoration. While multi-disciplinarity is merely a juxtaposition of different disciplines, and trans-disciplinarity requires more fundamental transformative changes resulting from the merging of disciplinary research and societal inputs; inter-disciplinarity seeks to combine disciplines to tackle a common issue, leading to innovation. It “amalgamates aspects and concepts from different disciplines so as to enable interdisciplinary research both at the individual and at the team level” (Adger et al., 2003). Had our group been composed of experts from similar disciplines, the outcomes would likely have been different. The diverse combination of disciplinary training, geographical experience and networks present in our group brings a more inclusive and multifaceted perspective on this governance challenge.

3. From local to global benefits of restoration

There are a myriad potential benefits from forest restoration including biodiversity conservation, the provision of ecosystem services, including health, food and cultural benefits. These benefits exist at multiple scales (Wiegant et al., 2022) and can also be further disaggregated as private benefits, such as those captured by individuals or multinational companies, or public benefits reaching society at large such as securing genetic diversity (Bozzano et al., 2014), precipitation (Tuinenburg et al., 2022; Ellison et al., 2024) or climate mitigation (Bastin et al., 2019). Global benefits capture the attention of international governance processes, and consequently national governments. Yet without local benefits, we contend that global benefits remain unattainable. Local benefits from forest restoration

include the provision of direct and indirect services such as construction materials, fodder, fuelwood, food, medicines, improvement in local micro-climate, and soil and water quality, erosion control, and employment (Wainaina et al., 2020). In many cultures, they also include a range of spiritual and cultural benefits (Brondizio et al., 2021). As local communities are not monolithic, broad assumptions about benefits to local people can be misleading if they fail to disaggregate between individuals (e.g., on the basis of gender, age or wealth) or groups (e.g., on the basis of ethnicity). For example, local elite capture is frequently cited as a challenge in forest management and restoration (Elias et al., 2022; Sapkota et al., 2021). Equally, gender issues often influence how benefits can be distributed at the local level. For example, in Burkina Faso the nere tree (*Parkia biglobosa*) is subject to multiple tenure rights based on gender, ethnicity, residence status, marital status and seniority within a lineage (Pehou et al., 2020). Tenure also has repercussions on the extent to which local and global, private and public benefits can be reconciled (Larson et al., 2023).

Although benefits exist at multiple levels, our concern is with the current political emphasis on the global benefits of forest restoration, in particular, carbon offsets, whose monetary benefits are captured by a few global actors. Furthermore, the real costs of forest restoration are all too often unjustly borne by less powerful, local actors (Elias et al., 2021). An emphasis on benefits at one spatial scale (accruing to a small set of actors) can lead to injustices, conflict and ultimately, restoration failure. Global to local benefits are needed to achieve durable biodiversity, climate and livelihood gains. The challenge is to ensure that equitable benefits accrue across scales. Polycentric governance approaches recognize these multiple connections across scales (Nagendra and Ostrom, 2012). Thus, reconciling global and local benefits requires a finer understanding of what each level of benefit entails.

Three overarching challenge categories frame our interdisciplinary observations: ensuring effective interaction between governance levels; addressing inequalities in power dynamics, and recognizing the need for diverse objectives and benefits.

3.1. Ensuring effective interaction between governance levels

We identify the value of **multi-scale** and functioning **governance structures** or mechanisms involving decision-makers from local to national and international scales. Such mechanisms acknowledge the importance of social inclusion to address potential conflicts around land use and land-cover changes such as forest restoration. Importantly, although essentially local-national in scope, such mechanisms would also link to global processes and efforts (e.g., via national representation at Rio Convention meetings). Some multistakeholder platforms have been set up for example in Kenya and Costa Rica (Wallbott et al., 2019; Mansourian et al., 2022) but these are often under-funded or hampered by powerful decision-makers. In line with such multi-scale structures, well-designed local restoration projects have access to balanced advisory committees from local and national/international actors. Inclusive planning can ensure that Indigenous Peoples, local communities, local governments and authorities and other major stakeholder[1] groups that may not be given sufficient voice at the local level can be heard while respecting and ensuring their free, prior and informed consent (FPIC). Partnerships can support the identification of common ground for restoration objectives that meet the needs of restoration actors and those of rural communities (Constant and Taylor, 2020).

Secondly, we identify as a key leverage point the multiple **brokers (or "intermediaries")** that sell "tree planting" to companies (e.g., One Tree Planted, Ecosia, Reforest'Action etc.). Situated generally

[1] We use the term "stakeholder" here as meaning any person or group affected by or who affects an issue, but acknowledge that this term has been associated with negative connotations

between local and international stakeholders, intermediaries play a significant role linking large-scale investors to local level initiatives. Vast sums of money are channeled through these intermediaries and their role has generally focused on the carbon aspects of tree planting, with a much smaller emphasis on community needs. As a critical link between the donor and the implementer, they offer a leverage point that could help to strengthen local level implementers, as well as influencing donors to change their priorities and focus. By improving and strengthening their own social and environmental standards, the impact on restoration interventions could be significant.

