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Current Opinion in Environmental Sustainability

Forest landscape restoration for livelihoods and well-being

James T Erbaugh[1,2] and Johan A Oldekop[2,3]

The scope and current investment for forest landscape restoration (FLR) is great, as are the demands put upon it for improving livelihoods and well-being. International leaders have pledged 350 Mha for FLR as part of international sustainability agendas. FLR is implemented primarily through incentives and institutions, with an emphasis on the role of active planting and land tenure reforms. Despite recent attention and a growing literature that assesses the contributions of FLR and related projects to livelihood and well-being, there is a dearth of evidence linking FLR to social, economic, or political outcomes. We present a simple framework to understand environmental and social effects of FLR interventions and we review the evidence linking FLR to livelihood and well-being outcomes. We suggest that to enhance benefits to local populations from FLR, it is necessary to better integrate socioeconomic and political data into FLR planning and implementation, to increase the role of informational implementation, and to develop monitoring and evaluation protocols to assess direct and indirect environmental and social impacts from FLR projects.

Addresses
[1] School for Environment and Sustainability, University of Michigan, 440 Church Street, Ann Arbor, MI 48105, USA
[2] Forest and Livelihoods: Assessment Research and Engagement (FLARE) Network, School of Environment and Sustainability, University of Michigan, MI 48109, USA
[3] Department of Geography, University of Sheffield, Sheffield S10 2TN, UK

Corresponding author: Erbaugh, James T (jerbaugh@umich.edu)

Current Opinion in Environmental Sustainability 2018, **32**:xx–yy

This review comes from a themed issue on **Environmental change issues**

Edited by **Arun Agrawal**, **Chuan Liao**, **Cristy Watkins**, **Laura Vang Rasmussen** and **Reem Hajjar**

Received: 27 November 2017; Accepted: 09 May 2018

https://doi.org/10.1016/j.cosust.2018.05.007

Introduction

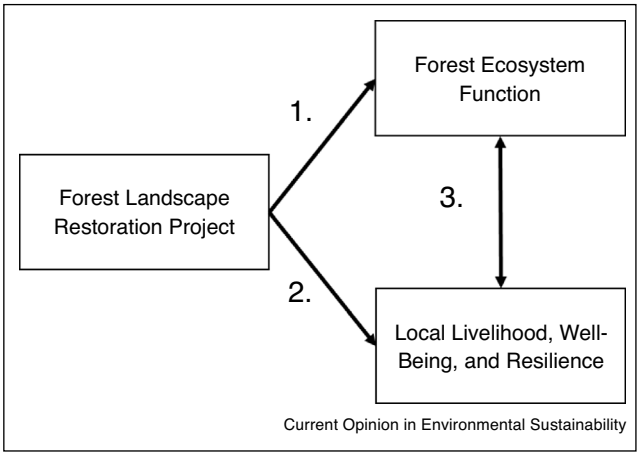
Global forests are under immense pressure from a suite of human activities, such as agricultural expansion and natural resource exploitation, in addition to global environmental change. Large-scale forest restoration is essential to ensure the continued flow of vital, forest-related
ecosystem services, including carbon sequestration, biodiversity conservation, and livelihood contributions [1,2]. Through the Bonn Challenge, international leaders have emphasized the importance of forest landscape restoration (FLR) by pledging to restore forests on 350 Mha of land using an integrated 'landscape approach' to environmental management [3•].

The landscape approach is an emerging concept that integrates social and environmental objectives across land-use sectors and scales of governance [4,5,6•]. Although implementation of, and research on, the landscape approach is nascent [7,8], numerous national and international stakeholders are rapidly incorporating it into processes that determine how natural resources are managed. The landscape approach relies on a combination of multi-stakeholder governance and iterative cycles of monitoring, evaluation, and implementation of social and environmental initiatives and interventions. As a landscape approach to forest restoration, FLR combines adaptive management and multi-stakeholder governance to unite forest restoration and regeneration with improvements in local livelihoods, well-being, and climate change resilience (LLWR) [5,9,10•]. In this review, we use a basic framework to understand how different approaches to FLR can influence social and environmental outcomes. We then present how forest restoration and LLWR are measured and consider the evidence linking FLR to livelihoods and well-being. Finally, we advance several strategies to help improve LLWR outcomes through FLR.

