

Barriers to Realization of Forestry Mitigation Potential in India

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Abstract

Implementation of mitigation options on land is important for realisation of the goals of the Paris Agreement to stabilize temperature at 2°C. In India, the Intended Nationally Determined Contribution (INDC) targets include a forestry goal of creation of carbon sinks of 2.5 to 3 billion tonnes by 2030. There are however, multiple barriers to implementation of forestry mitigation options in India. They include environmental, social, financial, technological and institutional barriers. The barriers are varied not just across land categories but also for a land category depending on its regional location and distribution. In addition to these barriers is the impeding climate change that places at risk realisation of the mitigation potential as rising temperatures, drought, and fires associated with projected climate change may lead to forests becoming a weaker sink or a net carbon source before the end of the century.

Key Words: forestry, barriers, mitigation potential, climate change, environmental, financial, social

Introduction

Mitigation, and adaptation to climate change contribute to the objective expressed in Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) to stabilize “greenhouse gas concentrations in the atmosphere at a level to prevent dangerous anthropogenic interference with the climate system... within a time frame sufficient to allow ecosystems to adapt... to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner” (IPCC 2014a). Mitigation scenarios of IPCC (2014b) indicate a potentially vital role for land-related mitigation measures. Globally, the COP 21 (Conference of Parties 21) agreement relies heavily on forests to achieve zero carbon emissions in the next half of this century-which is a pre-requisite

for limiting warming to a rise below 2°C.

In line with IPCC strategy for mitigation, Government of India in its Intended Nationally Determined Contribution (INDC) submission to the UNFCCC has included a target of creating an additional carbon sink of 2.5 to 3 GtCO₂ by 2030 (Government of India 2015). Forestry mitigation activities are likely to result in a range of outcomes in addition to carbon sequestration, and these include changes with respect to environmental, social and economic aspects. Achievement of this target is dependent on assessment of the barriers to realisation of the mitigation potential and overcoming them among other challenges. In this paper, barriers to implementation of forestry mitigation options and specific categories of barriers, corresponding to specific land categories are identified.

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A 'barrier' to mitigation potential is any obstacle to reaching a potential that can be overcome by policies and measures (IPCC 2007). Barriers to implementation of mitigation options on specific land categories identified as potentially available for implementation of forestry activities were analysed through a framework developed and analysed for the purpose. This included mapping of land categories and the various mitigation options and development of a questionnaire for analysing and ranking the various barriers by forest department officials (who are the primary implementing agency for forestland and wasteland categories) and local communities (for agricultural land).

Based on the survey and compilation of the barriers and the responses, the barriers could be broadly classified as environmental, social, technological, institutional and financial barriers. Table 1 presents these different categories of barriers and also discusses each of these barriers considering the potential land categories on which forestry mitigation options could likely be implemented under the Greening India Mission or for meeting the NDC targets. Below we discuss these broad categories of barriers to implementation of forestry mitigation activities in India.

Environmental barrier

Land and water availability for competing uses are the dominant environmental barriers that exist across India but with differences across regions. Land quality and availability of water and other local conditions of soil quality and carbon sequestration potential (Halvorson et al. 2011) would determine the level of realisation of mitigation potential of forestry activities.

This is a predominant barrier in wasteland land category, which are inherently poor in soil quality and water availability is also an issue. However, in forestlands this may not be a major barrier given the tree cover or shrubby vegetation that exists on even degraded forestlands. This is likely to be a barrier on agriculture lands as agriculture in India is predominantly rainfed and the land category considered here are fallow lands left uncultivated due to poor soil quality or lack of access to water.

Social barrier

The UNDP International Poverty Centre (2006) defines and characterizes poverty not only by low income, but also by insufficient food availability in terms of quantity and/or quality, limited access to decision making and social organization, low levels of education and reduced access to resources such as land or technology. High levels of poverty often can limit the possibility of use of land-based mitigation options such as afforestation/reforestation, because of short-term priorities that communities may have and the lack of resources. This is particularly relevant when forestry mitigation activities compete for land with other developmental needs such as mining (Forneri et al. 2006), or with food security (in case of bioenergy) as reported by Nonhebel (2005). Limited skills and lack of social organization in poorer communities may also limit the use of forestry mitigation options (Huettner 2012; Smith and Wollenberg 2012).

These barriers are specifically in the context of agriculture lands as communities have no or very little role in implementation of forestry activities on forestlands and wastelands. They however may or may not be involved in maintenance and management of forestland and wastelands as forestlands are state owned and the Forest Department has the responsibility of managing them and wastelands are under the jurisdiction of revenue department, unless a participatory management system is in place enabling social congregation and decision-making. Yet another barrier according to de Boer et al. (2011) could be social acceptance.

