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# Carbon Credits for Avoided Deforestation

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## Abstract

Several important issues need to be addressed to make avoided deforestation (AD) a feasible option for climate change policy. Traditional questions associated with land-based sequestration options have largely been discussed in terms of project-based approaches to carbon sequestration. For country-level commitments these concepts remain important, but we argue in this paper that they can and should be addressed differently. In order to address AD, it is useful to begin by outlining the international climate control regimes under which AD could be included as an option. Two general alternatives are discussed: an arrangement that is a linear extension of the current Kyoto Protocol but that involves more countries with specific emission reduction targets, and an alternative expanded arrangement that requires that essentially all countries have greenhouse gas emission targets. We consider how AD would fit into these two general types of international agreements and address questions related to baselines, additionality, permanence, and leakage. We conclude that the key issues related to including deforestation in either of these arrangements revolve around measuring, monitoring (e.g., additionality), and the development of efficient incentives by countries to alter their land-use regimes.

**Key Words:** avoided deforestation, carbon, sequestration, credits, climate, warming

JEL Classification Numbers: Q00, Q23, Q54, Q57

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## **Contents**

<b>Introduction.....</b>	<b>1</b>
<b>Plausible Post-Kyoto Regimes .....</b>	<b>2</b>
<b>Features of Each Regime.....</b>	<b>4</b>
<b>Conditions for Selling Credits Internationally.....</b>	<b>6</b>
<b>Conclusions .....</b>	<b>7</b>
<b>References.....</b>	<b>9</b>

## Carbon Credits for Avoided Deforestation

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### Introduction

There is a growing recognition that in order to achieve meaningful carbon emission reductions major progress will need to be achieved in avoided deforestation (AD), that is, in reducing the rate of global deforestation. This realization reflects the recognition that emissions from deforestation constitute 20–25 percent of global greenhouse gas (GHG) emissions (IPCC 2001). Clearly, investing in reductions in deforestation could crowd out some investment in energy abatement technology, so environmental groups, and consequently many governments, have for a long time been skeptical of crediting AD. Several recent studies, however, have suggested that ignoring AD and other forest mitigation activities would be highly cost-effective (e.g., Stern 2007), and some estimates have suggested that including AD and other forestry actions in climate stabilization policies could reduce overall costs by up to 50 percent (Sohngen and Sedjo 2006; Tavoni et al. 2007). Recent efforts by many rainforest nations have raised awareness on the issue of AD, and the concept of carbon credits for AD has become a legitimate issue to be negotiated.

Despite the interest in AD, several important issues need to be addressed to make it a feasible option for climate change policy. Traditional questions associated with land-based sequestration options—baselines, additionality, permanence, and leakage—of course will play an important role in the ultimate decision regarding AD. These issues have largely been discussed in terms of project-based approaches to carbon sequestration. Moving away from the project-based approach and toward country-level commitments, these concepts remain important, but we argue in this paper that they can and should be addressed differently.

In order to address AD, it is useful to begin by outlining the international regimes under which AD could be included as an option. We begin with a discussion of two general alternatives, both of which will accept AD credits. The first is an arrangement similar to the current Kyoto Protocol but involving more, but not all, countries with emissions reductions

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targets. Countries without specific targets would include some major countries experiencing substantial deforestation. The second or expanded arrangement would include all large carbon-dioxide emitting countries, including those with large forests. Although some authors (e.g., Grieg-Gran 2006) have suggested that one only needs to include Brazil and Indonesia in the international arrangement to have a large impact on global deforestation rates, for this example we assume all major countries have emission targets. We consider how AD would fit into these two general types of international agreements and address questions related to baselines, additionality, permanence, and leakage. We conclude that the key issues related to including deforestation in either of these arrangements revolve around measuring and monitoring (e.g., additionality) and the development of efficient incentives by countries to alter their land-use regimes.

