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Incentives to Reduce GHG Emissions from Deforestation: Lessons Learned from Costa Rica and Mexico

Katia Karousakis, OECD

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Katia Karousakis, Organisation for Economic Co-operation and Development (OECD)

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FOREWORD

This document was prepared by the OECD and IEA Secretariats in response to the Annex I Expert Group on the United Nations Framework Convention on Climate Change (UNFCCC). The Annex I Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. In a collaborative effort, authors work with the Annex I Expert Group to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the Annex I Expert Group. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

The Annex I Parties or countries referred to in this document are those listed in Annex I of the UNFCCC (as amended at the 3rd Conference of the Parties in December 1997): Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, the European Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, and United States of America. Korea and Mexico, as OECD member countries, also participate in the Annex I Expert Group. Where this document refers to "countries" or "governments", it is also intended to include "regional economic organisations", if appropriate.

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Questions and comments should be sent to:

Katia Karousakis
OECD Environment Directorate, ENV/CNRO
2, rue André-Pascal
75775 Paris cedex 16
France
Email: Katia.Karousakis@oecd.org
Fax: +33 1 4430 6184

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Executive Summary

Global deforestation is occurring at a fast rate, around 13 million ha/yr (FAO, 2006) and is a major contributor to climate change. Emissions from deforestation in the 1990s are estimated at 5.8Gt/CO_2/yr, and account for one-fifth of global anthropogenic greenhouse gases (GHG). Moreover, deforestation is the major source of GHG emissions from the land use, land-use change and forestry sector, it constitutes the main source of GHG emissions from many developing countries, and, at a global scale, GHG emissions from deforestation are higher than the total amount produced by the transport sector annually.

In December 2005, a two-year process was initiated with the UN Framework Convention on Climate Change (UNFCCC) at COP-11 where Parties were invited to consider issues "…relating to reducing emissions from deforestation (RED) in developing countries, focusing on relevant scientific, technical, and methodological issues, and the exchange of relevant information and experiences, including policy approaches and positive incentives." A number of options are being proposed for a RED instrument, including both market and non-market based approaches. This paper focuses on the use of a market-based approach to RED. A market to capture the carbon values of forests in developing countries, and hence to reduce emissions from deforestation, could serve to: (i) address a large fraction of global anthropogenic GHG emissions, (ii) provide strong incentives for developing countries to take actions to reduce emissions from deforestation, (iii) ensure long-term and sustainable funding to the forestry sector, and (iv) minimise the economic costs of achieving country emissions reduction targets globally.

Since a number of different options to capture and market the carbon values of forests are possible, and because a future post-2012 climate change framework is still unclear, this paper takes a broad approach to analyze how an instrument for RED may be operationalised. The main objective of the paper is to develop some lessons learned and good practices for an instrument to capture and market the carbon values of forests. The analysis is based primarily on two case studies of Payment for Environmental Services (PES) programmes that have been implemented to capture the forest values in developing countries, namely in Costa Rica and Mexico, as well as other experiences from the existing climate change framework under the UNFCCC and the Kyoto Protocol. The focus of the case studies is on PES schemes because such incentive mechanisms aim to internalize the external values of environmental services. PES schemes operationalise this by compensating landowners directly for the non-market public good benefits they provide via financial payments. As such, a carbon crediting instrument to reduce GHG emissions from deforestation in developing countries could be similar to a PES. The paper focuses on the following issues and design characteristics for each of the PES case studies:

- Legal Framework
- Institutional Structure
- Financing
- Baseline, Additionality and Leakage
- Monitoring, Reporting and Evaluation
- Compliance, Penalties and Enforcement

Establishing an international RED instrument will require fundamental decisions to be reached regarding the nature and design of the instrument. Different approaches will have implications for the environmental integrity and cost-effectiveness of the climate regime, as well as its equity/distributional effects, and political feasibility. Under a market-based approach, permits could be distributed/auctioned by developing countries based on the adoption of reduced deforestation targets (caps) as with the design of the current international emissions trading system under Article 17 of the Kyoto Protocol. Alternatively, tradable credits could be generated (as in the Clean Development Mechanism) using a sectoral or project baseline, essentially extending the range of project-types that could be included in any CDM-type mechanism of the future.