Traditionally communities grow annual crops on agricultural lands and shifting to tree-based systems such as agroforestry may not be readily acceptable to them. But there are regions in India where agroforestry or promotion of tree crops on agriculture lands is traditionally practiced and therefore may not be a barrier. Also, education and awareness may also help tide over this barrier of reluctance to accept new options for agriculture land.

Institutional barrier

Lack of institutional capacity can reduce feasibility of forestry mitigation measures. This is particularly relevant to areas where the key stakeholders are small-scale farmers or forest users (Thompson et al. 2011). Lack of regulations on

Table 1. Barriers to implementation of forestry mitigation activities in India

	Key barriers	Forestland	Wasteland	Agriculture land
Environmental	Land quality or soil condition	Not an issue in the case of moderately dense forests but likely to be a minor barrier in open forests.	Extremely degraded land category, therefore a significant barrier for high Net Primary Productivity.	Degraded and unproductive, primarily due to shortage or failure of rains. Soil quality could be a barrier for realising mitigation potential.
	Water availability	Natural source of water likely to be intact and not a barrier.	Could be a significant barrier, particularly in the drier regions of India, which are predominantly arid and semi-arid.	Since agriculture fallow is principally considered in the rainfed regions for forestry mitigation, this is a significant barrier.
	Carbon sequestration potential	Largely determined by the baseline condition of the land category and land quality. Unlikely to be a major barrier.	Significant barrier for high carbon sequestration rates	Moderate risk as condition of land being a private land holding, left uncultivated may not be the worst.
Social	Poverty	Communities have no or very little role in the implementation, maintenance and management of forestland and wastelands as forestlands are state owned and the Forest Department has the responsibility of managing them and wastelands are under the jurisdiction of revenue department.		Will determine the risk-taking ability and willingness of the farmer whose fallow land is being considered.
	Cultural			Traditionally and culturally annual food crop are promoted on croplands but there are regions in India where tree crops are promoted too.
	Limited skills			Maintenance of fruit tree orchards and commercial timber and pulp plantations requires certain amount of skill and training, which farmers possess.
	Low levels of education			Level of education determines awareness and acceptance of new options for implementation on farmer-owned agriculture land.
Institutional	Availability of trained personnel	Available with the forest department and therefore not a barrier.	Implementation usually through the forest department, which has trained personnel. However, with increase in scale, it may be a barrier.	Individual farmers may not have the required skill and technical knowhow, requiring adequate capacity building.
	Clear land tenure	Well defined for forest lands and therefore unlikely to be a barrier. In the case of some forest types, wherein natural regeneration option is to be implemented, some mechanism for sharing of benefits – both carbon and non-carbon incentives need to be formulated.	Tenurial rights rests with the revenue department but afforestation is sometime taken up by the forest department or some other agency.	Tenurial rights with individual farmers will enable smooth implementation. But, in cases where land is an undivided property, realization and flow of benefits and sharing may be a barrier.

Table 1. Continued

	Key barriers	Forestland	Wasteland	Agriculture land
	Rights to carbon incentives	Forest Department with shared rights with local communities on formulation of adequate institutional arrangements such as the Joint Forest Management.	Currently, no institutional mechanism or arrangement exists with respect to sharing of carbon incentives/benefits.	Rights with individual farmers, but may be a barrier, if the land is owned by more than one individual (undivided asset) and if the land has been leased out for farming activities.
Financial	Upfront investment	May be a barrier, given the reducing allocation for forestry sector over the years.	A barrier because of lack of financial resources.	Upfront investment is not available with farmers who are looking at tree-based farming as an alternative to failed annual crops
	Access to loans and credits	Not a barrier as routinely forest departments formulate projects to obtain funding from bilateral agencies.		Likely to be a significant barrier as there is limited awareness among farmers on loans and credits available and the ways to access them.
	High transaction cost	A significant barrier, given the large additional investment required and the need for monitoring, reporting and verification.		
	Fluctuation in carbon price	Likely to be a significant barrier, dependent on the demand for sink creation and existence of an international market and political willingness to curb carbon emissions or stabilize CO ₂ concentration in the atmosphere.		
Technological	Technological know how	Afforestation/reforestation are well-established forestry options and have been implemented on various land categories by forest departments as well as farmers through agroforestry. Therefore, not a barrier.		
	Skill and training	Skill to implement climate-friendly strategies that are both mitigation-adaptation activities in a synergistic manner is lacking. Sensitisation of personnel on these issues would help tide over the barrier.		

land use rights, its enforcement, no clarity on land tenure and carbon ownership are other institutional barriers (Lederer 2011; Palmer 2011; Rosendal and Andresen 2011; Murdiyarto et al. 2012).

