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Including Reduced Emissions from International Forest Carbon in Climate Policy: Understanding the Economics*

Deforestation and forest degradation currently account for about 15% to 20% of global greenhouse gas emissions, exceeding the global emissions of the transportation sector.[1] But efforts to curb deforestation and degradation have not yet been incorporated into the binding agreements to reduce GHGs such as the Kyoto Protocol to the UN Framework Convention on Climate Change (UNFCCC). Given the enormity of deforestation, and the realization that the world's remaining tropical forests are disappearing at an alarming rate, it is no longer a question of *whether* the prevention of forest carbon losses should be part of a global climate agreement, but one of *how*.[2] Policymakers are now considering the inclusion of *reduced emissions from deforestation and degradation* (REDD) into the UNFCCC post-Kyoto climate agreements. At the same time, legislators in the United States Congress continue to craft proposals to cap greenhouse gas emissions, several of which include a role for reduced emissions or increased sequestration of international forest carbon stocks as part of the policy portfolio.

A dimension that can greatly influence how international forest carbon policies work is the *source of financing* to pay for emission reductions. Compensation will likely come either as part of the global carbon market being used as a flexible compliance mechanism for those countries that face a mandatory cap on their emissions, some other non-market transfer of funds to the country achieving the reductions (often called the "fund" approach), or a mix of the two. A longer paper on which this brief is based directly assesses the consequences of including demand from a compliance market as the source of international forest carbon compensation. This does not presuppose the policy outcome (market or fund); rather, it uses the results of economic modeling efforts to inform the discussion, including how the inclusion of forest carbon might affect the carbon market price and the distribution of abatement efforts across sectors and countries.

Economic dimensions of international forest carbon payments

Whether the carbon market or other institutions provide the funds to drive the program, compensation to parties for reducing deforestation rates and corresponding GHG emissions lies at the heart of the current proposals. Thus the success of a forest carbon policy is ultimately tied to its economic viability. Viability applies at both the individual and the aggregate level. At the individual level, parties will opt in to a forest carbon program only if they expect the compensation will make the changes in land use practices economically worthwhile for them—that is, the compensation exceeds the opportunity costs of forgoing the returns from clearing the land plus any additional costs (e.g., for planning, measurement, monitoring, verification, and exchange) necessary to bring the credits forward to a buyer. Also at the local level, forest carbon compensation may affect the economic well-being of other parties (including indigenous people) who currently access to forests for food, livelihood, or recreation.

Terminology

Deforestation and degradation are principle subcomponents of ***international forest carbon***, denoting the two forms under which forest carbon stocks can be drawn down and emitted to the atmosphere. The other main components are afforestation, reforestation, and forest management which can build forest carbon stocks by removing CO_2 from the atmosphere via photosynthesis and carbon storage in biomass and soils. Because ***international forest carbon*** is broader in scope than ***REDD (reduced emissions from deforestation and degradation)***—and because the U.S. policy process, which is the primary focus of this brief, refers to international forest carbon rather than to REDD alone—we will follow that guide and use the terms ***international forest carbon*** and ***forest carbon*** in this brief, rather than the term REDD used more commonly in the UNFCCC discussions. In many cases, these terms can be used almost interchangeably.

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At the aggregate (national, international) level, economic viability implies that there is demand for international forest carbon reductions—either from GHG compliance markets, voluntary markets, or various forms of nonmarket institutions (e.g., official development assistance or ODA)—matched by funds to make it happen. There must be sufficient supply capacity of forest carbon credits to meet this demand at a workable price. And there must be provisions put in place to address the possibility of emissions leakage caused by shifting of deforestation to sources not covered by forest carbon policies, and the potential impermanence of these reductions due to subsequent release of forest carbon into the atmosphere. To make the policy work on the ground, infrastructure (technological, legal, and other) must be in place to ensure that reductions are properly quantified and monitored, that the rights to compensation are properly established, and that compensation flows through the appropriate channels.