From the **legal perspective**, incorporating a RED instrument into the existing climate change regime (UNFCCC and the Kyoto Protocol) should not be problematic with respect to public international law. The prerequisites for a successful RED instrument at the national level include the establishment of clear, well-defined and secure property rights. Any **institutional structures** with international level mandates would need to focus on those issues that need to be harmonized across national governments in order to ensure the environmental integrity and cost-efficiency of the instrument. Above all, this would include: (i) accurate and consistent monitoring and reporting mechanisms; and (ii) compliance mechanisms (depending on whether targets are binding or non-binding).

Several design issues would need to be addressed with regard to the **financing** of a RED instrument. For example, would payments be made up-front, only for ex-post verified emissions reductions, or in staggered format? Under the Mexican PES programme, payments are only made once it has been verified that there is no breach of contract. Under the CDM, payments are only made for ex-post emissions reductions. In JI however, certain national governments do make partial up-front payments on a case-by-case basis.

The establishment of a **base year** or base "period" would be necessary under a cap-and-trade approach, whereas a **baseline** would be necessary under a sectoral or project-level baseline-and-credit approach. A base year or period reflects emissions in a particular year or averaged over a certain number of years. A baseline refers to a projection of emissions from deforestation over time. The appropriate selection of a base period or baseline is important in ensuring that any emission reductions are additional to what would have occurred in the absence of the instrument (i.e. the counter-factual). For example, the PES case studies reveal that the static baselines used in the Costa Rican and Mexican programmes (i.e., payments with respect to status quo) are likely to have undermined the additional benefits generated from the programmes. In Costa Rica for example data suggests that deforestation rates were on the decline as of the early 1990's, before the introduction of the PES programme in 1996. Data requirements for setting a baseline involve time series data on changes in land cover which are difficult to obtain for many regions. A clear understanding of the underlying and proximate causes of deforestation will also be useful for estimating sectoral baselines. Given the complexity of the issues, an independent technical body may be helpful to assess whether a country's historical data and underlying assumptions on demand growth rates, agricultural prices and other assumptions, are appropriate and consistent with information from other sources and with those of other participating developing countries. Design choices between sectoral vs. project-based approaches would also have important implications for issues such as domestic leakage, administrative and transaction costs, and perverse incentives. Domestic leakage for example, is likely to be better addressed via a sectoral crediting mechanism rather than a project-based mechanism.

An effective RED instrument will require **monitoring methodologies and reporting systems** to ensure comparable and consistent estimates of emissions from deforestation. A comprehensive monitoring framework consists of technical, managerial and institutional elements. The technical functions refer to the choice of monitoring methods, data collection, handling and reporting. Monitoring is likely to require a combination of remote sensing (satellite imagery) and ground measurements. A key constraint for most developing countries however is access to satellite imagery data at reasonable cost, as well as technical infrastructure to use such information. The management process refers to planning and documentation and quality assurance/quality control, as well as organisation and staffing. The institutional element refers to institutional arrangements that are necessary to support a carbon instrument at the international, national, and local level. Case studies of monitoring and reporting systems used in Costa Rican and Mexican suggest the need for capacity building efforts in order to ensure programme success.

The need for **non-compliance penalties** would depend on the design of the instrument (i.e., cap-and-trade or baseline-and-credit, and binding or non-binding targets). Options include the introduction of a reserve (similar to the commitment period reserve under the Kyoto Protocol), other types of carbon credit buffers, non-payment, criminal and civil penalties for fraudulent reporting and non-compliance at the landowner level, and other approaches. Some of these options are mutually exclusive.

1. Introduction

Global deforestation occurs today at a fast rate, around 13 million ha/yr (FAO, 2006), with South America and Africa experiencing the largest losses. Deforestation has serious adverse consequences for the global environment and is responsible for habitat destruction, irreversible losses of biodiversity, has negative impacts on agricultural productivity and affects the livelihoods of millions of rural people. Deforestation is also responsible for one-fifth of global anthropogenic greenhouse gas (GHG) emissions, with emissions in the 1990s estimated at 5.8Gt/CO_2/yr, and is thus a major contributor to climate change.

