Feasibility of Avoiding Deforestation in Latin America

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Abstract
Deforestation is responsible for approximately eighteen percent of anthropogenic CO₂ and is the primary source of emissions in Latin America. Nevertheless, avoided deforestation (AD) was excluded as a Clean Development Mechanism category in the UN Framework Convention on Climate Change (UNFCCC) Kyoto Protocol’s (KP) first commitment period. The purpose of this paper is to determine whether avoiding deforestation in Latin America is politically desirable and economically feasible. A case study of Panama’s political climate with regards to AD was conducted and a range of policy options was suggested. Data for Colombia, Honduras, Mexico, Panama and Peru was gathered and analyzed as a model for the economic feasibility of AD in Latin America, which was performed according to the mixed-methods approach. Findings suggest avoiding deforestation in Latin America is possible, but will not be easy. There must be a politically conducive environment under which AD can exist before we ask whether or not AD makes financial sense. Presently, AD is economically feasible but politically impossible. As long as the rural poor look to the forest for livelihood, deforestation will continue. However, if presented with a viable alternative they could undoubtedly be swayed.
Acknowledgements

The following is a list of those we would like to thank for making this project a reality. This list is by no means complete as it would be impossible to acknowledge everyone. Thank you to:

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<thead>
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<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>Avoided Deforestation</td>
</tr>
<tr>
<td>A/R</td>
<td>Afforestation and Reforestation</td>
</tr>
<tr>
<td>BAU</td>
<td>Business as Usual</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CERs</td>
<td>Certified Emissions Reduction</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CO₂ₑ</td>
<td>Carbon Dioxide Equivalent</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of Parities to the UNFCCC</td>
</tr>
<tr>
<td>CR</td>
<td>Compensated Reduction</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EU ETS</td>
<td>EU Emissions Trading Scheme</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agricultural Organization of the United Nations</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
</tr>
<tr>
<td>Gt</td>
<td>Gigatons</td>
</tr>
<tr>
<td>GWP</td>
<td>Global Warming Potential</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>HFC</td>
<td>Hydro-fluorocarbon</td>
</tr>
<tr>
<td>IAN</td>
<td>International Aviation and Navigation</td>
</tr>
<tr>
<td>IGO</td>
<td>Intergovernmental Organization</td>
</tr>
<tr>
<td>KP</td>
<td>Kyoto Protocol</td>
</tr>
<tr>
<td>LUC</td>
<td>Land Use Conversion</td>
</tr>
<tr>
<td>LULUCF</td>
<td>Land Use, Land Use Change and Forestry</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MEPC</td>
<td>Marine Environment Protection Committee</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>PES</td>
<td>Payment for Environmental Services</td>
</tr>
<tr>
<td>REDD</td>
<td>Reducing Emissions for Deforestation in Developing countries</td>
</tr>
<tr>
<td>SBSTA</td>
<td>Subsidiary Body for Scientific and Technological Advice of the UNFCCC</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNCCD</td>
<td>United Nations Convention to Combat Desertification</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>WBI</td>
<td>World Bank Institute</td>
</tr>
<tr>
<td>WRI</td>
<td>World Resource Institute</td>
</tr>
</tbody>
</table>
1. **Introduction**

1.1. *Deforestation and Climate Change*

3.4 billion years ago the first photosynthetic organisms began to evolve (Mulkidjianian, Koonin et al. 2006) on what was then an anoxic planet. Today, about 7500 Gt CO$_2$ are stored in terrestrial vegetation and 31000 Gt CO$_2$ in the earth’s oceans (IPCC 2001; Prentice 2001), with more carbon sequestered in earth’s forests than in the atmosphere (Prentice 2001; Stern 2007).

Forests provide three major environmental services: watershed protection, biodiversity conservation and carbon sequestration. Forests are known to play an important role in regulating the global climate by affecting both locally and globally. Locally forests lower ambient temperatures or lead to higher relative humidity (Nombre, Sellers et al. 1991) and enhance the productivity of agricultural areas near by (Lopez 1997). Forests also provide other benefits including two the recreational use of forests their contribution to scenic beauty (Pagiola, Bishop et al. 2002) and a livelihood for much of the world’s population.

It is the critical role of carbon sequestration that plants play which is why we are interested in them for the mitigation of climate change. As plants grow they remove carbon from the atmosphere. They store this carbon either above ground in structures such as the trunk, branches, leaves and so on or the transfer carbon to the soil via roots, falling leaves and nodule. The carbon sequestered within the trees is released if they are cut and from the soil if it is ploughed. At the same time it is crucial to understand that apart for the loss of carbon, deforestation is associated with *inter alia* a loss in genetic and biodiversity, disruption in the regulation of water, a potential for a permanent
negative impact on the area through desertification and the effect on the human ecosystem.

Land use change (LUC) due primarily to deforestation is the second largest source of greenhouse gas emissions after emissions from fossil fuels (IPCC 2001). The most important greenhouse gas (GHG) accounts for almost 20 percent of global CO$_2$ emissions and 25 percent of all global GHG emissions from deforestation (IPCC 2000)$^1$. Nearly all of the emissions associated with deforestation is tropical (FAO 2006). To date, almost 136 Gt CO$_2$ has been released due to LUC, which is mainly through forest conversions (IPCC 2000). Throughout the 1990s the average LUC emissions was 1.6 Gt C ±0.8 Gt, due to the loss of 13 million ha of tropical forests each year (IPCC 2001; FAO 2006)$^2$. Deforestation is expected to remain a large source of carbon emissions in the future (Stern 2007). Furthermore, in Latin America land use change due to tropical deforestation is the largest source of CO$_2$ emissions. For example when national emissions of Brazil are calculated to include LUC, the country’s emissions output is approximately 250 percent greater.

Even thought tropical forests play a pivotal role in global climate regulation, avoided deforestation has been excluded as a Clean Development Mechanism (CDM) category in the UNFCCC’s first commitment period for various reasons: concerns that through forest conservation Annex 1 country’s could meet targets without cutting emissions (Fearnside 2001) and due to difficulties in resolving methodological problems (Yamin and Depledge 2004). As a result, there is not current legal framework that contains a mechanism to reward avoiding to deforest. Rather, tree plantations,

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$^1$ Other GHGs associated with deforestation are CH$_4$, N$_2$O, and CO (see IPCC 2000).

$^2$ The true emissions for tropical deforestation are unknown. They range from between 0.7Gt CO$_2$e to 8Gt CO$_2$e.
afforestation and reforestation (A/R) project, are the only forestry projects approved under the CDM. In any event, for the first commitment period the annual additions of CERs from sink projects is CDM is capped at 1 percent of an Annex 1 country’s base-year emissions, which severely limits the outsourcing of emissions reduction.

On December 7, 2005 leading up to COP11 in Montreal, Papua New Guinea and Costa Rica, representing the newly formed Coalition of Rainforest Nations\(^3\), presented their submission entitled “Reducing Emissions From Deforestation in Developing Countries: Approaches to Simulate Action.” It called for the inclusion of AD in the climate change regime going forward and suggested the creation of a new protocol to encourage AD or the inclusion of AD in the KP with a mechanism to allow carbon saved through AD in developing countries to be traded internationally and the credits used by Annex 1 countries to meet their commitments. Credits are generated by first creating national baseline rate of deforestation over a commitment period and any reductions that are achieved below the baseline level could then be sold under a carbon market. No trading would occur if the nation were above the baseline. In any event, this proposal must be seen in the context of post-Kyoto, 2012 and beyond, as end of KP’s first commitment period. Negotiations will soon begin for the second commitment period, where the possibility of modifying the regime to include a mechanism for compensated reduction\(^4\) in deforestation exists.

\(^3\) Submission by the governments of Bolivia, Costa Rica, Nicaragua, and Papua New Guinea, supported by the Central African Republic, the Dominican Republic and the Solomon Islands.

The idea of including AD in the post-Kyoto regime “assumes an even greater importance in light of the broadening debate about a more significant participation by developing countries in the future climate regimes” (Ebeling 2006). If current trends continue, emissions from present-day developing countries will be more than triple by 2050, accounting for more than two thirds of a more than twice 1995 global emissions (Ebeling 2006) (see Figure 1).

Figure 1 - Projected greenhouse gas emissions in different world regions
Source: (Ebeling 2006)

By including “developing countries into global mitigation efforts through a mechanism for avoided deforestation might entice other industrialized countries to join a post-2012 climate regime – while at the same time creating a major new and potentially cheap option for abating emissions”(Ebeling 2006). Moreover, according to many authors and government submissions, AD could be used to have countries accept larger commitments than they would otherwise have, thereby further reducing global carbon emissions (Fearnside 2005; P. Moutinho 2005).
Feasibility of Avoiding Deforestation in Latin America
1.2. **Avoided Deforestation and the Kyoto Protocol**

The UNFCCC was negotiated and signed in 1992 at the Rio Earth Summit, together with the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Biodiversity (CBD), with the ultimate objective of the to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

The Kyoto protocol to the UNFCCC is a legal framework that introduced binding GHG emissions targets at an average of five percent below 1990 (base year) levels for industrialized (Annex I) countries. The targets are to be met during KP’s first commitment period from 2008-2012. The target follows the principle of common but differentiated responsibilities, by which the historical polluters initiates emissions reductions. Although developing (non-Annex I) countries have made a general commitment to reduce their emissions during the first commitment period, reductions are not binding as their obligations have not been quantified.