International forest carbon must also be viewed through the wider lens of a multisector approach to mitigating GHGs. International forest carbon is seen by many as a potentially low-cost option relative to actions in other sectors, which underlies its appeal as a possible component of a global compliance market for carbon.[3,4] Low-cost options, if integrated into a market, will supplant some higher-priced mitigation actions from other sectors; that is how competitive markets work. However, this possibility has raised concerns in some corners that forest carbon and other forms of compliance offset mechanisms will "flood the market" and defer or even eliminate compliance actions from other sectors, such as energy, that are core to the GHG problem. While this should not necessarily be a problem as long as forest carbon mitigation is real, verifiable, and permanent, careful scrutiny is warranted to ensure that it meets these criteria.

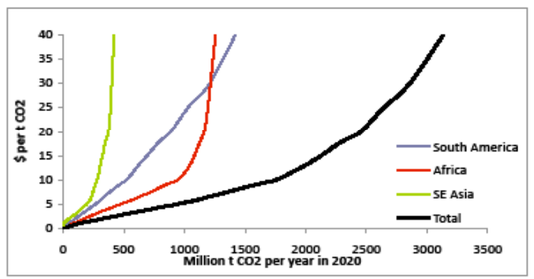
Informing U.S. climate policy deliberations

The primary audience for this brief includes those responsible for deciding whether and how to incorporate international forest carbon into a U.S. climate policy regime. We focus on the United States because of the momentum now building for a comprehensive climate bill emanating from the walls of Congress and the pronouncements of support for such an endeavor by the Obama Administration. Various proposals include provisions for including forest carbon in the policy. There are many excellent papers already on the role of REDD as part of a global climate agreement under the UN Framework Convention on Climate Change (UNFCCC), but not much has been written specific to the unique position that the United States holds in climate policy.[5] Not a signatory to the Kyoto Protocol commitments under the UNFCCC, the United States has nonetheless taken forward steps in recent years toward adopting a mandatory GHG reduction program of its own. The U.S. proposals with most political resonance of late—The Boxer-Lieberman-Warner bill (S. 3036) taken to the Senate in the summer of 2008 and the Dingell-Boucher discussion draft submitted by the House of Representatives—both included forest carbon as a potential source of international offsets to meet U.S. compliance commitments. In January 2009, the U.S. Climate Action Partnership (or USCAP) called for the United States to cut greenhouse gases eighty percent by the middle of the century using a "cap-and-trade" system.[6] This would set a firm cap on greenhouse gases, but gives businesses the flexibility to meet this cap by trading the right to emit these pollutants among themselves and through the use of "offsets" from uncapped sectors or countries. A prominent potential source of those offsets is through international forest carbon from developing countries, thus a careful look at the economics of this potential source is clearly needed at this time. Debate, discussion, and undoubtedly new proposals will continue to surface as this paper is being drafted in early 2009.

Recent economic studies: Key findings and policy implications

The U.S. policy community can benefit from a clearer understanding of the economics of forest carbon reductions to guide their decisions. Several studies have been conducted in the last two years that directly address the economic potential of forest carbon, how its inclusion might affect the compliance market for carbon, and how policy design issues like scope of coverage might affect outcomes. Differences in the scope of these studies and in the methods used produce a somewhat wide range of estimates. Unfortunately, the fact that this range is wide can skew the discussion. Advocates may point to the lower-cost estimates in the literature as strong evidence for taking action, but some of these estimates are incomplete (e.g., exclusive of transaction costs or opportunity costs that escalate with the scale of the program). But others are concerned that low costs will "flood the market" and divert mitigation from other sectors such as energy. These claims need to be put in proper context, which we attempt to do here. Taken together, the economic results do provide helpful insights to inform the policy development process moving forward. Key findings and policy implications are highlighted below.