A market-based instrument to capture the carbon values of forests, and thus to reduce emissions from deforestation in developing countries (RED), could serve to: (i) address a large fraction of global anthropogenic GHG emissions (20%), (ii) provide strong incentives for developing countries to take actions to reduce emissions from deforestation, (iii) ensure long-term and sustainable funding and (iv) minimise the global economic costs of achieving emissions reductions of countries with targets.

This paper aims to develop some lessons learned and good practices for an incentive instrument to capture and market the carbon values of forests. This is based primarily on two case studies of Payment for Environmental Services (PES) programmes that have been implemented to capture the forest values in developing countries (namely in Costa Rica and Mexico), as well as other experiences from the existing climate change framework under the UNFCCC and the Kyoto Protocol. The focus of the case studies is on PES schemes because such incentive mechanisms aim to internalize the external values of environmental services. PES schemes operationalise this by compensating landowners directly for the non-market benefits they provide via financial payments. As such, a carbon crediting instrument to reduce greenhouse gas (GHG) emissions from deforestation in developing countries could be similar to a PES.

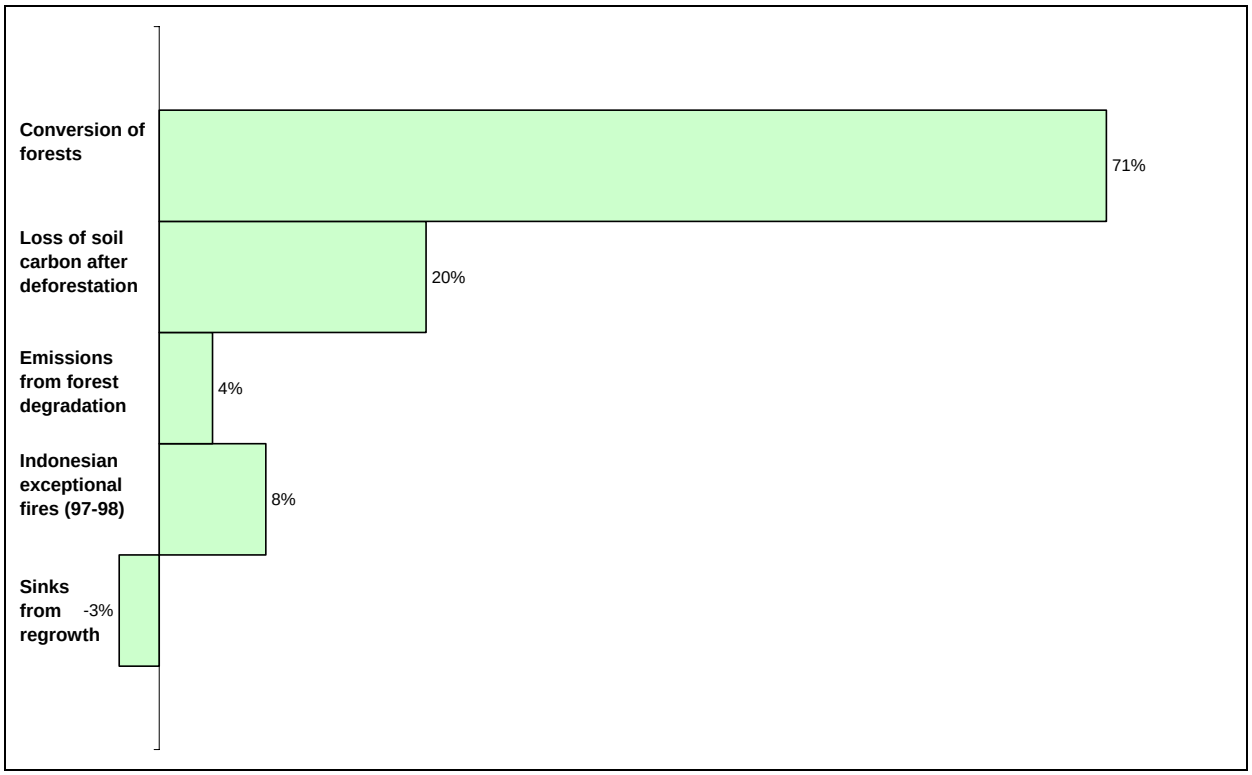
Since a number of different options to capture and market the carbon values of forests are possible, and because a future post-2012 climate change framework is still unclear, this paper takes a broad approach to analyze how an instrument for RED may be operationalised. The paper is organised as follows: Section 2 provides an overview of the role of forests in the context of climate change and the UN Framework Convention on Climate Change (UNFCCC), and discusses the available evidence on the potential costs and benefits of reducing emissions from deforestation. Section 3 presents the two case studies that have implemented national PES programmes to capture and market forest values, namely the PES programme to capture forest values in Costa Rica and the payments for environmental hydrological services of forests in Mexico. The section analyses the design characteristics of the programmes, including the legal frameworks; institutional structures; financing mechanisms; baselines and additionality; and monitoring and enforcement methodologies. Drawing on the insights from the case studies, as well as other experiences from the current climate change framework, section 4 explores possible options for an incentive to capture and market the carbon values of forests. Finally, section 5 concludes.