As location of abetment measure is climatically irrelevant, the cheapest mitigatory actions should be taken wherever possible. In order to reduce the cost of compliance the idea that Annex I countries with different “compliance costs could cooperate in a jointly implementing mitigation measures beyond their territory was accepted in the convention” (Yamin and Depledge 2004). AD is a highly cost-effective way of reducing greenhouse gas emissions and has the potential to offer significant reductions fairly quickly (Stern 2007), but the KP provided clarity by including three distinct mechanism allowing Annex I countries to achieve their emissions commitments by undertaking,

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5 FCCC, Article 3.3, chapter 1, and FCCC Article 4.2 (a) and (d), chapter 5
financing or purchasing emissions reductions generated extra-nationally. These flexible mechanisms are (see Table 1):

- **Clean Development Mechanism (CDM)**, allows for the crediting of projects implemented by Annex I countries in the developing world.
- **Emissions trading**, allows for the trading of emissions credits between Annex I countries. They are generated as a result of the achievement of lower than Kyoto target emissions in one country and sold to another.
- **Joint Implementation (JI)**, allows for emissions projects to be credited between Annex I countries.

<table>
<thead>
<tr>
<th>Project-related Mechanisms</th>
<th>Name</th>
<th>Article 6/Joint Implementation</th>
<th>Annex I - Annex I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorized Legal Entities</td>
<td>Yes</td>
<td>ERU</td>
<td>Yes</td>
</tr>
<tr>
<td>Kyoto unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit fungibility</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit use restrictions</td>
<td>Refrain from using ERUs from nuclear facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit carry-over</td>
<td>Yes - 2.5% of a Party's assigned amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit availability</td>
<td>2008 – 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coverage of activities</td>
<td>All Kyoto eligible sources and LULUCF activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsible institution</td>
<td>Accredited independent entities, Article 6 supervisory committee</td>
<td></td>
<td></td>
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</tbody>
</table>

Credits generated by CDM are credited using certified emissions credits (CERs). CERs are developed in order to help developed countries meet their emission targets. They are fully interchangeable (fungible) with other carbon credits (IPCC 2000; Yamin and Depledge 2004). There exist various types of CERs, which differ in their only in their expiry. There are permanent CERs and temporary tCERs, which were developed for the forestry sector, and place a “replacement liability” on the buyer (Pedroni 2005). Under the current climate change regime the conservation of tropical forests cannot be used to
generate credits, only new forest plantation projects qualify under the CDM rules. Even so, as mentioned above, CDM is caped at 1%, limiting the capacity that sink projects could potentially have.

The opposition in setting clear limits to deforestation or and for the exclusion of forest conservation in the CDM is due to many different factors. The Marrakech Accords of 2001 focused primarily on sinks rather than sources with regards to LUC. There seemed to be a “disregard for the actual and potential function of existing tropical forests as an enormous source of carbon and trace gas emission through deforestation and land-use change” (P. Moutinho 2005). The policy discussions focused on tree plantations as sinks, ignoring that LUC is a major source of GHGs. At the end of the conference a compromise was brokered to only include A/R projects under CDM. This was due to the fear that cheap AD carbon credits would flood the market, that forestry activities would crowd out other mitigatory actions, that leakage – the displacement of emission-generating activities outside a project’s boundaries – would occur, and so on. In all, it was felt that AD as it was presented in Marrakech would no ensure climate benefit.

As mentioned above, the Rainforest Coalition’s submission at COP 11 to the UNFCCC added a fresh perspective to AD. The submission highlights the context that the UNFCCC provides for addressing emissions from tropical deforestation but continues to say that the UNFCCC has neither the mandate nor an incentive for reducing emissions from tropical deforestation. As a result, the proposal aims to have AD credits trading on a global carbon market, by opening the CDM mechanism to AD or to develop a new protocol.

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6 UNFCCC Articles 1.9, 3.3, 4.1(c) and (d).
The approach suggested to curb deforestation is called compensated reduction and is prevalent throughout the literature (P. Moutinho 2005; Santilli, Moutinho et al. 2005; Ebeling 2006; Stern 2007). As mentioned above, it is a mechanism which would reward though country’s who deforest below a previously establish baseline, based on a historical national deforestation rates (see Figure 2). Changes in forest cover would be measured using remote sensing techniques, such as the use of satellite imagery. The amount of deforestation that was avoided is the difference between the baseline rate of deforestation and the new year’s rate, with the participating countries being issued internationally tradable emissions credits. To ensure permanence there would be the establishment of a carbon backing mechanism that credits early action and debits compliance failures. Participating countries would have to make a “continued effort” to stabilize and reduce emissions from deforestation going forward (Coalition 2005).

In contrast to CDM, nations participating in CR have full control over their emissions reductions and participation in such scheme; where funding in international and implementation is national. National-level policies and measures span a wide range of “options from command-and-control approaches to market-based incentives, and they could consist of the strict enforcement of land-use regulations to sophisticated schemes of payment for environmental services.
Since the Montreal AD proposal there has been a flurry of meeting, consultation, conferences, workshops and so on. There have been numerous submissions by governments, NGOs and IGO. All of this action is being conducted with the expressed intent of including AD in the next commitment period. In May 2007 in Bonn there will be a Subsidiary Body for Scientific and Technological Advice of the UNFCCC (SBSTA) conference to determine the fate of AD with respect to the KP. There seems to have been a paradigm shift in the climate change regime towards acceptance of AD as a mechanism that could contribute to the mitigation of climate change. The CR circumvents many of the problems with project-based approaches and provides vast synergistic benefits by linking environmental protection to emissions reduction in the developing world. However, there are serious political, social and economic hurdles that need to be overcome.

1.3. Research Objectives and Hypothesis

The purpose of this paper is to identify and assess the magnitude of the political, social, economic hurdles facing the successful implementation of AD policies in Latin America. While CR proposal is a step in the right direction there are still many questions
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and problems that need to be addressed. Potential obstacles range from how best to ensure climatic benefit to what type of payment mechanism will be employed to what political climate is conducive to AD and so on. The challenge to resolve both technical issues and the political and economic issues is far from complete. But given enough political will and high enough perceived benefits, technical challenges and disagreements may just fade. This paper will attempt to determine whether AD in Latin America is a politically desirable and an economically feasible policy.

Based on the readings and preliminary discussions we had before delving into this paper, we hypothesized that avoiding deforestation is difficult but possible.
2. Research Approach

2.1. Methodology

This thesis follows a mixed-methods approach and incorporates a literature review, various interviews, economic modeling, and analysis of submissions to the UNFCCC were also conducted (Crestwell 2003). We reviewed Latin American submissions in various stages of their internal negotiations, spoke with individuals involved with accrediting projects and with government bureaucrats and ministers to identify where the major obstacles facing AD are and how best to remove them. A list of all information gathered cannot be traced back to the individual interviewees and we used no standardized questionnaires where used.

2.2. Limitations

Limitations of research for this paper arose mainly for the lack of primary information about the social desirability of AD. Our research started at the ANAM offices in Panama City and ‘snowballed,’ we spoke with individuals for many different departments and then their counterparts at MIDA. As we did not conduct standardized interviews or even engage individuals from all the various stakeholding groups in this paper’s section of social attractiveness may be lacking somewhat. We were however able to secure informal interviews within the political structure of Panama, which lent itself well to the discussion.
Table 2 - Interviewee sampling by stakeholder group

<table>
<thead>
<tr>
<th>Stakeholder group</th>
<th>Sample size (N)</th>
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<tbody>
<tr>
<td>Government agencies</td>
<td>3</td>
</tr>
<tr>
<td>Research organization and universities</td>
<td>3</td>
</tr>
<tr>
<td>NGO</td>
<td>0</td>
</tr>
<tr>
<td>IGO</td>
<td>0, 1 not on record</td>
</tr>
<tr>
<td>Private sector consultancies, Project developers</td>
<td>2</td>
</tr>
<tr>
<td>Citizens groups</td>
<td>0</td>
</tr>
</tbody>
</table>

Initial contact with informants was established either through email where we outlined the purpose of the study and identified ourselves as university students. As our stay in Panama progressed we were introduced to various individuals and our first contact was established then. Interviews were all conducted in person and the location preferred by the interviewee in English, French or Spanish.