Linking forest landscape restoration to environmental and social outcomes

FLR projects aim to restore forest ecosystem function and contribute to LLWR, but they differ in their specific objectives, methods, or causal pathways of influence and impact [11•]. Under a first pathway, FLR projects are mainly designed or targeted to influence forest outcomes (Pathway 1, Figure 1), with LLWR outcomes considered as a secondary aim or knock-on effect (Pathway 1–3, Figure 1). Common forest restoration objectives include the rehabilitation of ecological function in degraded forests; reconstruction of forest systems on land previously used for different purposes (e.g. agriculture); and reclamation of severely degraded land that has experienced significant soil erosion and may be devoid of

Figure 1



Pathways linking forest landscape restoration (FLR) to forest and local livelihood, well-being, and resilience (LLWR) outcomes. Through pathway 1 → 3, FLR projects/interventions influence forest outcomes, with LLWR as an indirect outcome. Through pathway 2 → 3, FLR projects/interventions directly influence LLWR outcomes, indirectly affecting forest ecosystem function.

vegetation [1,12•]. These objectives are pursued through specific methods for planting, removal, and site preparation activities (Table 1). These methods are generally implemented by public (governments or NGOs) or private entities (landowners) that receive incentives or enforce institutions to promote forest ecosystem function. The 'success' of these activities in relationship to a specific forest restoration goal is often measured through one or many indicators (Table 2).

Under a second pathway, FLR projects are directly designed and predominantly targeted towards LLWR outcomes (Pathway 2, Figure 1), with forest outcomes occurring as a downstream effect (Pathway 2–3, Figure 1). Methods and benefit mechanisms linked to improved LLWR outcomes within the context of FLR often rely on the creation of incentive mechanisms, capacity building, and institutional development (Table 1). These methods include direct payments, market-based incentives, increased and diversified employment opportunities, and devolution of natural resource management and land rights [13,14]. Many studies identify improved LLWR as a contributor to reduced pressure on forest resources as well as forest-cover change; the growing payment for ecosystem services literature investigates the conditions, context, and value of trading capital for afforestation, reforestation, and reduced deforestation [15–17]. Indirect benefits are often the focus of continued monitoring and evaluation (Table 2), rather than the ongoing or longitudinal impact of direct benefits. These indirect benefits include forest-related regulating, supporting, and provisioning services that 'pay-off' over longer time scales [18,19].

Measuring forest landscape restoration environmental and social outcomes

To measure progress toward environmental and social objectives, FLR projects require specific metrics and baselines. Recent scholarship re-emphasizes the benefit of structural complexity as an indicator for monitoring and evaluating forest ecosystem function [20•]. This is in contrast to other commonly used measures, including remotely sensed land-cover data that categorizes land-cover into 'forested' versus 'non-forested' areas [21,22]. Although

Table 1

Direct and indirect methods for improving forest ecosystem function and livelihood, well-being, and resilience through FLR (adapted from [12•,77•])

Pathway 1 Direct forest mechanisms	Pathway 2 Direct livelihood, well-being, and resilience mechanisms	Pathway 3 Indirect impacts
Planting • Inter-planting, enrichment planting, agroforestry, taungya • Plantation/mono-cropping • Native regeneration/recolonization	**Livelihood** • Direct cash/non-cash transfers • Local marketing/business development • Tenure security/clarification	**Improved livelihood, well-being, and resilience** • Sustainable/reduced forest use • Enhanced regulation of forest use • Formal/informal planting, site preparation, other management techniques
Removal • Removal of unwanted species • Partial canopy removal • Selective removal • Fuel reduction	**Well-being** • Local participation in land management • Educational/training opportunities • Infrastructure investment • Conflict resolution/mediation • Clarification of stakeholder rights and responsibilities	**Improved forest ecosystem function** • Improved tree species richness • Presence of desired tree floral and faunal species • Improved soil stability, fertility, organic matter • Reduced soil erosion or flammable materials • Improved surface water, groundwater, water quality • Enhanced biomass productivity, carbon sequestration
Site preparation • Mulching, fertilizing, burning • Flooding/draining/connecting hydrological networks • Building barriers	**Resilience** • Employment alternatives • Adaptive management planning	