The paper does not address an important aspect of the PES programmes, namely how their design may affect the programmes' distributional implications. This was beyond the scope of the paper at this time.

2. Forests and Climate Change

Deforestation remains the major source of greenhouse gas emissions from land use, land-use change and forestry sector (IPCC, 2007). A recent estimate puts global net emissions from land-use change in the tropics at 4030 Mt CO_2/yr ±1000 and includes emissions from conversion of forests (representing 71% of net emissions) and loss of soil carbon after deforestation (20%), emissions from forest degradation (4.4%), emissions from the 1997-1998 Indonesian exceptional fires (8.3%), and sinks from regrowth (-3%) (Achard et al. 2004) (see Figure 1).

Figure 1. Breakdown of emissions of land use change in the tropics of 4 Gt CO_2/yr in 1990s and early 2000s



Source: Achard et al. 2004

Emissions from deforestation constitute the main source of greenhouse gases from many developing countries (see Table 1) and, at a global scale, are higher than the total amount produced by the transport sector annually. Projections indicate that approximately 10-20% of current global forestland will be converted to other uses by 2050 with large consequences for the global carbon cycle (MEA, 2005). Forests and climate change are therefore intricately linked and forestry can play a key role in contributing both to climate change mitigation and adaptation.

Table 1. Top 10 countries with highest annual deforestation rates plus some others

Country	Deforested area 1000 ha/y (Average 1990-2000) (FAO)	Deforested area 1000 ha/y (Average 2000-2005) (FAO)	LULUCF as % of total domestic GHG emissions (2000) (CAIT)	LUCF as % of total domestic GHG emissions (UNFCCC)
Brazil	2,681	3,103	62	55
Indonesia	1,872	1,871	84	34
Sudan	589	589	20	25
Myanmar	467	466	84	N/A
DR Congo	532	319	86	133.66
Zambia	445	445	40	10
Tanzania	412	412	18	96
Nigeria	410	410	50	30
Zimbabwe	313	313	58	180
Venezuela	288	288	38	-8.03
Top 10 Total	**8,009**	**8,216**		
Bolivia	270	270	68	57
Niger	62	12	6	56
Malawi	33	33	79	71
Sri Lanka	27	30	55	93
Togo	20	20	52	82
Panama	7	3	82	69

Source: FAO (2006); CAIT (2007) version 4.0 of WRI using 2000 data. CAIT estimates of GHG from land use change are developed by Houghton (2003). According to CAIT, the errors associated with these national estimates may be substantial. The full description of methods and results are provided on the CAIT website: http//cait.wri.org. UNFCCC data from http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php

2.1 Carbon Stocks and Climate Change

The net effect of deforestation on the level of GHG emissions depends on the density of the forest being cleared and the kind of vegetation that will develop in the deforested areas; some types of replacement vegetation capture more carbon than others. The largest emissions from deforestation arise when land is converted to agricultural production, especially when slash and burn techniques are used (OECD, 2007). The timing of CO_2 released per unit of forest area that is converted to possible alternative land uses will also vary. Planting new trees removes CO_2 from the atmosphere, but it takes far more time to absorb the same amount of carbon that is instantaneously released into the atmosphere when mature trees are burnt. Log extraction is not of itself responsible for large CO_2 emissions; when logs are used in furniture making or building for example, part of the carbon will remain stored. Of the various forest mitigation options available[1], reduced deforestation (and degradation) has the greatest potential to reduce emissions (IPCC, 2007).

[1] These include afforestation, reforestation, forest management, and reducing deforestation and degradation.

