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Kaysara Khatun

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Competing ecosystem services: An assessment of carbon and timber in the tropical forests of Central America

Kaysara Khatun[1]

Abstract

The study provides a quantitative appraisal of the carbon and timber stocks and flows of tropical (primary) forests by evaluating them simultaneously using data (physical and economical) from a number of sources. The provision of reliable and accurate estimates of the economic value of these services is crucial to plan adequate conservation policies that encourage the protection and sustainable management of tropical forests such as those under REDD/REDD+. Results indicate that the economic return for managing natural forests is influenced by timber and carbon prices as well as the discount rate applied. Timber on face value is the better land use option; however, there are many issues that need to be considered when valuing timber, especially regarding the management regimes. Revenues under REDD/ REDD+ option would be higher if co-benefits, which include monies from the sustainable extraction of timber under Sustainable Forestry Management (SFM) are considered.

Keywords: Carbon, Forests, REDD/REDD+, Timber
JEL Classification: F18, Q2, Q3, Q4,Q5, O2, P42

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[1] Basque Centre for Climate Change (BC3). Alameda Urquijo 4, 4^0 -1^a 48008 Bilbao, Spain

1. Introduction

Although burning fossil fuels remains the largest contributor to human-induced emissions, according to United Nations (UN) data (FAO 2005), the destruction of the world's forests (mainly in the tropics) releases about two billion tonnes of carbon per year thus tropical deforestation, accounting for around 25% of anthropogenic emissions of CO_2 and 18% of total greenhouse gases. The latest figures by the FAO (2010) show that there are signs that these numbers are decreasing in several countries but nonetheless continue at an alarmingly high rate in others. Deforestation and therefore natural resource depletion have become major threats to the environment and (local) economies of many developing countries and globally due to the large amounts of CO_2 that are being emitted due to forest clearing. This has been judged to be a huge cost to society in a number of ways; regionally in terms of local resources such as the availability of non-timber forest products(NTFP), often referred to as *the GDP of the poor*, as well as impacts on the biodiversity and severe environmental problems of soil erosion, soil fertility loss, watershed deterioration, and the destruction of coastal fisheries habitats, all with adverse effects on the livelihoods of the rural population (De Groot & Ruben, 1997). The Economics of Ecosystems and Biodiversity´s (Pavan Sukhdev 2008) first interim report states that '*Damage to forests and other aspects of nature could halve living standards for the world's poor and reduce global GDP by about 7% by 2050'*.

In the Copenhagen Accord at the Fifteenth Conference of the Parties (COP15) to the United Nations Convention on Climate Change (UNFCCC) in December 2009 a global climate change mitigation agreement through reducing emissions from deforestation and forest degradation (REDD), promoting sustainable forest management, and enhancing carbon sinks referred to as REDD+ (+ signifying enhancement) was reached. This has been further strengthened in Cancun during the COP16 proceedings, held in December 2010. The objective of REDD is primarily emission reductions, but it has the potential to deliver a range of "co-benefits", allowing for a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological, economic and social functions of the forest in a sustainable manner. This will enable community based forestry to be implemented immediately and aid towards development and poverty alleviation in forested regions. Forestry projects are still the only means through which much of the world's poor communities can hope to access financial benefits from internationals tools such as REDD.

The recognition of REDD+ suggests that sustainable forest management in the tropics will be promoted to include sustainable timber production and other ecosystem services. REDD+ is defined as **conservation, sustainable management** and **enhancement** of carbon stocks (Parker et al 2009). These enhancement

activities are not linked to emissions reductions, rather, it is a call for investment for tropical forests, which store carbon, increase sequestration by restoring lost carbon pools and creating new carbon pools in forest areas and thus creating rain, moderating weather conditions and protecting biodiversity (Varghese 2009).

The Millennium Ecosystem Assessment (MEA 2005) has classified a number of Environmental goods and services (EGSs) provided by tropical forests, namely cultural, provisioning, regulatory and support services; carbon falls under regulatory and timber under provisioning. The main aim of this study is to compare forest productivity; commercial value of timber against carbon mitigation options of natural (primary) forest systems for the Central American region.The study analyses the impact of deforestation by assessing carbon stocks and flows over a 15 year time period 1990-2005, based on data obtained from a number of institutes including the Food and Agricultural Organisation (FAO), the World Resource Institute (WRI), the International Tropical Timber Organization (ITTO) and, where applicable/available, from national sources.

2. Methodology

The paper looks to answer the following question when accounting for forest depletion;

How do we reconcile the provision of timber with the other EGS´s when valuing tropical forests?

To achieve this goal the main objectives are to:

Quantify the Present Value (PV) and the Net Present Value (NPV) of carbon and timber stocks and flows for a 15 year time period 1990-2005 for Central America by:

a) **Calculating the flow of timber production and carbon sequestration pools associated with the biomass of the forest floor for the specified time period**
b) **Examination of the economic controlling factors by exploring a number of carbon prices and discount rates for two timber species; teak (*teak grandis*) and eucalyptus.**

The analysis is carried out from two databases, for carbon and timber created using variables that reflect both stocks and flows in order to assess the PV and subsequently the NPV. The annual forest change rates are based on the FAO data (table 1) with the assumption that the change in forest area was a proportional increase/decrease in timber production, thus deforestation in this case is due to timber production.