Figure 1. Marginal cost function for reduction in deforestation in 2020 for three regions in Kindermann et al. (2008). Average of three model results.



Economic models suggest that over the next 20 years, carbon prices of $10–$30 per ton CO could generate 1.8–2.9 billion tons of CO_2 reductions per year globally through avoided deforestation. The models suggest that this amount could be roughly doubled if other options such as afforestation and forest management were credited.

Economic models can produce forest carbon "supply curves" to indicate potential quantities of forest carbon reductions at different cost-per-ton levels. Forest carbon emission reductions, like other forms of mitigation, produce rising cost curves. Initial reductions can be quite inexpensive, perhaps as low as US$2–5 per tCO_2 to reduce deforestation by the first 10% below baseline levels.[7] Additional reductions, though, become progressively more expensive. If the program is focused on deforestation only, the potential is 1.8–2.9 billion tons of CO_2 reductions for carbon prices of $10–$30 per ton CO_2. For the same prices, the total carbon could be doubled if other options such as afforestation, reforestation, and forest management are also credited. Reductions in deforestation emissions, combined with increases in forest carbon stocks through afforestation and forest management in tropical regions, could amount to a significant boost in mitigation potential from the global forest sector. At the $10–$30-per-ton range referenced here, forest sector mitigation can offset roughly 12%–20% of current global CO_2 emissions, a number that can make a substantial contribution to near-term reduction targets.

Table 1. Estimated share of total forest carbon mitigation from reduced deforestation.

	$/tCO$_2$		
Region	$20	$50	$100
Central and South America	0.64	0.57	0.42
Africa	0.95	0.81	0.65
Asia	0.38	0.31	0.23
Global	0.69	0.57	0.42

Derived using data from IPCC (2007) and Kindermann et al. (2008). Average of models.

If compensation is based on future projected carbon stock changes, then the best purely economic opportunities from supply can be found in Africa.

Given that forest clearing in Africa has, on an aggregate basis, been substantially lower than the other tropical regions (e.g., Latin and Central America, Southeast Asia), future emissions from Africa are expected to rise the most. Moreover, opportunity costs of keeping land in forest are expected to be lower in Africa than elsewhere in the tropics. Taken together, this creates better potential forest carbon supply conditions for Africa. However, governance reform, capacity building, and infrastructure needs may be greatest there, suggesting that investment in these factors will be necessary to realize this potential.

If the United States includes forest carbon reductions for compliance purposes, the supply of those reductions will depend on similar policy decisions by the rest of the international community as well as the linkages between the U.S. market and other carbon markets.

Currently, the UNFCCC is negotiating the role that international forest carbon, through the REDD mechanism, will play in a post-Kyoto (post-2012) compliance regime. Options range from full use for compliance to no use, and variations in between. If the post-Kyoto framework allows for full compliance, this means that the United States will need to compete for these reductions on the open market, possibly raising costs of these credits in the U.S. market. However, if all countries are on board in the compliance market, this may provide the certainty and funding to ensure that the supplies will materialize in the first place, thereby bringing down costs for all consumers. This will depend not only on U.S. decisions on the applicability of forest carbon for compliance purposes, but also whether the rest of the world (via UNFCCC) adopts international forest carbon (REDD) into its post-Kyoto compliance framework. Furthermore, even if other countries do not allow forest carbon for compliance purchases, their demand for reductions could still indirectly affect allowance prices in the U.S., depending on the linkages between the different markets.

The success of international forest carbon as a compliance strategy will depend on its costs relative to mitigation in other sectors and locations.

Including forests will lower costs of achieving a given climate change mitigation target. Initial emission reductions from forest and land use activities are expected to cost substantially less than further reductions from other climate mitigation activities, such as de-carbonizing the electric power sector or reducing transportation emissions.[8] Thus including forest carbon reductions in the portfolio of options can reduce the costs of and increase the flexibility associated with emissions reductions efforts in the U.S. and globally.

