Forest Landscape Restoration as a Strategy for Mitigating and Adapting to Climate Change

Supported by: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Context

Forest landscape restoration can contribute to climate change mitigation and adaptation by increasing productivity of landscapes, enhancing the resilience of forest ecosystems and landscapes, and reducing the vulnerability of forest-dependent communities. Numerous examples from around the world show that successful restoration of forest ecosystems is not only technically and economically feasible, but also socially desirable if prepared and designed with adequate participation of relevant stakeholders. This assumes special significance now as forest-based mitigation and adaptation measures are likely to be important components of the Intended Nationally Determined Contributions (INDCs) - the foundational pillars of the Paris Climate Summit later this year - of a large number of developing countries.

Forest Landscape Restoration (FLR) aims to improve the landscape for people and for biodiversity, through several approaches – agroforestry, tree planting, natural regeneration, connecting forest fragments etc. – so that it can better provide ecosystem services, support biodiversity and withstand threats such as climate change.

As part of a collaborative project entitled “Inspire, Support, and Mobilize Forest and Landscape Restoration” between the World Resources Institute (WRI) and the International Union of Forest Research Organizations (IUFRO), funded by the German Ministry of Environment (BMU), a group of IUFRO scientists has developed a framework to demonstrate how FLR can contribute to climate change mitigation and adaptation. A simple “stoplight” framework presented here is intended to help decision-makers to build resilient landscapes and understand how climate objectives can be addressed through FLR. IUFRO’s role in this context is to provide state-of-the-art scientific knowledge on FLR through analysis of restoration case studies, review of scientific literature and development of capacity building material.

Forest Landscape Restoration and Climate Change: A stoplight framework

From the scientific literature, we assembled a list of mitigation and adaptation activities relevant to FLR and evaluated 15 case studies of forest restoration from around the world for their actual or potential contribution to climate change mitigation and adaptation. Case studies were drawn from projects in South and Southeast Asia, East Africa, Europe, Latin America and North America. While these projects were not necessarily designed with climate change mitigation and adaptation in mind, they provide examples of what is being done on the ground. Additional activities that could enhance the contribution to climate change mitigation and adaptation are also proposed in the description of the case studies.

We used the list of mitigation, adaptation, and transformational activities (see definitions below) to design a "stoplight" tool and applied it to each case study. Each activity is rated just like a traffic light: green signifies that the activity is in place, yellow signifies that it is partly in place, and red means that it is not in place. This stoplight approach can be used both as an evaluation tool and a design guide for actual FLR implementation on the ground.

Three types of activities are listed in the framework: mitigation, adaptation or transformational activities.

Mitigation focuses on the ***causes*** of climate change, the emission of greenhouse gases (GHG) and their accumulation in the atmosphere. Interventions to mitigate greenhouse gas emissions either reduce the sources of, or enhance the sinks for GHG. Mitigation activities include carbon conservation (such as through the creation of protected areas) and increasing sequestration (for example, by planting trees), offsets through substitution for fossil fuels or unsustainably harvested wood, and the substitution of energy-intensive materials such as steel, cement, or plastic with wood products. The benefits of mitigation accrue globally, over the long-term because of the inertia of the climate system; therefore mitigation has been seen as primarily an international issue.

Adaptation focuses on the ***effects*** of climate change and is local in nature, with short-term effects on vulnerability of natural and social systems. Forests are vulnerable to climate change and adaptation is needed to maintain their functioning. Adaptation activities relevant to FLR mostly fall into the categories of practice and behavior, green infrastructure, and technology. Practice and behavior refers to revised or expanded practices that relate directly to building resilience, such as thinning stands to reduce transpiration loss as an adaptation to drought. Green infrastructure describes new or improved natural infrastructure that provides direct or indirect protection from climate hazards. Planting coastal mangroves to adapt to rising sea levels and protect from storm surges is an example of green infrastructure. Incremental and anticipatory adaptations are appropriate responses to mild to moderate changes in global climate. Severe and abrupt climate change will require more controversial actions, dubbed "transformational adaptation".

Transformational adaptation measures proactively respond to or anticipate climate change, are larger in scale or more intense than incremental or anticipatory adaptation measures, or they are novel either to a region or by their nature. Transformational adaptation measures include managing novel ecosystems or creating them using assisted migration of species.