2.2 The International Context of UNFCCC and Role of Forests in CDM and Sinks

The UN Framework Convention on Climate Change (UNFCCC) Article 4.1(d) requires all Parties, taking into consideration their common but differentiated responsibilities, to promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems.

Under Article 3.3 and 3.4 of the Kyoto Protocol, Annex I countries are allowed to meet their emissions reduction commitments by using net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities. This is limited to afforestation, reforestation and deforestation since 1990 (Article 3.3) and four management activities (forest management, cropland management, grassland management and revegetation) (Article 3.4). The Marrakesh Accords define afforestation as the conversion of land that has not been forested land for a period of at least 50 years to forested land. Reforestation is the conversion of non-forested land to forested land where, for the first commitment period, activities are limited to land that did not contain forest on 31 December 1989.

The eligible land-use, land-use change and forestry (LULUCF) activities under the Clean Development Mechanism (CDM) are afforestation and reforestation. Projects to reduce deforestation or forest degradation are currently not eligible for the CDM. In addition, for the first commitment period, a maximum of one percent of an industrialised country's base-year emissions may be offset annually by CDM forestry projects. Further, credits for forestry CDM projects are "temporary", namely temporary Certified Emissions Reductions (tCERs) and long-term Certified Emissions Reductions (lCERs). tCERs expire at the end of the commitment period subsequent to the commitment period for which they were issued. lCERs are valid until the end of the project's crediting period up to a maximum of 60 years (UNFCCC SBSTA, 2003)[2]. These types of credits impose a replacement liability on the buyer, making forestry credits less attractive than 'normal' CERs (Chomitz and Lecocq, 2003; Pedroni, 2005 cited in Ebeling, 2006).

The restrictions placed on forestry-related activities were introduced for several reasons. First, since the Kyoto emission targets had already been negotiated, there was concern that in the absence of such restrictions forestry activities would divert resources from other fossil fuel mitigation efforts. There were also a number of environmental concerns regarding issues such as leakage, permanence, and measurement uncertainties with regard to establishing baselines for forest-related activities (see Ebeling, 2006; Ellis, 2003; Jung, 2004). Leakage refers to changes in anthropogenic emissions by GHG sources which occur outside the project boundary, but are attributable to its activities. Permanence refers to the possibility that carbon is released into the atmosphere when trees are cut down, die, or affected by fire.

To date, forestry projects constitute only a very small proportion (0.22%[3]) of total expected CDM credits to 2012 (i.e., much lower than the 1% limit). This is due to low carbon prices, the long-term nature of investments (slow growth rate of trees), the expiring nature of tCERs and lCERs and the limits on crediting to only 2012, and that forestry project credits are not allowed in the EU Emissions Trading Scheme (ETS).

In addition to the low demand for carbon-sinks credits, the past decade has witnessed a reduction in Overseas Development Assistance (ODA) directed to the forestry sector as a proportion of total ODA funding. Funding reached an all time low in 2004. ODA to the forestry sector amounted to only 0.3% of total ODA, compared with past averages of 0.6% to 1.2% since 1990 (OECD CRS Database 2005). It seems unlikely therefore that any voluntary system for transfer payments between countries (e.g. ODA) would generate the necessary funds to significantly reduce deforestation. A market approach, with incentives for both developed

[2] lCERs must be replaced within 30 days after removal has been detected (5/CMP.1, §49(d).

[3] Calculated as total number of afforestation/reforestation CDM credits divided by total number of CDM credits (=609.5 / 282,812) (UNEP Risoe database as of February, 2007).

and developing country participation, could present a more viable long-term and sustainable option for financing measures to reduce deforestation.

The important role that forests in developing countries can play in carbon mitigation suggests that new approaches could be harnessed to take advantage of the opportunity at hand. Indeed, there has recently been an increasing impetus to reduce emissions from deforestation in developing countries (RED) within the United Nations Framework Convention on Climate Change (UNFCCC) process. A two-year process was initiated at COP-11 (December, 2005) when Parties were invited to consider issues "…relating to reducing emissions from deforestation in developing countries, focusing on relevant scientific, technical, and methodological issues, and the exchange of relevant information and experiences, including policy approaches and positive incentives" for potential recommendations to the UNFCCC at COP-13 (December, 2007). This impetus has been spurred in part by the availability of new inventories that have increased coverage of forests; the fact that carbon mitigation in forests has been reported to be more cost-effective than mitigation options in other sectors (Kauppi and Sedjo, 2001); and a joint proposal put forward by the Rainforest Coalition (Papua New Guinea, Costa Rica, and others) at COP-11 to include RED in a post-2012 climate change framework.