2.3. Philosophical Considerations

Our research and analysis was as objective as it could be. Nevertheless, we recognize that all research is subjective, to some extent, and that our work was conducted through cultural lenses different from those that an AD policy would directly affect. It is therefore critical that our paper be read in that light.

Good research ethics are critical to performing good research. As a result, while preparing, researching and writing our report we have followed the “McGill University Policy on Research Ethics” as prepared by the Research Policy Committee of the Faculty of Graduate Studies and Research.
3. Is AD Politically Attractive and Socially Desirable?:

Case Study Panama

3.1. Overview

Humans depend on forest ecosystems for their well-being. Any new government policies that are drawn up, which could potentially limit access to those resources, those affected, the stakeholders, must be consulted. The following section will attempt to describe the social and political conditions that need to exist in Latin America before which the successful implementation of national avoided deforestation policies are possible.

Figure 3 shows how such a political and social reformation process could potentially unfold. What is interesting to note are the synergistic benefits associated with the changes that allow AD to occur. Benefits include: Establishment of good governance, institutional reforms, intra-governmental cooperation, poverty alleviation, carbon sequestration and so on. Moreover, the following section will analyze the difficulties associated with conforming to the tenants suggested by Figure 3 and make suggestions to overcome the political obstacles facing in Latin America. These obstacles are presented and demonstrated in the context of Panama.
3.2. Good governance

Good governance is the first requirement to establishing an appropriate political climate under which AD will be successful. It is defined as “the process of decision-making and the process by which decisions are implemented” (UNESCAP). Study characterizes good governance using eight major indicators which are participation, rule of law, transparency, responsiveness, consensus orientation, equity and inclusiveness, efficiency and finally accountability (Kaufmann, Kraay et al. 2005). Achieving good governance would mean satisfaction of all the criteria above. This situation would “assure that corruption is minimized [and] that the views of minorities are taken into account and that the voices of the most vulnerable in society are heard in decision-making” (UNESCAP). Involvement of stakeholders who depend on a resource such as
the forest would most certainly have an impact on management strategy, such as an AD policy. Moreover, corruption minimization would allow for increased efficiency of management plan as it allows for capital to flow to the appropriate recipient. These characteristics of good governance would favour successful implementation of policies necessary to achieve a conservation goal such as avoidance of deforestation.

3.3. Institutional reform

As institutions govern the daily lives of citizens, reforming those institutions would change the ways that citizens interact with their environment. This relationship could be used to reform institutions so that an intuition’s environmental management strategies could be employed. With particular interest to avoiding deforestation, these modifications consist in new policies or economic incentive that would favor sustainable development, alleviate poverty, improve technologies, and remove incentive to deforest.

There is a need to reform the national institutions in Panama, which are currently divided and inefficient. According to a 2004 report by the Economist, “historically the effectiveness of policy making [in Panama] is compromised by vested interests, corruption and a lack of will on the part of the government to pursue structural reforms” (Unit 2006) While collecting data for this paper, we were working at ANAM and can say we saw these practices first hand, how the countries policies are shaped around the needs of the elite rather than around the needs of the people and the land.

The Authority that has the mandate of protecting the environment is ANAM (Autoridad National del Ambiante). Observation made in the ANAM offices illustrates the lack of efficiency of the institution mainly entailed by the deficiency of the communication system; internet and telephone access is sporadic at best, and for two
weeks in March and April the forestry department at ANAM did not have either a phone or internet connection, although all the employees had brand new Dell computers. Reform, in this case, would seek to increase efficiency in achieving conservation goal by improving organization and minimizing corruption, which would allow for reorientation of policies to new targets.

Institutional reform could consist in decentralization of power. This concept, omnipresent in development literature, is defined as any political act in which a central government formally cedes powers to actors and institutions at lower levels in a political-administrative and territorial hierarchy (Ribot, Agrawal et al. 2005). It is thought to improve efficiency of policies and achievement of any management goal. Practically this could favor public involvement in conservation issues and lead to creation of a management plan that would slow down deforestation. Although decentralization is very interesting avenue to explore, it is important to mention that the outcome to decentralization are uncertain and highly dependant on political climate (Chomitz 2005; Ribot, Agrawal et al. 2005; Veron and Williams 2006).

3.4. **Intragovernmental Cooperation**

In keeping with the ideas stemming from good governance, institutional reform would also mean a reinforcement of the ability of the central government to create consensus among the authorities and ministry and achieve goals such as forest conservation, which is why the following section related to intragovernmental cooperation.

In Panama, there is a chronic lack of consensus, cooperation, and communication between MIDA (Ministerio de Desarrollo Agropecuario) and ANAM. While both
government departments work on land-use management issues, they both have wildly
different perceptions on how best to use the land to tackle development issues. These
differences directly influence their land management strategies. MIDA’s view is that
deforestation is an issue of lesser importance as there exists economic incentive for
reforestation in Panama and that a large proportion of the territory is under national
protection. However, ANAM argues that deforestation goes on at a high rate even in the
protected area and that reforestation is never near to correspond to deforestation rate
(ANAM 2004).

This opposition in perception is illustrated by the contradiction of agenda between
the two parties concerning the expansion of the agricultural frontier. The efficiency to
put in practice their land management strategies is strongly influenced by asymmetry in
power between the two institutions. ANAM is an authority whereas MIDA is a ministry.
A ministry has the right to vote in the cabinet for the adoption of laws whereas an
authority does not. Therefore, even though ANAM’s goal, in that chapter is to protect
national land from deforestation, it does not have the political and economic strength to
compete with MIDA.

MIDA want Panama to become a net-exported of cattle. Their view is that this
industry is the one they can be the most competitive in because there is no need for
provision of grain to the farmed animals (comm. Olmedo Espino R.). Even though,
Panama is currently a net importer of beef, they wish to reverse the situation by reducing
national demand for beef, through taxation of beef product for local consumption (IBTM,

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7 It is worth noting that unlike other cattle exporting countries, Panama does not have the
agricultural base to feed the cattle, as a result all cattle must be grazed. Grazing in
Panama requires 5 cattle per hectare for a good yield, some part of the country it is 0.1
cattle per hectare.
Impuesto sobre las Transferencias de Bienes Corporales Muebles) and by augmenting production through many economical incentives such as ley 2, 3, 25 which are discussed later. The national grain industry being not as productive as in the US, Panama cannot compete with them and an increased dependence on the international market ensues. MIDA contributes to the development of the cattle industry for two main reasons. Firstly, they believe that this could allow them to fortify their economy in the long run as it would decrease their dependence on international market. Secondly, there are powerful lobby that strongly benefits from growth of the industry. In the opposition clan, ANAM considers that Panama land use will most likely contribute to the impoverishment of the next generations through environmental deterioration and degradation of Panama’s heritage and richness. The current legislative system as well as “ANAM's limited budget for protected area management constrains current efforts to protect these critical areas” (USAID). This asymmetry of power is undesired on a sustainability point of view as it results in an inability to address the challenges of forest conservation.

An avenue to resolve the issue of lack of cooperation could be international community help to provide an incentive for different institutions such as MIDA and ANAM to make synergistic efforts toward the achievement of the latter’s forest conservation goal and the former’s economic sustainability goal. Positive developments have been occurring in the AD chapter as World Bank is setting up a pilot project of Productividad Rural. This program aims to alleviate poverty and improve technology while preserving forest resources. This consists of a loan of at least 30 millions $ which would seek cooperation between MIDA and ANAM (comm. Catherine Potvin). Collaboration between institutions would allow for efficient conservation of forest and
progress toward realization of sustainability goal by preventing occurrence of conflicting economic incentive.

### 3.5 Strategies to Slow Deforestation

#### 3.5.1. Overview

The management strategy should ultimately favor sustainable development of agriculture alleviate poverty and favor preservation of forest. These should include on one hand establishment of clear property right and on the other hand adoption of new policies that would alleviate poverty, improve technology and ultimately sustainable use of the land (Stern 2007).

#### 3.5.2. New Economic Incentives and Policies

**Economic incentives**

There is a necessity for Panama to change economic incentive in order to encourage alternative economic activities that would allow for conservation of forest. Panama must modify existing legislation in order to limit the expansion of the agricultural frontier to the extent to which conservation of forest is desired. Tax shelters and economic incentives to cattle ranchers exist in laws such as: LEY NO.2; 20 de marzo 1986, LEY NO. 3, 20 de marzo de 1986, LEY 25; 30 de noviembre de 1992 (Vicomex). These shelters act as incentives to increase the rate of cattle ranching start-ups in panama. A case in Brazil suggests that this situation favors asymmetric competition between small and big producer for land, characterized by land ownership concentration. This phenomenon concentration is clearly occurring in Panama, according to the Economist Intelligence Units, leads to an increased rate of conversion of forest to crop land or pasture (Binswanger 1991).
Payment for preservation of forest would be a cost effective way to ensure conservation. It also has a potential to alleviate poverty as the permanence criteria of a PES requires that poverty be alleviated if it represent a treat to the conservation of forest (Wunder 2005). In Panama, it would mean to provide the campesino with the forest resource he is dependant on or a substitute. Compensation would have to be coupled with a rural work program that would keep the farmers from exploiting the frontier and further deforest. Another way to proceed would be to provide subsidies to improve technologies and allow subsistence farmer to harvest their land sustainably without having to clear new parcels of land.