### **Plausible Post-Kyoto Regimes**

In order to successfully address deforestation, it is generally agreed that some market-based system of incentives is desirable, indeed required, for promoting behavior leading to AD. It is often maintained that the use of tradable carbon credits to promote AD would be an appropriate system. However, the efficacy of any particular system of credits for carbon from AD is likely to be highly dependent on the nature of the overall post-Kyoto climate control regime. This paper briefly examines some of the possible credit systems that could be applied to two post-Kyoto regimes.

In the current Kyoto regime no AD credits are allowed. However, AD credits could be introduced. Several types of post-Kyoto regimes are possible. In this paper we examine how various types of AD credit systems would fit into two general characterizations of the post-Kyoto world. Explicitly, these two types of post-Kyoto regimes are:

- a) A linear descendant of Kyoto: This regime, as with the current Kyoto Protocol, would involve two sets of countries: countries that had specific GHG emission targets (Annex 1 countries) and those countries (including some major countries with large levels of deforestation) that ratified the new protocol but would not have specific GHG targets.

- b) An expanded agreement: This post-Kyoto arrangement would apply if essentially all countries, including those with large levels of deforestation, would have specific GHG emissions targets. That is, all countries would be Annex 1 countries.<sup>1</sup>

### ***Linear Descendant of Kyoto***

Essentially, this regime would be an extension of the current Kyoto Protocol with, perhaps, a number of new countries added to those with specific emission reduction targets but a substantial number of countries without specific GHG emission reduction targets. In the current system, countries having targets have limited use of the Clean Development Mechanism to undertake activities in the developing countries without targets that would generate carbon credits. A linear successor to the Kyoto Protocol would have large numbers of countries experiencing significant deforestation that would not have specific emissions targets; some of these would also be countries experiencing high rates of deforestation. One proposal, brought forward by Papua New Guinea and Costa Rica, suggests that participating countries voluntarily reduce their deforestation rates below a baseline rate in return for tradable credits. These credits could then be purchased by countries that have specific targets and used to meet their obligations. The current Kyoto Protocol allows this with respect to afforestation projects (but not for AD), but sets limits on the number of forestry credits that can be counted against a country's target. Under the current system, countries do not have baselines. Instead, baselines, additionality, and leakage are determined at the level of individual projects. In this project-based world, with substantial limits imposed on the quantity of credits that can be imported by countries that have targets in the current Kyoto Protocol, the value of forest carbon projects is very low. The current low value for forestry credits makes sense because the supply of potential projects is very large, but the demand, which is determined by the country-level allocations, is very low.

A difference between the current Kyoto world and this linear-descent post-Kyoto regime is that countries would have to specify forest baselines at the level of the country, and AD credits would be allowed and based on changes relative to this baseline. This distinction, as discussed below, has important implications for measuring and monitoring protocols, among other issues.

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<sup>1</sup> Alternatively, an expanded agreement could include essentially all the greenhouse gas emitters, including those with large deforestation emissions, with the emission target calculation inclusive of emissions from forestry.

If some forested countries did not have specific emissions reduction targets, all of their AD credits could, in principle, be available to the carbon markets.

### ***Expanded Agreement***

In this arrangement essentially all the major carbon-emitting countries (including those emitting carbon dioxide–equivalent gases) would have specific GHG emissions targets, that is, all countries would be Annex 1 countries including developing countries with large levels of deforestation (e.g., Brazil and Indonesia). If credits for AD were allowed, these countries could generate AD carbon credits. Clearly, as with the linear-descent regime described above, under the expanded agreement countries would have to specify forest baselines at the level of the country, and AD credits would be allowed and based on changes relative to this baseline. This would require the ability of these countries to measure and monitor their carbon emissions associated with land-use change. Depending on the specific level of the emission reduction target for an individual country, countries experiencing deforestation could in principle be suppliers or demanders on an international carbon-trading market. However, since essentially all countries would have emissions targets, many would find it advantageous to simply utilize credits from AD activities that were accomplished to meet their own national emissions targets with few or no credits making their way to the carbon-trading markets. Thus, the number of AD credits making their way to world markets could be very modest.