Restoring natural beech forests on farmland in Denmark (Photo by: P. Madsen)

Landscape Restoration Udaipur, Rajasthan, India (Photo by Foundation for Ecologial Security)

Case Study - Mitigation and Adaptation Potential

The stoplight tool is illustrated here through a case study from the Lower Mississippi Alluvial Valley USA. The stoplight summarizes the case study, so that not all mitigation, adaptation, or transformational activities are shown; only the actual or potential activities relevant to this case are presented.

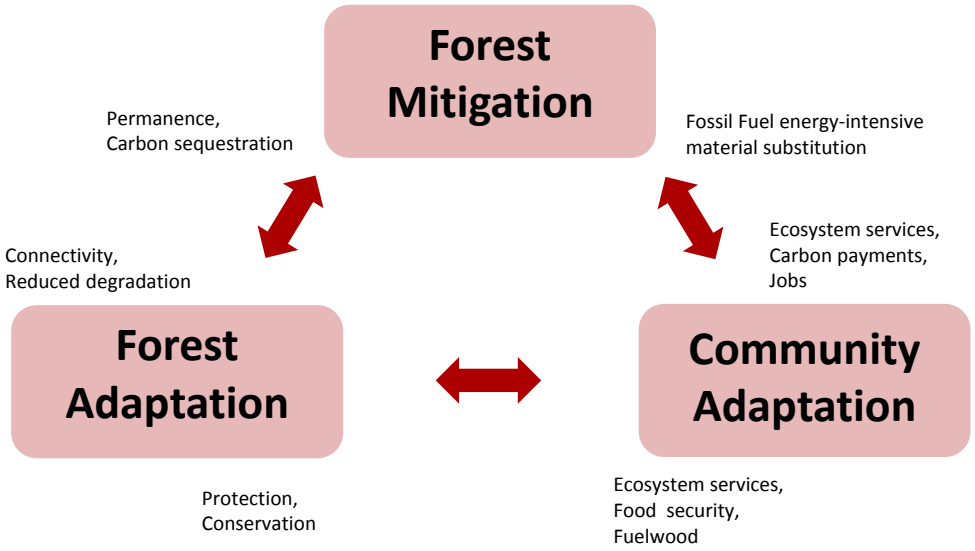
In place
Partly In place
Not in place

Lower Mississippi Alluvial Valley, USA Case Study Stoplight

Mitigation/ Adaptation/ Transformation	Objective	Mechanism	Restoration Activity	Implementation Level
Mitigation	Sequester carbon	Increase forest area	Afforestation	
		Increase biomass/unit area	Increase productivity	
			Longer –lived species	
		Increase soil carbon	Increase rooting depth	
	Reduce emissions	Bioenergy	Bioenergy plantations	
Adaptation	Maintain forest area	Reduce deforestation drivers	Policy reform--"Swampbuster" regulations	
			Conservation easements	
			Improve silviculture	
	Maintain carbon stocks	Reduce degradation	Sustainable forest management (improve regeneration)	
	Maintain other forest functions	Improve biodiversity	Afforest with mixed species	
			Recover endangered species (Louisiana black bear, pondberry)	
			Manage for species of concern (Neotropical migratory songbirds)	
		Improve hydrology	Restore microsites	
			Plant stream buffers	
	Manage for resistance	Reduce vulnerability to stressors	Integrated pest management of Populus deltoides	
		Overcome regeneration barriers	Secure advance Quercus regeneration	
		Reduce vulnerability by introducing new material	Breed, introduce new provenances, genetic modification	
	Manage for resilience	Expand population (within range)	Emphasize *Quercus spp*. in afforestation	
		Expand range		
		Create refugia		
Transformation	Novel ecosystems	Manage spontaneous ecosystems	Management of mixed plantings	
		Create ecosystems	Translocate species	
			Replace species within assemblages with desired functional traits	
			Introduce exotics (non-native species) with desired functional traits	

Conclusion

By providing ecosystem services and protecting settlements from extreme climatic events, forest landscape restoration plays an important role in the adaptive capacity of local communities and the broader society as illustrated through the 15 case studies. A socio-ecological system that links forest mitigation, forest adaptation and community adaptation can be described in the context of FLR (see illustration below: adapted from Locatelli et al., 2011). Interventions related to FLR impact on this socio-ecological system and thus require broad knowledge generated by the bio-physical, economic, social and political sciences.



Dry tropical forest restoration in Ghana
(Photo by: J. Stanturf)

Community consultation for forest landscape restoration in Ghana (Photo by: E. Foli)