**Technologies**

Improvement in technology allow for increase in productivity and sustainability of the land. This would mainly consist of improved access of modern technology to small farmers. Policies may be needed to overcome the barrier of adoption of greener agriculture which may be associated with a greater cost and risk for the farmer (Chomitz 2005).

In Panama, subsidies to improve efficiency of production are largely targeted to the rich owner because in order to get access to subsidies one has to own land. Even though there is currently massive distribution of land title in Panama, the reality is still that a great minority of the population owns the majority of the land and power. Therefore, the money does not usually get to the poor (Melgarejo 2007).

An other issue to consider is that even though the rural poor is provided with technological and financial means to sustainably cultivate their land, it does not mean that it will do so. There must be effort invested in education of the peasant in insure proper management of the land.
Recent studies carried out in Panama propose methods such as improved crop-fallow agriculture (Tschakert, Coomes et al. 2007), or agroforestry (Fisher and Vasseur 2000) to improve sustainability of land. Another avenue would be the use of higher yield and more tolerant crop that would limit conversion of forested land into agricultural land (Chomitz 2005).

3.5.3. Establishment of Clear Property Rights

The forest that is under secure land ownership is more likely to be sustainably managed as it provides the owner with incentive to preserve the land as well as means to do so.

The massive distribution of land title in Panama consists of programs that aim to secure ownership of the land. PRONAT (Programa Nacional de Administración de Tierras) is the national institution that serves this purpose. It was instituted by the minister of economy and finance of Panama and financed by the World Bank, the program execution period 2001-2006 (UNDP). This program grants to every landowner access to credit and provides them with legal right over their land. With particular interest to avoidance of deforestation, the ultimate goal of land titling is to alleviate poverty and provide means to peasant to sustainably harvest their land. Study show that land security favors long term sustainable investment by the campesino as the long-term payout would be greater and the discount rate lower (Nelson, Harris et al. 2001). Land security also serves a political stability purpose as “clarification over boundaries and ownership, and allocation of property right that is regarded as right by the communities will enhance the effectiveness of property right in practice and strengthen the institution
required to support end enforce them” (Stern 2007). In other words, involvement of the stakeholders would provide legitimacy to the institutional system.

**Distribution of land title and conservation of forest:**

There exist strong incentives for forest conservation in the canal watershed as it provides more than 95% of drinking water in Panama and allow for proper functioning of the Canal (the Economist intelligence). ACP (Autoridad Canal de Panama)’s forest management plan included enforcement of clear property right. The distribution of land title led to poverty alleviation coupled with conservation of the forest cover. Quantitative evidence of satellite images show that the forest cover did not significantly change and that conservation effort were effective (Presentation Sir Bourdett, ACP). This suggests that forest management plan can be carried out in Panama when there is a real political will to do so.

The situation is different in the Darien where the deforestation is enormous compared to the rest of the country. MIDA plays a role in the massive issuing of land title in this area (see A.3) as their goal is to promote development of cattle ranching industry which is facilitated by securing of land ownership. This is followed by an increase in deforestation. According to ANAM this is because national lands get privatized, excluding ANAM of any management plan in those particular forests (Melgarejo 2007). However, a study carried out in the Parque National Darien concluded that “legal protection of a national park seems to have made little difference to land use within the park” (Nelson, Harris et al. 2001). Rather, the geographic proprieties and accessibility to resource influenced deforestation rate. This suggests that, even though there seems to exist a direct link between disempowerment of ANAM in the region and deforestation
rate, the real issue really is the choices that the nation takes in terms of land use, road infrastructure and economic development.

Zoning in function of land potential would permit maximization of biodiversity and economic benefits. The information can be used by landowner or by government to make a choice in term of land use and development of road placement, protected area ect. This plan would have to be done while taken in account the human dimension as public participation is necessary to ensure effective enforcement of conservation effort. This situation exists in the canal watershed where public acceptance of the conservation program favored sustainability of land use (presentation of Sir Bordett ACP).

### 3.6. Sustainable Land-Use and Development

**What is a sustainable land use?**

Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (FAO). Sustainability of land use would allow for feasibility of AD as it promotes conservation of the forest and enhance well-being of the population that depends of it. IUCN sustainability criteria include human as well as ecological wellbeing components. A project is thought as sustainable when it maximizes the human population and ecosystem wellbeing. As such, a land that is managed sustainably is a land that will be able to provide resources in the long run for human population. As a consequence, there will be no need for the subsistence peasant, provided with a sustainable living, to deforest. This would lead to a decrease in pressure on the forest ecosystem and possibly an avoidance of deforestation. Therefore human wellbeing is closely linked to ecosystem well-being.

**Sustainability and Social desirability of AD**
One could perceive land use such as national park as sustainable but it is only to the extent that it allows for local population’s sustainability. In Panama, 24% of the landmass is enclosed in protected areas (Fisher and Vasseur 2000). Given that protection of land would further limit accessibility of forest resource to the rural poor, is forest preservation socially desirable? It is as long as it would not contribute to exacerbate rural poverty. An unsustainable situation is illustrated in a case of Aguas Claras, a community situated in the buffer zone of the Canal Watershed between a teak plantation and a protected forest area. The community members are highly informed about the importance of forest conservation but provided with little mean to compensate for their need in forest resource. Ensuing poor living conditions have led to massive migration of villagers to the city (pers com Zena Wright). This phenomenon further increases pressure on cities infrastructures and exacerbates poverty. This reinforces the idea that when opting for conservation land use, government has to think about the populations that are dependent on this resource and provide them with compensation.

An example of sustainable management of the land would be a land use plan that would use native species to convert degraded fallow land into an Agro-forestry project. Biological sustainability would be insured by benefits in terms of water availability, erosion regulation, biodiversity etc. Social sustainability would be insured, as the project would also provide jobs, health and educational benefits. Study carried out in Ipeti-Emberá, Panama, also demonstrates, through economic analysis, attractiveness of AD as a mean achieve those goals (Coomes, Grimard et al. submitted August 16, 2006).

In conclusion, AD is desirable to the extent that land-use changes required for carbon sequestration coincide with those required for poverty alleviation and sustainability creating a synergy when meeting both objectives. Social desirability of AD
Feasibility of Avoiding Deforestation in Latin America

may be achieved but is highly dependant on political will and ability of the government to modify their structure to allow for sustainable resource management.
4. Economic Feasibility of AD in Latin America

4.1 Overview

After having established that avoiding deforestation in Latin America is a politically difficult task, which first requires structural, policy and attitude changes both from the government and the people in order for AD to be successful, we must now determine whether AD in Latin America is a financially sound venture.

This was done by first calculating and determining the deforestation rate, carbon in biomass and land’s opportunity costs for Colombia, Honduras, Mexico, Panama and Peru where determined and by then constructing economic models of deforestation reductions of 5000ha, 25% and 50%. We then calculated 1%, 5%, 10%, 15%, 25% the total base-year emissions of all Annex I countries and calculated the total emissions radiative and non-radiative of international aviation and navigation as potential sources of demand for those future AD credits were identified. Following that we described and provide concrete examples the different financial mechanism of implementations available for a compensated reduction scheme in Latin America. We finally made our recommendations as to whether AD is economically feasible.

The pathway of economic feasibility of AD can be seen in Figure 3. For AD to be a viable option to agriculture in Latin America, every item in the pathway needs to be satisfied.
4.2. Assessment of Carbon Stocks

Latin America has been looked at an ideal starting point for AD initiative since it represents a significant carbon sink accounting for about a quarter of the worldwide forest cover. In order to assess the supply of carbon in Latin America the carbon in biomass, land’s opportunity cost and the deforestation rates need to be determined. For this we calculated those of Colombia, Honduras, Mexico, Panama and Peru and the results can be found in Table 3.
Table 3 - Supply metrics

<table>
<thead>
<tr>
<th>Country</th>
<th>Annual average deforestation (ha)</th>
<th>Carbon in biomass (tC/ha)</th>
<th>Opportunity costs (US$/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>190000</td>
<td>98.0</td>
<td>37.50</td>
</tr>
<tr>
<td>Honduras</td>
<td>65920</td>
<td>52.5</td>
<td>289.36</td>
</tr>
<tr>
<td>Mexico</td>
<td>938000</td>
<td>27.0</td>
<td>30.00</td>
</tr>
<tr>
<td>Panama</td>
<td>52000</td>
<td>161.0</td>
<td>61.00</td>
</tr>
<tr>
<td>Peru</td>
<td>260000</td>
<td>122.50</td>
<td>1627.00</td>
</tr>
</tbody>
</table>

It is important to note the wide discrepancies between both the opportunity costs and the carbon in biomass. The variation in opportunity costs ranges from $30 to $1627. This is due to the types of agriculture selected to be included as a country’s opportunity cost (see table 4).