### **Features of Each Regime**

The linear descendant of Kyoto would involve additional countries that would have specific emission reduction targets. However, it would leave many important countries out of the group that has specific targets, that is, a number of major countries would not be Annex 1 countries. Given that several of the countries that have high levels of deforestation are also major overall GHG emitters, it is clear that a linear descendant of Kyoto would provide much less stringent GHG control than the expanded agreement, whereby these tropical-forested countries would also have specific GHG reduction targets. This would be the case since the bifurcation of Kyoto Protocol countries between those with and without specific GHG targets would continue and many important countries would not be given emissions targets. One immediate, and important, implication of the linear-descendant approach to the Kyoto Protocol is that the price for carbon sequestration or reduced emissions from AD would depend explicitly both on the targets set for countries and the limits imposed on importation of credits generated from forestry

in other countries. Continuation of the current regime restricting credit imports would reduce the value of AD.

Alternatively, if there were few limitations on how much carbon could be imported, there would consequently be ample opportunities for countries with large levels of deforestation and no emission targets to offer AD credits to the markets. One might even argue that the fears of many critics of biological sequestration would be realized in that efforts at emission reductions could be redirected from energy emission control to a biological emphasis simply because deforestation efforts are relatively low cost.

As an example, consider the current situation. European countries currently need to reduce emissions by many million tons of carbon per year from 2008 to 2012 in order to meet their Kyoto obligations. Prices in the European Trading System during the test market phase in 2006–2007 were in the range of \$30–\$50/ton C.<sup>1</sup> Tropical countries like Brazil and Indonesia, on the other hand, emit the equivalent of 0.3–0.6 million tons C per year due to deforestation. Estimates from several models suggest that for prices observed on the European Trading System in recent times, Brazil and Indonesia could reduce their emissions from deforestation by 100 to 200 million tons per year (Kindermann et al., 2007). Obviously, including possible emission reductions from other countries, as with AD, would provide substantial benefits for countries involved in the Kyoto Protocol. As long as the developing countries can prove gains (i.e., if, in conjunction with the Clean Development Mechanism, they can show baselines and additionality and handle leakage if it is present), there is no substantive reason why deforestation credits should not be worth just as much as energy credits on international markets. The use of these credits in international markets will reduce prices, but this also reduces costs.

An expanded agreement, which would involve targets for most major countries (including those with high rates of deforestation), would be considerably more stringent in its carbon constraints, and would presumably raise the price of carbon. Such a regime would also provide incentives for countries to control their deforestation as a means to meet their own overall emission reduction targets. In such a situation many of the credits are likely to be used domestically with far fewer AD credits making their way to carbon-trading markets. However, in this situation, with most countries having emission targets, the market price (assuming international trade of permits is permissible, and thus a single global price emerges) of carbon would be substantially higher, reflecting the fundamentally more stringent nature of the regime.

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<sup>1</sup> Note that 1 ton of carbon requires 44/12 tons of carbon dioxide

## Conditions for Selling Credits Internationally

Implementing either system described above obviously depends upon the ability to monitor forests and forest carbon in a reasonably accurate way. In concept, adequate monitoring appears feasible (Sedjo and Toman 2001; Brown 2002); this paper does not address that question specifically but takes it as a given that physical monitoring of carbon stocks and flows is feasible. However, at least two major concerns persist: permanence and leakage. Permanence addresses the question, “if deforestation is avoided today, will it also continue to be avoided tomorrow?”. Countries can choose to handle this in different ways, either by zoning or otherwise regulating the actual use of land, or through economic instruments like rental payments. For example, Sedjo and Marland (2003) suggest that countries could utilize periodic rental payments for land that is preserved from deforestation based on performance (e.g., the existence or absence of appropriate levels of forest cover on the location).

