ASSESSING THE OPPORTUNITY COSTS OF AVOIDED DEFORESTATION AT REGIONAL LEVEL: INSIGHTS FROM PROTECTED AREA MANAGEMENT IN BOSAWAS, NICARAGUA

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Deforestation and decay of biomass is the second largest source of anthropogenic GHG emissions. REDD is being considered as one of the mechanisms in a post 2012 international climate agreement which developing countries can use to mitigate climate change. Yet, questions arise if this mitigation measure will be sufficiently attractive to change current land use decisions. A main challenge that REDD faces is choosing policy levers that will address deforestation and forest degradation drivers without harming rural livelihood and society's welfare. For instance, in Nicaragua the poverty rate among the population that is directly engaged in agricultural production lies above the national average (70%), and much of the deforestation in Nicaragua (which has an annual rate of 2%) is driven by this population in search for fertile land and firewood (annual per capita firewood consumption is nearly 1 m3).

This research examines the cost of REDD implementation at a regional level in order to assess the forest cover and livelihood impact of potential REDD scenarios. We do so by focusing on Bosawas Protected area in north-central Nicaragua. Declared an International Biosphere Reserve by UNESCO in 1997, Bosawas represents the most extensive moist broadleaf forest ecosystem in Central America, and is also the living space of two indigenous communities: Miskitu and Mayagna. The study area comprises three sectors with different institutional challenges: (i) indigenous territories with well-defined land tenure inside the core zone, known as MITK and MSB, (ii) a core zone area southwest of both indigenous communities with insecure tenure, and (iii) a municipality (Siuna) with insecure tenure located in Bosawas's buffer zone. Generally, when estimating the cost of REDD implementation, research has focused on global and national level. Our work relies on empirical data where opportunity cost estimations are done at regional level, ensuring more accurate results about land values.

Opportunity costs are calculated from data obtained through expert interviews in the study area and are based on a 30-year-land use trajectory. The economic activities analyzed were: maize, beans, cocoa plantation, coffee plantation, dairy cattle and cattle ranching. In parallel, information about land market values was also collected as an alternative way to estimate opportunity cost of land use. For the estimations of transaction and implementation costs two potential policy levers have been chosen to perform the analysis: law enforcement and payment for ecosystem services. Data related to transaction and implementation costs have been supplemented with information from Costa Rica. In addition, a multi-criteria analysis was performed to identify social costs and benefits of REDD. Finally, distributional income effects of the considered levers are assessed by considering the links between benefits and costs, and various income groups.

Preliminary results show that opportunity costs vary between land use trajectories ranging from USD 210 $ha-1year-1 to 804 $ha-1year-1. The highest opportunity cost is located in indigenous areas, far from markets, where labor costs are low and land availability allows for long fallow periods with higher yields. Land market values were collected mainly in the buffer zone because land transactions are prohibited and rarely found in the core zone. Information indicates that forestland has the highest sale prices,

which reaches USD 2107 $ha-1, however it is lower than total NPV estimates in the buffer zone (on average USD 7971.75 $ha-1). On the contrary, in Costa Rica's case study, forestland values reache USD 3436 $ha-1 and present the lowest land values in comparison to alternative land uses (three times below the highest alternative land value), which is in fact a typical scenario for land use conversion to the best alternative land use. The implementation cost information provided by Costa Rica's PES scheme and Nicaragua's data about enhancement of law enforcement suggest that the latter policy lever is more efficient. Insecure tenure constitutes a real impediment to PES in the long run, mainly in areas with the highest deforestation rates. Additional measures such as land titling, technological change and diversification of economic activities are needed to enhance livelihood in rural areas facing environmental degradation.