2.3 The Estimated Costs of Reducing Emissions from Deforestation

The costs of reducing emissions from deforestation depend on the cause of deforestation (timber or fuelwood extraction, conversion to agriculture, settlement or infrastructure), the opportunity cost of forest (i.e., returns from its potential to alternative uses) and on any compensation paid to the individual or institutional landowner to change land use practices. These costs will vary by country or region depending on soil and climate conditions, type of land use for which forest lands are appropriate, the scale of the operation, the distance from the market and quality of transport infrastructure (IPCC, 2007; Chomitz et al. 2006). The potential volume of emissions reductions achieved will depend on the size and sustainability of the incentives provided –e.g., the magnitude of the emissions reduction targets that are adopted in a post-2012 climate framework and the resulting carbon price that prevails in the market, as well as the capacity of all stakeholders to implement a future RED instrument.

A number of studies have estimated the potential costs of RED, including both top-down global economic models providing large scale trends and bottom-up studies addressing implementation issues such as transaction cost barriers. It must be appreciated that these estimates are heavily dependent on the assumptions made about returns to different types of agricultural activity and the patterns of land use in deforested areas and other significant input variables.

In global models, the spatial distribution of mitigation in response to carbon price signals is generally consistent across models and studies (IPCC, 2007). Overall, mitigation response spatially is reasonably constant throughout several regional and project level models. Considerable avoided deforestation is observed in South and Central America, Africa and South East Asia. Estimates suggest that the break even prices of CO_2 are ~10 Eur/ton in Africa, ~30 EUR/ton in S. America and ~60 Eur/ton in SE Asia (land opportunity cost in the timber market are relatively high) (Sathaye et al. 2005; Benitez et al. 2005; Strengers et al. 2004; Waterloo et al. 2003).

Richards and Stokes (2004) estimate that the cost of carbon sequestration in forest and land use range from USD10 to 150 per ton of carbon (USD3-40/tCO_2). Sohngen and Mendelsohn (2001) suggest that forests could account for approximately a third of total abatement over the next century. Up to 2030, Sathaye et al. (2001) have identified significant mitigation potential of about 6 billion tons of carbon (1.64 billion tCO_2), the bulk of which may be achieved at relatively modest costs that range below USD20 per Mg C (USD5.5/MgCO_2). However, Benitez et al. (2006) estimate a higher carbon price of USD50/tC(USD14/tCO_2) is needed to sequester approximately 6.9 billion tones of Carbon (1.9 billion t CO_2), roughly equivalent to 1 year of carbon emissions in the energy sector.

By 2050, Sathaye et al (2005) project a cumulative carbon gain of 10,400 $MtCO_2$ at a price of USD5/t CO_2 deterring conversion of one to two million square kilometre of forest. About half the reduced deforestation potential is estimated as being achievable at a negative cost or net economic benefit, when evaluated at discount rates between 10% and 12%. Negative cost arises because the revenues from the sale of non-carbon products exceed the costs of these options. A carbon price of USD100/ton (USD 27.3/tCO_2) is estimated to induce conservation of five million square kilometres by 2050, abating the release of 47 billion tC (12.8 billion tCO_2) (Sathaye et al. 2001).

Using a scenario of carbon price of USD10 +5% annual carbon price increment, Sathaye et al (2005) estimate the cumulative maximum land area available for mitigation options (forestation and reduced deforestation) in 2050 in Africa, Asia and Latin America to be 567 Mha, accounting for 67% of global total. The area for avoiding deforestation is estimated at 364 Mha. Of the two mitigation options, avoided deforestation accounts for 68% of mitigation and 32% afforestation. These results are typically skewed where Sohngen and Sedjo (2006) estimate some 80% of C benefits in some scenarios from land use change (e.g. reduced deforestation and forestation) vs. some 20% from forest management.