Table 4 - Land-use and opportunity costs

<table>
<thead>
<tr>
<th>Country</th>
<th>Opportunity cost (US$)</th>
<th>Land-use type</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>37.50</td>
<td>Pilot project to increase biodiversity in pastures</td>
<td>World Bank project</td>
</tr>
<tr>
<td>Honduras</td>
<td>289.36</td>
<td>Payment for environmental services and watershed maintenance</td>
<td>(Anguita, Cruz et al. 2006)</td>
</tr>
<tr>
<td>Mexico</td>
<td>30.00</td>
<td>Payment for hydrological services</td>
<td>(Alix</td>
</tr>
<tr>
<td>Panama</td>
<td>61.00</td>
<td>Subsistence cattle ranching</td>
<td>(Coomes, Grimard et al. submitted Augest 16, 2021)</td>
</tr>
<tr>
<td>Peru</td>
<td>1627.00</td>
<td>Intensively farmed crops</td>
<td>(Pinedo</td>
</tr>
</tbody>
</table>

Land opportunity costs have a direct and linear effect on land-use, making conservation tremendously difficult, if not impossible, in areas where highly profitable ventures already exist (see Figure 4). The differences in opportunity costs are clearly seen with the values used and the use of these values have wide ranging consequence on the results of this paper. If for example subsistence ranching in Panama has only a $61 per ha net-benefit to the landholder, a large-scale rancher who generates $1000s per hectare would not want to participate in such a scheme and not every farm in Peru generates more than $1600 per ha.
The relationship between profitability and carbon emissions from deforestation depends on three factors: the amount of carbon in biomass, the opportunity cost of the land and the financial difference between the present land-use and the alternative incentive. In many cases AD is more profitable than agriculture. Figure 5 shows that by pricing carbon at $5tn only farmer in Honduras and Peru are profitable, whereas Farmers in Colombia, Mexico and Panama would be more financially viable if they were to sell AD credits. When carbon is priced at $10tn only Peruvian farmers are profitable. It is important to keep in mind that that the weighted average of carbon market prices in 2004-2005 was $5.63tC. Another way to look at Figure 5 is, as Chomitz put it, “is worth while, after allowing for the damages caused by carbon release, to convert forest to [low value] uses” (Chomitz 2005).
Having established the opportunity costs, carbon in biomass and deforestation rates, for the countries we worked with, economic models were made to determine the quantify of carbon emissions abated and potential income that could be gained by cutting the rate of deforestation by 5000ha per year and 25 and 50 percent within a decade (see Table 4). 5000ha per year was chosen on the advice of the head forester of Panama as a difficult but achievable reduction target (Melgarejo 2007), the 50 percent was chosen based on the report prepared for the Stern Review of the economics of climate change (Grieg-Gran 2006; Stern 2007) and the 25 percent was chosen as it is a more conservative target for AD and it is a proportional measurement. The data (see Table 4) is used to compare supply, carbon emissions mitigated, with demand, which will follow in the next section.
Table 5 - Summary of five countries' metrics

<table>
<thead>
<tr>
<th>Deforestation reduction by:</th>
<th>Quantity of land that avoided deforestation</th>
<th>Potential income</th>
<th>Carbon emissions mitigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>less 5000 ha per year</td>
<td>250000</td>
<td>102243000</td>
<td>23050000</td>
</tr>
<tr>
<td>less 25% in 10 years</td>
<td>376480</td>
<td>120132903</td>
<td>21907200</td>
</tr>
<tr>
<td>Less 50% in ten years</td>
<td>752960</td>
<td>240265806</td>
<td>43814400</td>
</tr>
<tr>
<td>Halt in deforestation</td>
<td>1505920</td>
<td>480531612</td>
<td>87628800</td>
</tr>
</tbody>
</table>

In order to better understanding of the magnitude of emissions from deforestation in the five countries under study; Table 5 presents the total annual carbon emissions from deforestation. The sum of the carbon emissions from the five countries from deforestation represents 1.1 percent of global emissions from deforestation. By comparison Brazil and Indonesia equal four-fifths of the emissions reductions gained by implementing the KP in the first commitment period (Santilli, Moutinho et al. 2005). Even if 98.9% deforestation take place outside of our study site, the site contains more than 7% of the plant’s biodiversity and has many other characteristics that are under threat from deforestation.

Table 6 – Annual carbon emissions from deforestation

<table>
<thead>
<tr>
<th>Country</th>
<th>Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>0.01862</td>
</tr>
<tr>
<td>Honduras</td>
<td>0.0034608</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.025326</td>
</tr>
<tr>
<td>Panama</td>
<td>0.008372</td>
</tr>
<tr>
<td>Peru</td>
<td>0.03185</td>
</tr>
</tbody>
</table>

Emissions from deforestation: **0.0876288**

4.3. **Assessment of Carbon Demand**
Having assessed demand at no more than 0.0876Gt per year (0.2% of global carbon output), we can now look for potential buyers of AD credits. For this paper two sources were identified: increase of the CDM cap from 1 percent to 5, 10, 15 or 25 percent and following the call made by Jacques Chirac for a “green revolution” assessed the carbon output by international aviation and navigation. The results of the demand assessment can be seen in Figure 6.

**Figure 7 - Supply and demand of carbon**

**4.3.1. CDM Cap Manipulations**

As explained above the CDM, or more specifically the used of CERs, is caped at 1% of baseline year’s emission for Annex I countries. Presently only Sink projects are eligible under the CDM and they are restricted to afforestation and reforestation, leaving sources, such as tropical deforestation, uncovered by the CDM. Backroom negotiation for post-Kyoto have undoubtedly begun it seems likely that restrictions to the CDM will be reviewed for the second commitment period. Many authors and government submissions have been explaining that given the inclusion of AD to the CDM Parties to the conference, i.e. both Annex I and potentially non-Annex I countries, would be more likely to accept more stringent emissions targets, as illustrated in Figure 7.
Figure 8 - AD in the CDM may lead to deeper emissions cuts
Adapted from: (Coalition 2007)
NB: REDD is reducing emissions from deforestation in developing countries and will be explained in 4.6.3.

Increase to the cap coupled with the inclusion of AD as a CDM would be a significant source of demand for Latin American carbon. The annual carbon output of the five counties under study amounting to less than 0.0876, which represents a mere 62% of a 1% cap. If the second commitment period were coupled with much larger emissions targets, 20 to 40 percent, with a larger role for CDM, 10 to 25 percent of total emissions, there would be enough excess capacity so that most of topical forests could be conserved.

4.3.2. International aviation and navigation

International aviation and navigation (IAN) is an interesting source of demand for AD credits. IAN accounts for anywhere between 2.8 to greater than 10 percent of global emissions. For accounting purposes to the UNFCCC emissions from domestic navigation and aviation are covered by the transport emissions included in a countries national emissions, while emissions from international aviation and navigation are reported
separately and not counted to a country’s carbon balance sheet. Moreover, under IPCC Guidelines emissions from international aviation are not counted against national emission totals and are not classified under national emissions from transport (IPCC 1997). Emissions from fuel sold to ships or aircraft engaged in international transport are reported by the country where the fuel is loaded but are excluded from that country’s national total (Yamin and Depledge 2004). In other words, all civil domestic flights inside a country are domestic, and ships not engaged in international transport are accounted for nationally, regardless of the length of a journey i.e. Los Angeles to Honolulu.

Under both the UNFCCC and the KP the international Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) will regulate emissions from international bunker fuels, rather than directly under the KP. As a result, the ICAO and the IMO have been leading policy options formations to limit bunker and to “lessen the need for the climate regime to be proactive in the controversial policy issues surrounding allocation and control options” (Yamin and Depledge 2004).

This balance sheet dichotomy raises many questions related to future international emissions accountability, such as, who should be responsible for international transport’s emissions, the country the vessel is registered to, the country the company who owns or leases the vessel or the country which the vessel is going to? The answers to these questions are beyond the scope of this paper, nevertheless they are an interesting topic of discussion and a segue into determining whether AD could function in the climate change regime given international policies that already exist.