Economic modeling shows that forest carbon as part of a global compliance market could lower the global allowance price by 9%–26% if deforestation only is included, and by about 33% if all international forest carbon is included.

Estimated potential purchases by the U.S. for compliance purposes to meet targets in line with the Lieberman-Warner 2008 America Climate Security Act range from 0.9–1.9 billion tons of CO_2 per year (valued at $19–$33 billion) for deforestation only starting in 2012 and rising to 1.2–2.2 billion tons (valued at $36–$55 billion) by 2020. This represents 11%–19% of cumulative U.S. abatement through 2050. The opportunities increase if the suite of creditable international forest carbon activities includes afforestation, reforestation, and changes in forest management. One analysis estimates total U.S. forest carbon purchases from developing countries at 1.1 billion

tons ($19 billion) in 2012 rising to 1.5 billion tons ($39 billion by 2020 and $64 billion by 2030). This represents about 18% of total U.S. abatement, or more than twice the potential contribution of avoided deforestation alone according to this scenario. The cost savings potential of forest carbon depends critically on how much of the estimated potential supply can be realized in practice as well as on the global demand, determined by the overall emissions targets, imposed limitations on trading, and the possibility of "banking" excess emissions reductions for use in future periods.

Allowance price reduction benefits need not cause "flooding" or diversion of effort from other sectors. Inclusion of forest carbon in a global regime could help achieve a higher level of climate protection for the same cost as a regime without forest carbon.

At the global scale, including avoided deforestation as an emissions reduction option, with some limitations on trading prior to 2020, lowers the total costs of a 550 CO_2 equivalent climate stabilization policy by up to 25%, with modest estimated impacts on incentives for investment and innovation in renewables, carbon capture and storage, and other energy technologies. The estimated cost savings from including avoided deforestation can enable a more stringent climate target of about 520 ppm stabilization without an increase in the overall cost compared to a policy where deforestation is excluded from the carbon market.[9]

International forest carbon could be used to induce broader participation in the global carbon market to achieve greater overall reductions.

For example, a bilateral agreement between the United States and Brazil allowing 80% of Brazil's deforestation reductions to be used for U.S. abatement exclusively until 2020 could reduce the allowance price by 4%. In addition to the 20% of deforestation emissions reductions which Brazil does not trade, the associated cost savings could finance about a 1% increase in the stringency of the cumulative U.S. emissions cap (e.g., a 1% reduction in allowable emissions over 2013–2050) while keeping the costs of compliance in the U.S. the same as in the case without forest carbon credits.

Broader participation is critical to prevent emissions leakage to countries that do not participate in a forest carbon program.

The effectiveness of an "opt-in" policy to reduce forest carbon emissions could be undermined by emissions leakage from sources that remain outside the purview of the policy. Avoiding deforestation in one place can simply shift it—and its emissions—to another place if proper incentives and accounting are not in place to keep it from happening. Economic analyses show that leakage can be substantial when policy incentives are isolated. This suggests that policymakers should make every effort to engage all major sources of forest carbon in an agreement in order to minimize leakage across countries. National accounting systems can help control for leakage within a country by ensuring that any leakage that does occur is captured within the national accounts. Absent national accounting, discounting or other credit adjustments will likely be necessary to adjust crediting to deduct for leakage problems.

Forests as a mitigation tool are complemented by their role in adaptation, suggesting that forests can pay a double-dividend in combating climate change.

Tropical forests in particular provide natural insurance against many threats—drought, flooding, and vector-borne diseases to name a few. These risks could be exacerbated by climate change; thus, keeping forests intact or expanding forest areas can contribute positively to future adaptation efforts.

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8 IPCC, 2007.

9 Current goals are focused more on 450 ppm, based on findings of the Intergovernmental Panel on Climate Change (2007), but the study that examined the cost-stringency tradeoff was focused on 550 ppm (see note 3, Tavoni et al.).