More recently, Sohngen and Beach (2006) examine the extent of baseline deforestation and associated carbon emissions and the economic potential for incorporating reductions in deforestation as an option for mitigating climate change. Using a Global Timber Model, a market model that accounts for above and below ground vegetative carbon stock, they find that there is a large potential for avoided deforestation to help reduce GHG mitigation costs. An annual reduction of 8.4% to 15.3% annual tropical deforestation rates could occur at a carbon price of USD5/t C (USD1.4/tCO_2) (an average of about 0.1 billion/tC (0.03 billion/tCO_2) per year) where the most significant changes are projected to occur in Africa and Central America. At a higher carbon price, i.e. USD100/t C (USD 27/tCO_2), the results suggest that deforestation can virtually be stopped with an average rate of 1.6 billion tones of carbon per year.

Obersteiner et al. (2006) estimate that, in the complete absence of information on forests at risk of deforestation, a global carbon conservation programme that aims to avoid half of baseline deforestation would require USD197bn in 2006, and USD188bn in 2025 (i.e., on average USD6/tC/5 years (USD1.6/tCO_2/5 years)). When aiming to reduce the deforestation rate by 50% until 2025, the financial resources required to balance out net present value differences on exactly those forests that would otherwise be converted (i.e. under perfect information) rise from some US$0.16bn in 2006 to US$2.9bn in 2025 due to increasing geographic coverage of the carbon incentive scheme. He suggests using a carbon tax of USD12/tC (USD3.3/tCO_2) on deforestation would cut deforestation in half, where Latin America and Sub-Saharan Africa combined would account for 82% of reduced deforestation.

Finally, research commissioned by the Stern Review (2006), suggests that the direct yields from land converted to farming, including proceeds from the sale of timber, are equivalent to less than USD1 per ton of CO_2 in many areas currently losing forest, and usually well below USD5 per ton (calculation assumes CO_2 levels per hectare of tropical forest preserved is 500-750 t per hectare). The opportunity costs to national GDP would be somewhat higher, as these would include value added activities in country and export tariffs. Grieg-Gran (2006) found when using alternative methodologies, there are significant opportunities to protect forests in some regions at low costs, the marginal abatement cost curve could rise from low values up to around USD30 per ton of CO_2 were deforestation to be eliminated completely (Stern Review 2006, pp. 540).

2.4 Capturing Forest Values with Payment for Environmental Services Programmes

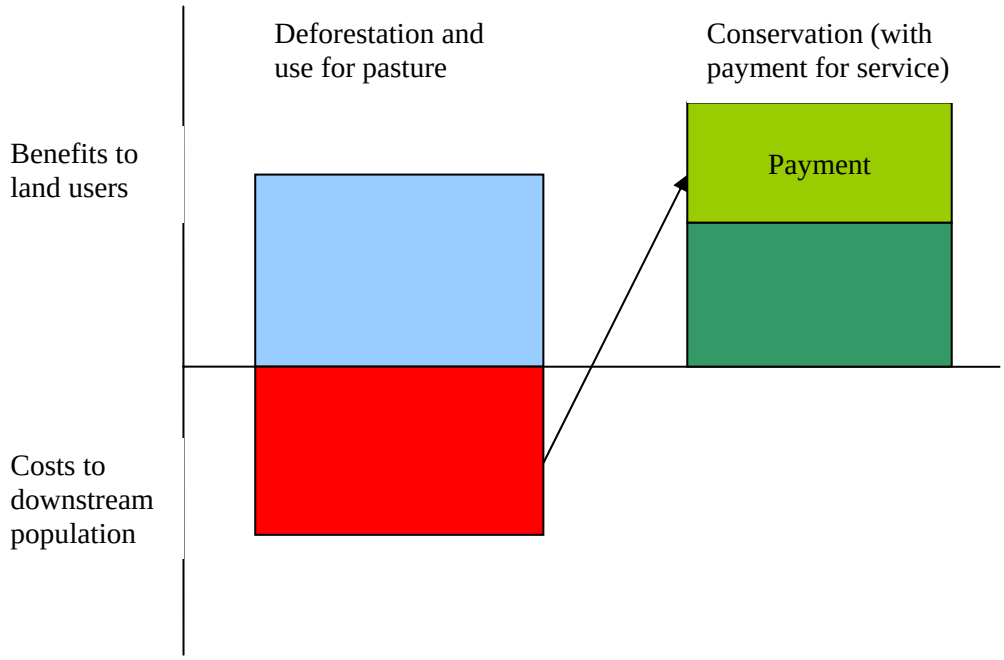
In order to realise the carbon benefits of reducing deforestation, some form of incentive mechanism will need to be designed and implemented. Payment for Environmental Services (PES) programmes offer one example of such a mechanism, and indeed are now being used to capture and market a number of other indirect use values of forests, including watershed services, biodiversity, and landscape beauty in some places. PES