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8 Article 2.2 states that Parties to the protocol shall “pursue limitation or reduction of emissions… from aviation and marine bunker fuels, working through ICAO and IMO, respectively.”
In 1999 the Intergovernmental Panel on Climate Change (IPCC) published a report entitled “Aviation and the Global Atmosphere” in it the Panel suggests regulatory and market based approaches to emissions mitigation. One of the possible policy measures suggested by the IPCC report are, “voluntary and mandated policies to reduce emissions internalize to producer or consumer many of the associated environmental costs” (IPCC 1999). The report continues to say that, “emissions trading… enables participants from all industries to cooperatively minimize the cost of reducing emissions” (IPCC 1999) and that it would be the government’s role to set up caps on emissions and rules under which trading could take place. Furthermore, in October 2004 the ICAO published its consolidated statement of continuing policies and practices related to environmental protection. It is this document, and more specifically Resolutions A33-7 Appendices H and I, which have been guiding the environment policies of the ICAO. Resolution A33-7 Parties to the ICAO to “continue to study policy options to limit or reduce the environmental impact of aircraft engine emissions … placing special emphasis on the use of technical solutions while continuing its consideration of market-based measures, and taking into account potential implications for developing as well as developed countries” (ICAO 2004). All of this to say that credits would fit into the policy frameworks for reducing emissions from aviation developed by the IPCC and the ICAO.

On an aside, in researching this document we went to the ICAO headquarters in Montreal to meet with the chairwoman of the ICAO’s environment policy committee, Jane Hupe. Mrs. Hupe is a terribly busy woman who kept one of the authors of this paper waiting for four hours only to have the meeting canceled indefinitely.

As for the shipping industry the IMO published a report in 2000 called, “A Study on Greenhouse Gas Emissions from Ships” noting that improved emissions reporting is
needed to better estimate the impact of shipping globally and that policy options to reduce emissions do exist (IMO 2000). Marine Environment Protection Committee (MEPC) in October 2002 developed a draft resolution on greenhouse gas emissions from ships urging Parties to identify and development mechanism need to “identify and develop the mechanism or mechanisms needed to achieve the limitation or reduction of GHG emissions from international shipping, and in doing so give priority to the establishment of a GHG emission baseline, the development of a methodology to describe the GHG-efficiency of a ship expressed as a GHG-index for that ship, recognizing that CO2 is the main greenhouse gas emitted by ships. [Also, to take] into account related cost-benefit evaluations and verification procedures and be based on an evaluation of technical, operational and market-based solutions” (MEPC 2002)

Before any carbon generated by IAN can be mitigated the type of market and baseline must be first determined. This would bring up serious question such as, will IAN become a separate Party to the convention, functioning as a country with respect to Kyoto, or will IAN be responsible to a new protocol? Again, the answers to such questions are beyond the scope of this paper, but it is clear that the framework policy for AD to be used in IAN. We can now go about calculating the quantity of emissions that IAN are responsible for, establishing a demand.

We opened this section on international aviation and navigation by saying that IAN accounts for anywhere between 2.8 to greater than 10 percent of global emissions. The 8-point gap between the two ends is due to global warming potential (GWP) of certain greenhouse gases. Some GHGs are more powerful per unit of emissions than other in terms of radiative forcing. “GWP provide a common metric to compare and measure the relative radiative forcing of GHGs without directly calculating the changes
in atmospheric concentrations. GHGs are calculated as the ratio of the radiative forcing that would result from the emission of 1 kilogram of greenhouse gas to that from the emission of 1 kilogram of carbon dioxide over a period of time (usually a 100 years)” (Yamin and Depledge 2004), which is the reason why we express emissions as carbon dioxide equivalents (CO$_2$e). With respect to IAN (see Figure 8), the radiative effect if greenhouse gases can be clearly seen, with the difference between the radiative and non-radiative emissions of shipping being much greater than aviation.

Figure 9 - Global warming potential of IAN
Sources: (DCAA 2000; IMO 2000)

Any mitigatory response of the transport industry to their carbon emissions must reflect the full contribution of emissions from aviation to climate change. The implications of taking into account the radiative effects of GHGs are tremendous. As we stated above, before IAN could buy carbon credits, regardless of the source, bunker fuel needs to be accounted for either in some national inventory scheme or by the creating a Party to the convention representing the emissions of international transport. As most of
the world’s shipping fleet is registered in a few developing nations for tax and labour purposes, under a scheme where vessels registered in a country would have those vessel’s emissions counted towards that country’s target would drastically make it impossible for those countries to meet their targets, such is the case of Bermuda, Liberia and Panama to name a few.

With respect to Latin America, more specifically the 5 countries under study, the use of IAN as a demand source for AD credits is feasible for various reasons. IAN is emitting more than 4.49 Gt CO₂e generating a sizable market for carbon credits. If the 5 countries were half deforestation within a decade, their annual reduction in emissions from deforestation would equal only 9.75 percent of the IAN mitigating 1 percent of its emissions output (see Figure 9). This illustrates the a huge potential demand for carbon credits.

<table>
<thead>
<tr>
<th>Gt CO₂e</th>
<th>Annual quantity of carbon mitigated when deforestation is reduced by 50% reduction over 10 years</th>
<th>1% radiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00438144</td>
<td>0.044932</td>
<td>0.049432</td>
</tr>
</tbody>
</table>

**Figure 10 - Relationship between IAN and AD**

Furthermore, the international regulatory bodies that govern IAN, the ICAO and the IMO, need cost effective options to off set their emissions. The situation is
particularly acute in the aviation industry where they face some of the most difficult challenges in emissions mitigation, “whilst there is potential for incremental improvement is efficiency to continue, more radical options for emissions cuts are very limited” (Stern 2007). Even as air traffic is set to rise by nearly an order of magnitude by 2050 (IPCC 1999), the potential for either the consumers or the produced to internalize the environmental cost associated with their actions opens up a world of possibilities for AD.

4.4. **Risk Assessment**

Just like in the business world, where every good investor knows his or her aversion for risk, so too must countries assess their appetite for risk before choosing an appropriate compensated reduction scheme. Here we define risk as the variation of the price per unit of carbon. Good investors also know to diversify their portfolio, in order to hedge certain types of risk, which is where AD fits in.

In a 2005 Chomitz said, “forest carbon [is] a useful component of a comprehensive climate change mitigation portfolio” (Chomitz 2005). By having access to various sources of carbon credits, such as, AD, A/R, JI, EU ETS and so on, a country is able to balance their exposure to risk. AD complements the basket of credits that already exist as they have the added advantage of providing local and global co-benefits that would be difficult to isolate and finance otherwise. Financing AD means preserving, biodiversity, hydrology, cultural services and other characteristics of forests that are difficult to monetize.
Once the amount of risk a country is willing to accept is quantified, that country is able to look into ways to best ensure climatic benefits, keeping in mind those risks. Which leads us to the next section.

4.5. Ensuring Climate Benefit

4.5.1 Overview

There are many challenges that need to be faced before AD can be effectively integrated into global carbon markets. Many of the obstacles are technical issues, such as additionality leakage, permanence and monitoring that, when given enough political will, can eventually be overcome. Other obstacles include determining how best to include tropical deforestation emissions in terms of the international response to climate change. Based on the amount of risk a country feels it can expose itself to, an appropriate implementation mechanism needs to be employed, be it fund-based, market-based or a hybrid model.

4.5.2. Technical issues

The technical issues that this paper will soon discuss are the issues that have had the largest impact in hampering the reduction of emissions from tropical deforestation. For the most part these objections are what kept AD out of the Marrakech accord, and therefore out of the KP. The technical issues include questions about: additionality, leakage, monitoring, permanence and price. The solution to these issues not only depends on new technologies and old fashion diplomacy but on the type of mechanism chosen by a particular country. Therefore, in this section, we will explain the technical issues as they relate to the mechanisms of implementation.
Additionality

In order for a CDM project to be approved for the generation of CERs, the project must be real, measurable and have long-term benefits related to the mitigation of climate change and when the reductions are additional to any that would occur in the absence of the certified project activity (Yamin and Depledge 2004). Chomitz describes additionality as an “inherently unobservable characteristic of projects” (Chomitz 2002), but this does not stop people from trying to observe it. Additionality tests we drawn up during the Marrakech Accords to prevent CERs from being generated without merit. Paragraph 43 of the Marrakech Accords states that a project is considered to be additional when anthropogenic emissions by sources are reduced below those that would have occurred in the absence of CDM project registration.

All this ties into AD because for AD to be additional one must prove that without it deforestation or degradation would have occurred. This might seem easy enough, but consider the example where the owner of a plot of land applies to an AD project. His land however, has no access roads leading in or out, making agriculture, ranching or forestry impossible. Does this have a right to AD funds? The answer to this is dependent on the type of payment mechanisms that exists. Our question presupposes that it is a project level market based payment mechanism, had the scale of the mechanism been different, like on a national level, whether the man deforested or not would be irrelevant if the country was below its baseline, as explained in the introduction to this paper.

Leakage

The question of leakage arises in AD when someone said, “if you protect Panama’s forest, the Costa Ricans will just cut more of theirs” and “if we stop deforesting in our country, every other country will deforest just a tiny bit more to make up for us.”
Leakage occurs in many contexts where a project acts locally, but has distant repercussions (Chomitz 2005) but it will not be hectare-for-hectare (Chomitz 2002). Chomitz comes to the conclusion that, “leakage will be smaller if other parts of the economy can intensify production and absorb the freed-up capital and labour; and if consumers are relatively sensitive to the price of whatever commodity is affected by the forest project.”