The issue of leakage reflects the potential problem that the protection of one area of forest simply deflects the deforestation elsewhere (Sohngen and Brown 2004). Of course, leakage disappears in a global system that accounts for all carbon because the area of forest monitored is all inclusive and thus captures all deflected deforestation. Under either regime, AD could be included. However, to include AD requires that it be measured and verified. With the linear descendant to the Kyoto Protocol model described above, carbon could become a commodity that a country could trade at a global level, but the country would need to be able to verify the reductions at the level of the entire country. Thus, if countries that do not have allocations want to sell forestry credits on the international market, they would be required to develop monitoring systems that would allow them to verify their reductions at the national level beforehand, and only those credits verified as additional could be sold. Note that it would also be advisable to follow this approach under the current Kyoto Protocol.

Thus, for example, a country’s total internal deforestation would be determined. An approach might be to establish a baseline for a country’s level of deforestation, perhaps one based on recent trends, or one based on future land-use projections from economic models (in either case, call this the business-as-usual trend). The country could then receive carbon credits for subsequent performance that was better than the business-as-usual trend would suggest.

Obviously, a country’s performance may end up worse than its baseline. Such countries would not be able to sell credits on the international market, and thus would receive no transfer payments from countries that have commitments. It may also be possible to issue carbon debits if net deforestation is greater than that of the trend. While it would likely be difficult to force

countries that have entered voluntarily to purchase offsets to make up for these debits, it might be possible to deduct current losses from future gains. To some extent this would account for the permanence question. If a country reduced deforestation below the baseline trend for several years and sold the credits, but then exceeded the baseline trend by some amount for one year, that country would need to make up those additional emissions before selling additional credits.

For the expanded agreement, agreeing to develop measuring and monitoring protocols for the entire country would be required. Countries would also have to develop baselines from which deviations at the national level could be monitored and verified. We believe that this would be an important part of the decision for countries before they commit to entering into an agreement. While verification systems could be important, the implementation of these systems would be weighed against the potential benefits of selling credits on an international market. The value of selling credits, in turn, would depend on their market prices, which would depend on the stringency of the targets undertaken by all countries as well as their relative marginal costs.

The idea of national-level verification and crediting tied to the trend represents an improvement from the existing project-based world of carbon sequestration, but it is not perfect. First, finding agreement on what is the appropriate trend may be difficult. Second, leakage in reality need not be confined within a country and could occur beyond the border of a country. Given the voluntary nature of the linear descendant of the Kyoto Protocol, and given the limited number of countries likely to be involved in the expanded agreement, there will be many opportunities for cross-boundary leakage. This is an important reason to involve most forested countries, particularly those experiencing deforestation, since leakage beyond a country could be accounted for where it occurs only if the second country also has emission targets. However, it is important to note that this issue is not explicitly limited to forestry credits, since other carbon-emitting industries can also shift production across regions.

## Conclusions

The discussion suggests that there are several ways that credits for AD could be defined and implemented. These depend importantly upon the nature of the climate agreement subsequent to the current Kyoto Protocol. Although a more inclusive arrangement such as the expanded agreement may be preferred, experience suggests that something less may be achieved, for example, a linear extension of the Kyoto Protocol. Obviously, unlike the regimes following the Kyoto Protocol, the post-Kyoto regimes considered in this paper must recognize AD as a bona fide basis for carbon credits. However, AD credits would likely function quite differently depending on whether the post-Kyoto regime involved specific emission targets for most

forested countries or just a few. With a worldwide system of country targets, most countries experiencing deforestation may find it advantageous to use the AD credits to meet their country targets, thus making them largely unavailable for global trading. If, on the other hand, many countries experiencing deforestation did not have formal emissions targets, then any AD credits that accrued would be available and likely traded internationally. Of course, a system in which many countries do not have formal targets would undoubtedly be fundamentally less stringent than one in which most countries have targets.

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