Thirdly, we also recognize **national governments** as critical actors between global processes that encourage, fund or otherwise support forest restoration, and local actors that stand to directly benefit, or lose from forest restoration. Their toolbox for restoration needs to be greatly expanded including coordinated and coherent land-use policies, financial incentives and greater support and delegation to their local representative branches (Brancalion et al., 2017; Wiegant et al., 2020). National governments shape, and are in turn guided by, global governance processes such as international environmental conventions (e.g., the Kunming-Montreal Global Biodiversity Framework under the CBD), or trade rules (e.g., the EU deforestation free regulation). As such, their role is critical to ensure that restoration brings a balanced flow of benefits to their citizens and to apply mechanisms to facilitate these. For example, in response to the Bonn Challenge on Forest Restoration, several countries have developed their national restoration strategies. Financial incentives for tree planting significantly influence the choice of tree species used in restoration (Kimambo et al., 2020). Sectoral conflicts however, often undermine their effective implementation as illustrated in Rwanda (van Oosten et al., 2018).

3.2. Addressing inequalities in power dynamics

The vastly divergent financial and political clout of different stakeholders in forest restoration results in major power imbalances. Current restoration efforts are skewed by large-scale, powerful actors. Many such initiatives are funded by global players such as multinational companies or conservation NGOs. Redressing power imbalances can be partly achieved by building the **capacity** of local-level organizations (both public and private) to play a more substantial role in national (and even international) negotiations. Prioritizing community-led organizations ensures that their voices are heard and their roles secured as effective and full partners in setting priorities for, and implementing, restoration, whilst ensuring their FPIC.

Another key opening to address power dynamics is through the **recognition of rights**. This might signify securing land or forest tenure rights – whether to communities or privately to local community members (de Jong et al., 2018; McLain et al., 2021). It also includes political recognition of certain rights for historically marginalized groups, such as forms of ‘native title’ for indigenous groups, or formal representation in decision making bodies (Benzeev et al., 2023; Sze et al., 2022). For example, an assessment of tenure reform in 23 countries found that in most countries forestry laws fail to recognize customary rights (Aggarwal et al., 2021).

Creating a dedicated **funding stream** for restoration derived from an externality to polluting industries (e.g., pollution or discharge, or agricultural export tax), and creating a multi-stakeholder mechanism to oversee fund management can secure long-term investment in restoration. For example, in Viet Nam payments for forest ecosystem services are being transferred from public hydropower companies to forest communities (via central or provincial Forest Protection and Development Funds that redistribute the money – Gallemore et al., 2024). Other longterm and sustainable approaches to secure funding for restoration are gradually being tested, such as trust funds, public-private partnerships, labelling schemes, among others (Lofqvist et al., 2023).

3.3. Recognizing the need for diverse objectives and benefits

Changing the focus from quantitative targets for tree planting/ restoration to **multi-objective targets** based on broad participatory processes that specify the (global and local) outcomes sought through restoration and related pathways provides a more realistic set of restoration objectives. Although less easily communicated than quantitative targets, such approaches would better reflect reality, offer a more socially acceptable process, and provide a mechanism to monitor progress against real benefits and outcomes rather than against artificial numerical targets such as numbers of trees planted. It is increasingly acknowledged that a whole range of non-monetary values of trees need to be considered in forest restoration such as the spiritual importance of forest groves, risk mitigation or the ecosystem services provided (e.g., Dasgupta, 2021; Brondizio et al., 2021). Indicators that measure benefits to people rather than the number of trees or hectares are needed.

Acknowledging and emphasizing that forest restoration can indeed yield **multiple benefits** for many individuals or groups, and ensuring that these can be realized (and measured, for example through spider diagrams such as those proposed by DeFries et al., 2004). For example, an emphasis on the global benefit of carbon often fails to acknowledge the basic priority of food security for local communities. As such, mechanisms are needed that can not only recognize the multiple benefits of forest restoration but also ensure that they can accrue to different stakeholders. For example, agroforestry - when effectively implemented - can be a solution that can meet both short-term social and long-term ecological objectives of restoration. In this respect, questions of procedural equity need to be central to restoration (Adeyeye et al., 2019). Given that in many instances huge sums of money are transacted by global actors for forest restoration, with few if any monetary benefits provided to local stakeholders, setting up strong and fair benefit sharing mechanisms can help local actors to see real benefits from restoration.

4. Future priorities and recommendations

Addressing the challenges of securing both public and private benefits of restoration at different scales requires multiple interventions. We have identified three overarching challenges and eight more specific ones (Table 1) to improve the sharing of benefits of forest restoration across different scales and actors that can be adapted to specific contexts but serve as a useful starting point for both restoration practitioners and policymakers to ensure a more just and equitable approach to forest restoration. In identifying some of these potential leverage points, we recognize that context matters, and some of the governance solutions proposed may need to be refined, modified and adapted to suit specific circumstances.