**Monitoring**

In researching for this paper we spent countless hours trying to secure the deforestation rate from government contacts throughout Latin America only to receive the same answers from all of them, “we just don’t know!’ Monitoring is critical for an effective AD policy, after all if you are working with national baselines, how else are you suppose to know at what rate the forests are growing or shrinking? But since the Marrakech Accords satellite and remote-sensing technologies have become more accurate and more cost effective. At the March 2007 UNFCCC AD Workshop in Cairns, Australian deligates agreed that the need for solid monitoring would allow for the replication of results leading to a more cost effective program.

**Permanence**

The three main issues with regards to permanence according to Chomitz and echoed by many national AD submissions to the UNFCCC are:

- That temporary sequestration buys insurance against catastrophe in the face of uncertainty, since we are unaware of the threshold beyond which catastrophe could occur it is best to use the inexpensive tropical forests as cheap insurance.
- That temporary sequestration could buy time until a technological advance occurs and
Feasibility of Avoiding Deforestation in Latin America

- That temporary sequestration might be permanent; as AD could be the forest transition bridge developing countries need to stop putting pressure on forests for small gains.

Source: (Chomitz 2005).

Moreover, traditional insurance could be brought for fires, flood and so on through firms such reforest or new insurance schemes could be develop, such as the establishment of a carbon banking mechanism, which credits early action and debits regression later on before paying out.

Summary

In all, all 5 technical issues are primarily a result of the mechanism of implantation chosen to avoid deforestation. The next section outlines what are the options for Latin America.

4.5.3. Mechanism of implementation

Market-based

The market-based methods have been developed keeping in mind issues prevalent in the discussion of the clean development mechanism: leakage, permanence and additionality. The market mechanisms proposed are associated with baselines developed at the national level to prevent leakage. Based on the difference between Annex 1 countries’ 2004 emission levels of CO2 equivalents and their Kyoto emission targets, non-compliance will represent a massive $5.83 \times 10^{17}$ tCO2e. The ability of Colombia, Honduras, Mexico, Panama and Peru to meet the inevitable demand for CERs based a total cessation of deforestation is limited at 0.713 GtCO2e. Therefore, countries should take on a national voluntary commitment to reduce their deforestation rates in the form of
a reduction target vis-à-vis this national baseline. Developing countries meeting their target would be allowed to trade the achieved emission reductions, coined compensated reduction, through a carbon market.

These market mechanisms are plagued with three main difficulties. First, national baselines are determined using past deforestation rates create a premium for countries who massively deforested in the 1980’s and where remaining forested areas are hard to access and a disadvantage for countries who never did deforest on a large scale. Second, the proposed mechanisms link the market approach to the achievement of national commitments. Yet, the income, to be generated by the market, will be uncertain. The investor’s risk associated with a market-based approach will be downloaded to governments who would have to accept a national commitment to participate. Finally, falling prices could imply that a government program would no longer be able to pay the opportunity costs, honor contracts signed with private forest owners, displaced farmers, etc. which may lead to the inability to meet the REDD target

**Fund-base**

Fund-based or non-market instruments carry a more conservative carbon accounting system with lower performance standards than a market-based approach, which intern causes non-market instruments to fetch a lower price per ton.

This mechanism circumvents the difficulty of national baseline and the limitation of relying on a carbon market plagued with uncertainty. However, a major difficulty with these fund-based mechanisms is that no effort has been made by the proponents to identify a constant and sufficient source of funding to replenish them. Without an effort to determine appropriate source of replenishment we believe that these fund-based
Feasibility of Avoiding Deforestation in Latin America

mechanisms will unlikely provide sufficient amount of resources to stimulate REDD action. The Stockholm Conference on environment and development (1992) estimated that US$ 30,000,000,000 would be needed to sustainably manage the world’s tropical forests. Moreover, it is believed that the forestry sector only receives 27% of that amount (FAO 1997).

**Hybrid**

Our analysis suggests that none of the mechanisms proposed to date could stimulate action to reduce emissions coming from deforestation. We suggest that flexible mechanisms need to be designed to allow countries with diverse national circumstances to participate. We envision the possibility of REDD based on both on a fund and market-based approaches at the project level. The fund could serve for prompt start pilot projects, to build-up national capacity and help evaluating the legislative aspects of REDD, etc. Replenishment of such fund would need to be tied to UNFCCC and the Kyoto Protocol in order to ensure a predictable flow of money. Possible sources of replenishment that should be examined are: non-compliance of Annex 1 countries, international aviation, taxes on petroleum goods. The cost should be viewed by Annex 1 countries as payment for environmental services rendered. Furthermore, it might be possible to design a fund linked to ET or JI in a way similar to the adaptation fund. Without identifying clearly the source of replenishment a fund will not work.

Even if a fund source is identified, it is our belief that the amount of money necessary to offset the cost of avoided deforestation in developing countries will unlikely be generated. Thus countries engaging in REDD will most probably have to do so relying, at least partly, on their national resources. In consequence, we feel that the
international mechanisms should not be based on a target, rather should support the new national initiative on REDD.

We argue that project-based mechanisms should also be part of the tools providing an incentive to countries to reduce the emissions coming from deforestation. However, given the volume of emissions potentially stemming from avoiding deforestation and the associated opportunity cost, we believe that a market mechanism would only be able to stimulate actions if coupled with increased commitments of Annex 1 countries. In their submission to UNFCCC in March 2006, Morocco had already raised that point. Finally, our economical analysis suggests that carbon credits from avoided deforestation are likely to be inexpensive with an off-set cost about half of the price of forest CDM. To avoid market flooding and damages to the flexibility mechanisms, the carbon credits linked with REDD could be flagged for a certain portion of Annex 1 obligations and capped in a way similar to that of LULUCF. Difficulties with additionality, leakage and permanence could be accounted for if the project-based market mechanisms are only accessible to countries who have engage, under the fund, in a national effort to reduce emissions from deforestation. They would be complementary to the actions taken nationally under a fund and would help achieve larger reduction.
5. Conclusion: Is avoiding deforestation socially desirable and economically feasible?

Avoiding deforestation in Latin America is possible, but will not be easy. There must be a politically conducive environment under which AD can exist. Only then can we ask whether or not AD makes financial sense.

In Latin America’s case, more specifically Colombia, Honduras, Mexico, Panama and Peru, AD is economically feasible. There are high amounts of carbon in biomass, the opportunity costs of the land are low and deforestation rates are high. Nevertheless, is no strong political force driving AD from within. AD is policy conceived by Annex I countries so they can reduce emissions in a more cost effective manner. AD may not be desirable in all situations, and the policies described in section 3 are only the means to an AD end.

If AD is to be successful on a grand scale, the desire will have to come from within. Top-down imposition of forestry polices without massive repression are impossible. As long as the rural poor look to the forest for livelihood, deforestation will continue. However, if presented with a viable alternative they could undoubtedly be swayed.

We have identified several areas were no research has been done. By addressing these concerns and obstacles would lead to a swifter adoption of AD by all stakeholders (see A.5.).
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103(35): 13126-13131.


Appendices

A.1. Executive Summary

Feasibility of Avoiding Deforestation in Latin America
Michele Boileau and Jordan Isenberg
STRI and Catherine Potvin

Deforestation is responsible for approximately eighteen percent of anthropogenic CO₂ and is the primary source of emissions in Latin America. Latin America land use change due to tropical deforestation is the largest source of CO₂ emissions. In 1997 the world got together to begin the process of cutting global carbon emissions based on the UN Framework Convention for Climate Change (UNFCCC), for these negotiations the Kyoto Protocol (KP) was born. Nevertheless, avoided deforestation (AD) was excluded as a Clean Development Mechanism (CDM) category. Therefore, as it stands KP neither promotes nor prohibits projects that reduce emissions from tropical deforestation.

The purpose of this paper is to determine whether avoiding deforestation in Latin America is feasible politically, socially and economically. This thesis follows a mixed-methods approach and incorporates a literature review, various interviews, economic modeling, and analysis of submissions to the UNFCCC were also conducted. For the political and social analysis, a framework was created to ameliorate the social context so AD can function. As for the economic feasibility of AD in Colombia, Honduras, Mexico, Panama and Peru was determined. The paper was written in the McGill’s NEO offices at STRI and with informal interviews being conducted in person in Panama City and via phone and email between January and April 2007.

Avoiding deforestation in Latin America will be a politically difficult task, requiring good governance leading to institutional reform and intra-governmental
cooperation, the creation of strategies to slow deforestation, such as new policies and incentives and the establishment of clear property rights. AD in Panama and, by extrapolation Latin America, presently is not desirable. However, through application of the framework suggested in section 3, the conditions might right for AD to be viable.