Based on a hypothetical hectare of forest land and its subsequent changes, this study attempts to gauge deforestation and the losses and gains in monetary terms. Reforesting costs are not taken into account; it is assumed that the trees are taken from the primary forest directly.

Table 1: Forest area increase/decrease for the period 1990-2000, source FAO 2008

Country/area	**Forest**						
	Area			**Annual change rate**			
	1990	**2000**	**2005**	**1990-2000**		**2000-2005**	
	1000 ha	**1000 ha**	**1000 ha**	**1000 ha/yr**	**%**	**1000 ha/yr**	**%**
Belize	1,653	1,653	1,653	0	0	0	0
Costa Rica	2,564	2,376	2,391	-19	-0.8	3	0.1
El Salvador	375	324	298	-5	-1.5	-5	-1.7
Guatemala	4,748	4,208	3,938	-54	-1.2	-54	-1.3
Honduras	7,385	5,430	4,648	-196	-3.0	-156	-3.1
Nicaragua	6,538	5,539	5,189	-100	-1.6	-70	-1.3
Panama	4,376	4,307	4,294	-7	-0.2	-3	-0.1
Total Central America	**27,639**	**23,837**	**22,411**	**-380**	**-1.5**	**-285**	**-1.2**

The study is structured as follows: forest inventory data are analyzed, and the resulting stem density, and volume data are classified into the two tree species so that revenues from timber harvesting and carbon for each tree type can be estimated.

3 Main findings

- Total value of carbon stock for Central America forests range from $381- $521 at carbon price[2] of $3; $953 -$1,304 at a price path of $7.5 and $2540- $3,476 for $20 in the year 2005 per hectare

[2] The study looks at three carbon price paths based on possible values attainable in the regulated and voluntary sectors. $3 is the mode, $7.50, the median and $20, representing the higher end of the market

from the sale of carbon from avoided deforestation. For timber[3], the price range in 2005 is as follows: teak is \$15,242-\$20,857 for stumpage price \$200 $/m^3$ and \$28, 655- \$39,212 for log price \$376/m^3. Eucalyptus has a range of \$1626-\$2,225 for stumpage price \$20/m^3 and \$15,039-\$20,579 for log price \$185/m^3. The countries with the greater forested areas obtain the higher ranges due to more areas available for timber harvesting or alternatively for potential conservation.

- The main incentive for conserving tropical forests is strongly influenced by the carbon price path. If carbon is priced at \$3 the mode value, which can be obtained by forestry projects at the moment of writing, the NPV when compared to timber use falls short. However, at \$20, carbon credits are comparable with eucalyptus (stumpage prices) but too low for teak.

- The discount rates strongly influence the NPV and PV for carbon and timber, suggesting that setting lower discount rates would be applicable if the future is given precedence compared to higher discount rates which would factor in the current development requirements of the poorer nations.

- The timber on face value is the better land use option but it is difficult to determine the true costs from stumpage to log.

The results indicate that the economic return for managing natural forests is influenced by costs of timber and carbon prices and the discount rate applied. Returning to the original question, on whether ***we can reconcile the provision of timber with the other EGS´s when valuing tropical forests,*** there are many issues that need to be considered when valuing timber, especially regarding the management regimes, for example if forests are conserved the value for timber drops to zero. Revenues under REDD/REDD+ option would be higher if co-benefits, which include monies from the sustainable extraction of timber under Sustainable Forestry Management (SFM) are considered. SFM allows extraction of timber for economic gain leading to a periodic yield of wood whilst maintaining the production potential of the forest (Nieuwenhuyse et al 2000).

The analysis clearly illustrates that as a land use option, teak timber is more profitable on a hectare basis than the lower priced eucalyptus. In spite of its simplicity, an interesting characteristic of this study is that it relies on elements that can be easily approximated; the results are highly supportive and consistent of the other empirical studies such as those by Niskanen (1998) which compared teak with eucalyptus

[3] The values used are taken from literature and the International Tropical Timber Organization (ITTO)

production in Thailand, and a study by Camino et al (2002) which looked at teak in central America. However, it needs to be noted that the NPV -which is *the discounted sum of values of eco-system goods and services that would flow from a forest over a period of time, net of costs incurred*-does not capture the value of the forest wealth or possible change in it, only the flow of goods and services. Whilst net returns from timber are more profitable than those for carbon, the analysis does not reflect the multiple revenue sources available from the natural forests, both direct from carbon (and non- timber products, which are beyond the scope of this study) and indirect (environmental and social), including these revenues makes the carbon option as a more attractive investment.

Conclusions

Maintaining the world´s forests offers opportunities to protect vegetation on land under the REDD project norms. There exists a huge potential for REDD and REDD+ projects in Central America, however to realize this potential, there is a need to create an environment that promotes low-risk carbon emissions reduction opportunities and underscore the sustainability elements, while reducing transaction costs. The response of governments, forestry officials, private institutes, and rural communities are likely to be influenced by the price path of carbon over time and the value of forests is highly contingent on which user perspective is applied. Conservation projects can provide an alternative source of income and with standing vegetation, the benefits to the environment and local livelihoods can continue into the future, well past the crediting periods of carbon.

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