In India, congenial institutional arrangements such as the Joint Forest Management exist, which not only allow communities to co-manage forests (both forestland and wastelands) but also provide rights over the benefits from these managed lands. In the case of agricultural lands, the sole ownership rests with an individual farmer and therefore not a barrier for implementation of mitigation activities. There have also been successful Clean Development Mechanism forestry projects in India, that demonstrate that sharing of carbon incentives among stakeholders including communities is possible and institutional arrangements and policies favour this.

Financial barrier

Land-based mitigation measures such as afforestation

and agroforestry require upfront investments. The scale of financing sources can be a barrier for using land-based mitigation potential (Streck 2012). Alternatively, lack of access to finance by farmers and forest stakeholders for implementing AFOLU activities (Tubiello et al. 2009) could be a barrier. Madlener et al. (2006) state that “financial concerns, including reduced access to loan and credits, high transaction costs or reduced income due to price changes of carbon credits over the project duration, are potential risks for land-based mitigation measures, especially in developing countries, and when land holders use market mechanisms”.

In India, among the three potential land categories available for forestry mitigation, investment is a barrier in across all land categories, including forestland as financial allocation to forest sector has been decreasing over the years. This could be compensated by forest departments aware of various loans and credit avenues as opposed to individual farmers whose awareness on loan and credit is limited.

Technological barrier

Technological barriers refer to the “limitations in generating, procuring, and applying science and technology to identify and solve an environmental problem” (IPCC 2014b). Some of the land-based mitigation options such as afforestation are well-established. Further, lack of trained people could be a barrier to implementation (Herold and Johns 2007).

Among the three land categories considered, matching mitigation options to specific land categories of varied quality and input availability is likely to be a barrier to implementation. Further, choice of species that are climate resistant or adaptable to changing climate conditions may be a challenge even in the forest department with skilled technical personnel who may not be acquainted and familiar with the issue of climate change and therefore implementation of mitigation options that could potentially be adaptation options as well.

Overarching Barrier to Realisation of Forestry Mitigation Potential

In addition to the barriers discussed above, climate change could be an additional barrier to realisation of forestry mitigation potential. Climate change over the past seems to have had a generally positive impact on forest productivity but this is only true of sites where water is not a limiting factor (IPCC 2014a). However, the magnitude and spatial distribution of the positive impacts of increasing atmospheric CO₂ on carbon uptake, and possibly carbon sinks, are still debated (Gurney and Eckels 2011) given the varied environmental, social and technological environment that exists across different countries, regions and locations even within a vast country like India. Climate change has also increased the extent of insect and fire outbreaks through a combination of elevated plant drought stress and greater insect survival (Clark et al. 2016). Some such incidences have also been recorded in India in the forests of some of the states.

Global average surface temperature change, relative to 1850-1900, is projected to exceed 0.3°C to 4.8°C under various climate change scenarios RCP2.6, RCP4.5, RCP6.0 and RCP8.5 (Reginal Concentration Pathway)

scenarios. In addition to warming, there would be changes in not only the quantum of precipitation but also its distribution. This combination of warming and changes in precipitation will impact vegetation, particularly the carbon stocks and productivity in most cases in a negative manner. Further, rising temperatures, drought, and fires may lead to forests becoming a weaker sink or a net carbon source before the end of the century (IPCC 2014a).

Thus, global change, including the impacts of climate change, can affect the mitigation potential of the forestry sector by either increasing (nitrogen deposition and CO₂ fertilization), or decreasing (negative impacts of air pollution) the carbon sequestration. Studies suggest that the beneficial impacts of climate change are overestimated as some of the feedbacks are ignored (Körner 2004), assuming linear responses. It is quite likely that the negative impacts may be larger than expected (Schroter et al. 2005), with either some effects remaining incompletely understood (Betts et al. 2004) or impossible to separate one from the other.

Conclusions

Barrier analysis shows that there are multiple barriers that hinder adoption and effective implementation of forestry mitigation activities on different land categories. The main barriers to implementation of mitigation activities on forestland and wastelands include lack of investment, limited investment and participation of local communities as evident from the survey and response of both forest department personnel and local communities. In case of activities being implemented on private or agricultural lands, the key constraints to adoption and implementation include farm size, credit availability, lack of access to information and human capital, availability of quality seedlings and technical information, and a market for produce in the case of timber and pulp plantations and fruit orchards.

There are other new emerging issues in the context of realisation of mitigation potential in the forest sector. They include impact of climate change on the mitigation potential and implications of the mitigation activities on ecosystem services, their quantification and their implication to developmental goals and targets, and the larger sustainable development agenda.

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