Going forward we recommend firstly the need to recognize the diversity of benefits of forest restoration, at different scales, reaching different stakeholders, and the need to balance these out, emphasizing the importance of local benefits. Secondly, we believe that an interdisciplinary perspective to addressing this challenge yields a more complete and realistic set of solutions. Importantly, we suggest that an interdisciplinary perspective allows for a more comprehensive definition of the governance challenges and solutions around forest restoration. Interdisciplinarity promotes a pluralistic perspective (Pascual et al., 2021) and we found that through discussions within our interdisciplinary panel we were able to identify more diverse and realistic solutions than had we remained within the confines of one discipline. Approaching the problem from our different disciplinary backgrounds, contexts, and experiences demonstrated how, although some of the

individual issues we identified may have been discussed by others, the combination of issues presented stems from our interdisciplinary nature. Going even further, where possible, a transdisciplinary perspective that also brings in society would provide an additional dimension and perspective. Restoration projects more generally can benefit from advice stemming from such diverse perspectives, disciplinary backgrounds and experiences. Thirdly, we highlight the nuance between public and private benefits from restoration originating at different scales and reaching different stakeholders. This differentiation is important when seeking to adapt governance tools for restoration (for example financial incentives, tenure arrangements or multistakeholder platforms). Finally, we emphasize the plurality of restoration with local, national and international initiatives being led by diverse groups, delivering multiple benefits to different groups. The need to better align benefits with local stakeholders - who have the most to lose - remains a critical challenge.

Table 1: Overview of governance challenges

Challenge category	**Challenge**	**Example**
Ensuring effective interaction between governance levels	Need for **multi-scale** and functioning **governance structures and mechanisms** involving decision-makers from local to national and international scales	Kenya and Costa Rica have experimented with multistakeholder platforms (Wallbott et al., 2019; Mansourian et al., 2022)
	Considering multiple **brokers (or "intermediaries")** as important leverage points	By requiring the use of native species, (or keeping non-invasive, exotic species to a maximum of 20% - pers. comm.)the search engine Ecosia which is an intermediary, plays an important role in improving restoration practice.
	National governments could use better tools or mechanisms as they play a critical role ensuring that restoration brings a balanced flow of benefits to their citizens	A mechanism developed by Ghana under its Forest and Wildlife Policy of 2012 is the provision of tree tenure certificates which incentivizes farmers to carry out restoration (Baruah et al., 2016). Similarly in India, the Forest Rights Act (FRA) and the Panchayat Extension of Scheduled Areas (PESA) Act contribute to restoration by improving the rights of communities and their ownership of forest products (Govindarajulu et al., 2023).

Addressing inequalities in power dynamics	Redressing power imbalances by building the **capacity** of community-level organizations	In Brazil's Amazon, support for coalitions of communities enables them to be stronger. For example, the Associação Terra Indígena Xingu (Xingu Indigenous Land Association, or ATIX) was created in 1984 to bring together different Indigenous groups to conserve and restore their territory (Brondizio et al., 2009) and a broader alliance formed later, the Xingu Seed Network (Schmidt et al., 2019).
	R**ecognition of rights** (to land or forest tenure rights – whether to communities or individuals	In Viet Nam, several laws, including the Land Law of 2003, grant households the rights to transfer, inherit, mortgage or lease land thus incentivizing forest restoration (Nguyen and Kull, 2022).
	Creating a dedicated **funding stream** for restoration derived from an externality to polluting industries (e.g. pollution or discharge, or agricultural export tax)	The "Reflorestar" payment for ecosystem services program in Espirito Santo State in Brazil pays landowners via a 3% levy on oil taxes (Kissinger, 2014; Pagiola et al., 2019).
Recognizing the need for diverse objectives and benefits	Changing the focus from quantitative targets for tree planting/restoration to more **multi-objective based approaches** that specify the (global and local) outcomes sought through restoration, and the pathways to reach those.	A long-term restoration program in Sabah (Malaysia) included several targets beyond numbers of trees, and focused on connecting forest fragments and re-creating habitat for the endangered orang utan (*Pongo pygmaeus*) (Mansourian et al., 2020),
	Acknowledging and emphasizing that forest restoration can yield **multiple benefits** for many individuals or groups, and ensuring that these can be realized	The Trees4All project in Thailand's Nan Province is supporting local farmers to plant native trees leading to increased income, resilience and biodiversity (RECOFTC website).

CRediT authorship contribution statement

Stephanie Mansourian: Writing – original draft, Project administration, Methodology, Funding acquisition, Conceptualization. **William M. Adams:** Writing – original draft. **Karma Bouazza:** Writing – original draft. **Joice Nunes Ferreira:** Writing – original draft. **David J. Ganz:** Writing – original draft. **Jack Hurd:** Writing – original draft. **Stefano Pagiola:** Writing – original draft. **John Parrotta:** Writing – original draft. **Bruno Ramamonjisoa:** Writing – original draft. **Nanie Ratsifandrihamanana:** Writing – original draft. **Roger Villalobos:** Writing – original draft. **Gretchen Walters:** Writing – original draft. **Christian A. Kull:** Writing – original draft, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

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