Avoiding deforestation in Colombia, Honduras, Mexico, Panama and Peru and, through inference Latin America, is economically feasible. Feasibility was established by determining supply of carbon, 0.04 Gt CO\(_2\) per year at 50% reduction of deforestation with in a decade, and matching it to potential buyers, i.e. demand sources. Sources of demand were identified to be CDM cap increases and international aviation and navigation. Our analysis shows that there a huge potential demand for AD credits, with 1 percent of international aviation and navigation representing only 9.75 percent of the annual AD credits generated by reducing deforestation rates by 50 percent over 10 years.

If AD is to be successful on a grand scale, the desire will have to come from within. Top-down imposition of forestry polices without massive repression are impossible. As long as the rural poor look to the forest for livelihood, deforestation will continue. However, if presented with a viable alternative they could undoubtedly be swayed.
A.2 Resumen Ejecutivo

La deforestación es responsable por aproximadamente 18% del carbono emito para los humanos. También es la primaria fuente de emisiones en América latina. En 1997, el mundo se reunido para empezar el proceso de disminuir las emisiones globales basado sobre la Convención Marco de las Naciones Unidas sobre el Cambio Climático (CMNUCC). De este marco nació el protocolo de Kyoto (PK). Sin embargo, la Deforestación evitada (DE) fue excluida como categoría de mecanismo de desarrollo Limpio (MDL). En su estado actual, PK ni promueve ni prohíbe los proyectos que reducen las emisiones en carbono para deforestación evitada (DE).

El propósito de este documento es de determinar si evitar la deforestación en América Latina es factible en el punto de vista político, social y económico. Esa tesis sigue un método que incorpora a una revisión de la literatura, varias entrevistas, modelos económicos, y una análisis de sumisiones al CMNUCC. Para analizar el contexto político y social, un marco que asegura la factibilidad de DE fue creado. Usando modelos, la viabilidad económica del DE fue determinada en Colombia, Honduras, México, Panamá y Perú. El documento fue producido en las oficinas de McGill del programa NEO en STRI. Las entrevistas informales conducidas por teléfono y coreo en la ciudad de Panamá fue conducido entre el mes de Enero a Abril 2007.

Evitar la deforestación en América Latina será una tarea política difícil, requiriendo una buena “gobiernance” que conduce una reforma de las instituciones y una cooperación intra-gubernamental. La creación de estrategias para reducir la
deforestación podrían consistir en nuevos incentivos económicos y el titulación de las tierras. El DE en Panamá y, por extrapolación en América latina, no es actualmente deseable. Sin embargo, con el uso del marco sugerido en la sección 3, DE podría ser viable.

Evitar la deforestación en Colombia, Honduras, México, Panamá y Perú y, es económicamente factible. Esa viabilidad fue establecida determinando la oferta de carbono, que es de 0.04 Gt de CO₂ cada año para reducción del 50% de la deforestación en 10 años. Eso fue comparado con las fuentes potenciales de demanda que fueron identificadas como aumentos del “cap” de MDL y aviación y navegación internacionales. Nuestra análisis demuestra que existe una demanda potencial enorme para los créditos del DE. En efecto, solamente 1% de aviación internacional y de navegación representa 9.75% de los créditos anuales del DE generados reduciendo la 50% de toda la deforestación en 10 años.

Para que DE sea posible en escala magnífica, el deseo de hacerlo tendrá que venir de adentro del país y es necesario de proporcionar el pobre con una alternativa viable a la deforestación.
A.3. **Massive Land Title Distribution: An Article**
The following can be found at: [http://www.mida.gob.pa/](http://www.mida.gob.pa/)

Entregan 149 títulos de propiedad. Unos 149 títulos de propiedad a pequeños productores del la provincia de Darién del Programa Nacional de Titulación (PRONAT), entregaron este sábado el Ministro de Desarrollo Agropecuario, (MIDA), Guillermo Salazar y el Diputado Giovanni Castillo, del circuito 5-1. El Ministro del MIDA, Guillermo Salazar, durante el acto de entrega de títulos de propiedad a pequeños productores. Actividad realizada en los terrenos de la Feria de Santa Fé, en la provincia de Darién. Durante el acto de entrega, celebrado en los terrenos de la feria de Santa Fe de Darién, el Ministro Salazar, el Alcalde de Chepigana, Benigno Ibargüen y el Director Regional del MIDA en Darién, Ing. Eduardo Quirós, felicitaron a los productores por el respaldo ofrecido al gobierno nacional en el proceso de titulación masiva de tierra.

Sólo en los dos años y cinco meses de gobierno del Presidente Martín Torrijos, se ha logrado entregar a nivel nacional, más de 25 mil títulos de propiedad, cifra que supera lo realizado en los cinco años de la administración pasada.

La titulación de la propiedad es un problema que involucra a muchas personas, incluyendo a las ubicadas en las ciudades de nuestro país. Es por eso que el nuevo programa urbano, pretende iniciar la expedición de unos 20 mil títulos mensuales, ya que se hace más fácil el trabajo en estas zonas. Por su parte, Balbino Barrios, productor beneficiado, pidió a los moradores darienitas hacer valer sus derechos, ya que es la única forma de sacar adelante
las riquezas que ofrece la provincia. Igualmente pidió al Ministro del MIDA, continuar con el programa de titulación masiva de tierras en la provincia.

Actualmente hay muchas personas esperando legalizar sus tierras, pero por falta de dinero no han podido titular sus fincas que por años han cultivado y son el sustento de sus familias. De aquí es que el gobierno aprobó un programa especial, para que el MIDA asuma parte de los costos que implica la titulación.

El titular de la cartera agropecuaria, reiteró a los presentes, el llamado de las autoridades de no vender sus terrenos y recalcó que debían hacer un esfuerzo para que estos títulos les permitan conseguir financiamiento y así continuar produciendo más y mejorando sus niveles de vida, la de sus familias y sus comunidades.
### A.4. Calculations of the Radiative effects of IAN

#### Radiative effect of Navigation

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#### Radiative affect of aviation

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A.5. **Recommendations for Next Year**

The project we are submitting, as far as we know, has no predecessor. We are not representing the interests of a particular NGO but those of the people of Panama, Latin America, and of every tropical forest. As such, any student who follows our lead must be aware of the lack information and steep and technical learning curve that exists before embarking on a journey through AD.

As with any internship, one on AD, it is as rewarding as the amount of effort you put into it; it is not easy, the concepts are not intuitive. At the same time it is highly rewarding to see that your work is not only relevant, to a topic as important as climate change, but useful to the extent that the knowledge you are generating is new, fresh and people are genuinely interested your results.

That said we feel that we are “victims” of the right place, right time, syndrome. We are lucky to be working on this project just as negotiations for the KP’s second commitment period. We cannot predict with 100 percent certainty what will happen to AD with regards to KP this time next year. What we can offer is a hearty good luck to those who embark down the trail.
A.6. Project’s Budget

A.6.1. Time investment
Chronogram of activities:

January 11th:
- During the first week we were introduced to the people in ANAM

January 18-19th:
- Worked on the PowerPoint presentation on avoided deforestation in Central America

January 24-25:
- Worked on the Latin American submission on avoided deforestation.

February 5-14th:
- We decided on a Project and meet our internship supervisor Catherine Potvin
  - We set up meetings and gathered relevant literature.

February 19-25th:
- Jordan has meetings in Montreal with Profs Coomes, Thomassin and ICAO

March 8-9th:
- Completion of the assessment of demand of carbon.

March 19-23th:
- Jordan goes to Montreal; collect all data needed for paper, attempts a meeting at the ICAO
  - Michele: gathered information, oriented thoughts, conducted interviews

March 27-28th:
- Data analysis

April 16 – 20th:
- Begin rough draft

- Created charts, tables etc.

## A.6.2. Monetary investment

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<th>Frequency</th>
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We spent a more than 350 hours each working on this project totaling 700 hours.

Valuing our time at 25$/hr we the cost of this report is $17500+286=17786. This sum excludes the environmental cost this project had due to the many flights, car trip etc.
A.5. **Areas of AD policy with no literature**

The following is an uncompleted list of the areas we feel that more work needs to be carried out with respect to AD. We say that it is incomplete as it is by no means a comprehensive list.

1. The creation of an international aviation and navigation party to the UNFCCC, so that international transport is not included in any national emissions targets, allowing for the industry to self regulate.

2. Allow non-Annex I countries to meet a post-Kyoto commitments through AD

3. Is the cost of buying options to offset market risk less then the administrative costs of running a fund? Reconciling the idea of fund- and market- based mechanisms provided a funding source for a non-market mechanism has been identified.
### A.6. Annex I Parities to the Convention’s metrics

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<tr>
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Sums:

NB: EU was subtracted from the totals, to avoid double counting.