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Analysis

Estimating the opportunity costs of activities that cause degradation in tropical dry forest: Implications for REDD +

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ABSTRACT

The viability of national REDD + programs will depend in part on whether funds generated from sales of carbon credits are sufficient to cover the opportunity costs (OC) of forgone uses of the forest. We present the results of a study in which OC were estimated in dry tropical forest, in western Mexico. We focus on OC of activities which result in forest degradation such as shifting cultivation, grazing of cows, gathering of firewood, and poles for construction. Our approach inventoried the net returns for each activity as OC, stratified by size of forest holding and ownership condition. Cattle provided the largest share of returns, together with the subsidy paid for cultivation. The main implications for the design of REDD + payments are (1) at minimum, payments for carbon would have to be higher than the government subsidy currently paid for clearance for maize/grazing; (2) the compensation payments, would be between US$160–800 per hectare/year. The social implications of making carbon conservation more profitable than the current uses should be considered as some of the most vulnerable groups may lose their livelihoods. Overall, the opportunity costs per ton of carbon appear to be high compared with the current price of carbon on the international market.

1. Introduction

Mexico is relatively advanced in its plans to implement Reduced Emissions from Deforestation and Degradation (REDD +), a policy which is currently under development by the UNFCCC. An extended public discussion process has contributed both in the development of the 'Vision for REDD+' (SEMARNAT, 2010) and in the preparation of the national strategy for REDD +, which is now in draft. Mexico has a number of advantages over other developing countries interested in REDD + in that in Mexico (a) forest tenure is clearly defined, it has been variously estimated that 59% to 80% of all forests are under the authority of communally managed rural agrarian settlements (*ejidos* and *comunidades indigenas*) (Barnes, 2009; Bray and Merino-Pérez, 2002; Skutsch et al., 2013); (b) there has been an active program of payments for environmental services for water and biodiversity for the last 10 years, mostly through such rural settlements and thus considerable experience with this kind of instrument (Alix-Garcia et al., 2005; Muñoz-Piña et al., 2008) and (c) a national forest inventory was initiated in 2004, with the result that data on forest condition is available for around 23,000 sample plots, which are spread at 5 km intervals throughout forested land (SEMARNAT, 2010).

Despite these undoubted advantages, there remain many uncertainties about whether REDD + would be viable in Mexico. A central question is whether the funds that are likely to be generated by the eventual sale of 'forest carbon credits' representing reductions in emissions of carbon dioxide relative to an agreed baseline or reference emission level, would be sufficient to cover the costs of achieving such reductions. A variety of costs would be involved, such as the transaction costs (costs of implementing robust measuring, reporting and verification (MRV) procedures, costs of marketing the credits, etc.), costs of implementing the program (capacity building, administration) and most importantly, the value of benefits that would be lost if conservation actions put a stop to currently profitable uses of land, that is to say, the opportunity costs to the forest owners or managers (Dixon and Sherman, 1990; Gregersen et al., 2010; Karky and Skutsch, 2010). Although it is clear that decisions to participate in REDD + are unlikely to be based entirely on financial criteria, it is likely that forest owners and managers would have to be paid something on the order of what they are earning from current uses of forest, if they are to change the way they use the forest in order to conserve carbon. Much of the thinking behind REDD + assumes that the value of the carbon conserved may be converted into compensation payments to make conservation worthwhile to the local stakeholders, under the general principles of

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payment for environmental services (Engel et al., 2008). Understanding the magnitude of the returns currently received by groups of farmers is therefore a prerequisite to designing a viable REDD + strategy.

Earlier studies of opportunity costs in connection with REDD + have focused on costs of deforestation (forest clearance for alternative land use), but have not considered the costs of degradation, even though degradation is one of the main elements to be included in REDD +, constituting the 'second D'. Degradation in the context of REDD + is understood to mean the lowering of the average amount of biomass (and hence the carbon stock) within a forest, while the forest still remains forest. Stern (2007), for example, suggested that most deforestation in the tropics entails opportunity costs of less than US$2 per ton of carbon, based on a meta study which combined the results of a number of individual research studies (Grieg Gran, 2006, 2008). It is not clear whether the opportunity costs of degradation would be higher or lower than this, and clearly a large variation may be expected between different types of forest and between the kinds of agriculture that might replace it (the majority of forests included in the Stern study were of the humid tropical variety, although a large range of potential agricultural futures were included). Moreover, while expressing the opportunity costs in terms of tons of carbon may be useful in the context of winning support for REDD + from policy makers who have responsibility for combating climate change, from the point of view of the stakeholders on the ground, it is the opportunity cost per hectare that matters.

The aim of the research described here was therefore to quantify the net returns per hectare to current uses of dry tropical forests, which unlike other forest types in Mexico do not supply timber but are widely used for shifting cultivation, cattle grazing and wood products such as firewood and fencing material. Shifting cultivation in particular is often singled out as a major cause of forest degradation, and even of deforestation. Frequently characterized as a 'primitive' and 'wasteful' agricultural practice, and stigmatized by the term 'slash and burn', shifting cultivation in fact provides relatively high returns to labor without the need for external inputs such as fertilizers and pesticides. As long as the fallow cycles are not overly shortened, it may represent a highly sustainable farming system, with a stable biomass and carbon stock, albeit that the stocks are somewhat lower than in intact forests (Mertz, 2009; Mertz et al., 2009; Seidenberg et al., 2003). Management to reverse the degradation processes and create conditions under which trees could regenerate naturally to levels expected in undisturbed forests would require either halting or moderating shifting cultivation, the associated grazing, and the off-take of living wood, all of which would have a cost in terms of the livelihoods of those engaged in these practices.

The following section describes typical shifting cultivation and associated practices as observed in an area in western Jalisco which is engaged in planning for a sub-national REDD + project. Thereafter the methodology used to assess opportunity costs is explained. The results are presented, after which the following questions are dealt with: (1) what are the opportunity costs associated with different activities undertaken in these woodlands (2) what is the influence of land holding size on these costs (3) what would be the social consequences of making carbon conservation economically competitive with current production activities.

2. Shifting Cultivation and Other Uses of the Dry Tropical Forests

This study is located in Jalisco in the western-pacific area of Mexico, in part of the watershed of the River Ayuquila where a REDD + early action project is currently being implemented (Fig. 1). The higher parts of this river basin are dominated by Pine (*Pinus* spp.), Fir (*Abies*), and Oak forests (*Quercus*), while the lower areas are naturally occupied by extensive areas of tropical dry forests (TDF). These are deciduous and semi-deciduous woodlands with a considerable range of tree species, but with a much lower biomass density and lower canopy cover than the temperate forests. The coniferous and oak forests are widely exploited for timber, but TDF is commonly utilized for other purposes, particularly for shifting cultivation, collection of fuelwood and building poles, extraction of mushrooms or medicinal plants and cattle grazing.

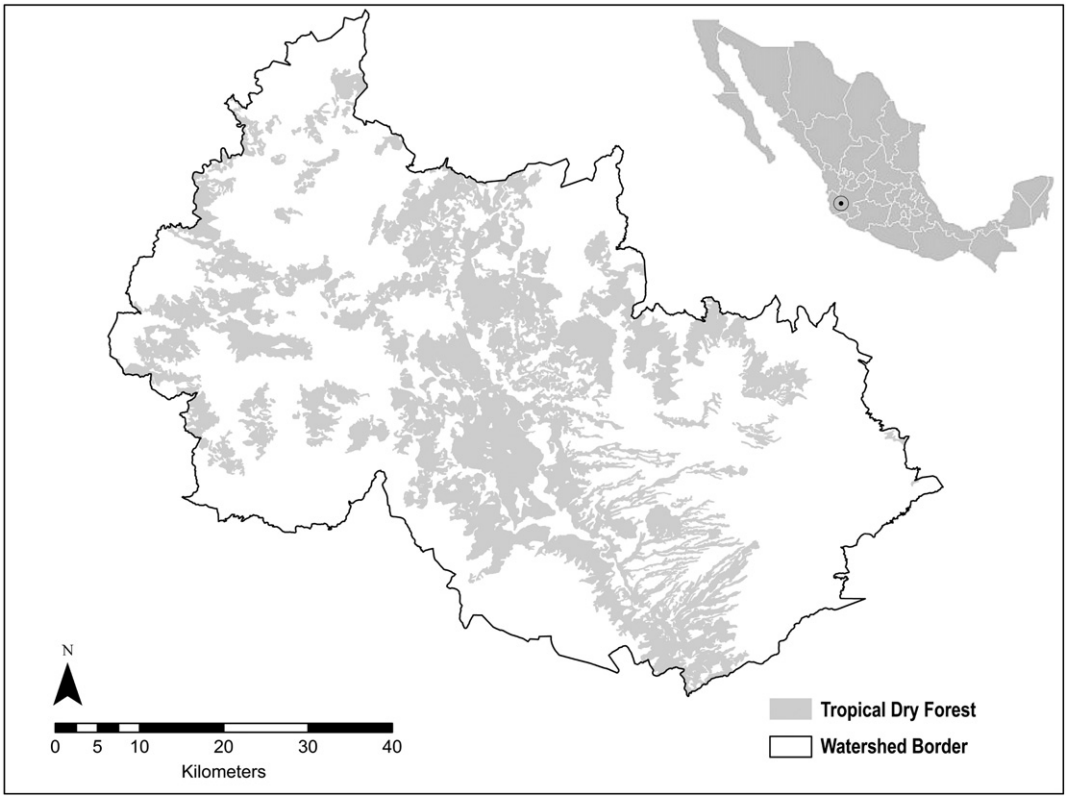

Fig. 1. TDF in the watershade of the River Ayuquila, Jalisco, Mexico.