programmes are recognised as a promising and innovative alternative to the more traditional approaches for transfer payments (Richards, 2000; Pearce, 2004).

A PES can be defined as a system whereby: Service user(s) pay service provider(s) to provide a well-defined environmental service (or a land-use likely to secure that service) in a conditional and voluntary transaction (Pagiola, 2005)

PESs create markets for environmental services where none previously existed. Ideally, the buyer is the beneficiary of the environmental service e.g., water users, hydroelectric consumers, recreationists, and society at large in the case of global public goods. The payment helps to internalise negative externalities of deforestation into the decision-making process of forest land-owners by providing compensation to the forest-owner for protection costs and foregone revenues from alternative uses. The payment is meant to tip the balance for a forest owner towards forest conservation as opposed to the alternative land use that would have occurred in the absence of the payment (see Figure 2).

Figure 2. Payments for environmental services



Source: Pagiola and Platais, 2005

The environmental services provided by forests include biodiversity, watershed services, landscape beauty and carbon storage. Available economic estimates suggest that carbon values tend to dominate these non-market forest values (Pearce, 2001, cited in OECD, 2006) implying that the creation of incentives to capture these carbon benefits may offer the most promising PES approach for reducing deforestation. Although more than 300 PES programmes have been implemented globally, most are relatively recent and only a minority are more than a few years old (Mayrand and Paquin, 2004). In early, rudimentary stages of PES programme development, these may be more akin to transfer payments; more sophisticated PES programmes are market-based instruments. Similar to emissions-trading schemes, the environmental integrity and cost-effectiveness of a PES programme will strongly depend on the design and implementation characteristics of the programme, such as the monitoring, reporting and verification procedures to assess environmental performance. Much can therefore be learned from existing programmes in place.

3. Case Studies

The two case studies examined in this paper are Payment for Environmental Services (PES) programmes in Costa Rica and Mexico. To assess how effective the case study countries have been at capturing forest values, the paper focuses on the following issues and design characteristics for each of the PES programmes:

- Legal Framework
- Institutional Structure
- Financing
- Baseline, Additionality and Leakage
- Monitoring and Evaluation
- Compliance, Penalties and Enforcement

More specifically, the two case studies selected for the analysis are (a) the Costa Rican PES programme, and (b) the Mexican PES programme for hydrological services. Costa Rica, in particular, is considered a pioneer in incentive mechanisms and payments for environmental services. The PES scheme, introduced in 1996, was the first national PES programme worldwide and, given its longer time span, can provide insights into, inter alia, the administrative, monitoring, and enforcement costs of implementing a national PES programme.

More recently in 2003, Mexico introduced a national Payment for Environmental Hydrological Services programme. The programme was designed by the federal government to pay forest owners for the benefits of watershed protection and aquifer recharge in areas where commercial forestry is not currently competitive. It seeks to complement the forestry and water policy by providing economic incentives to reduce deforestation in areas where water problems are severe. The Mexican PES is also one of the larger programmes in scale and scope, and is interesting in part due to the nature of the property rights and *ejidos* that dominate the land ownership regimes.

Both of the countries selected represent cases in which the PES programmes are considered state-of-the-art relative to many other PES programmes that are beginning to evolve in other developing countries.

Table 2 provides a summary of forest statistics in the two case study countries.

Table 2. Comparative data on forests in the case study countries

	Costa Rica	Mexico
Total Land Area	5,106,000 ha	190,869,000 ha
Total Forest Area	2,391,000 ha	64, 238,000 ha
% land area	46.8%	33.7%
Primary forest cover	180,000ha	32,850,000 ha
% land area	3.5%	17.2%
% total forest area	7.5%	51.1%
Annual deforestation rate (2000-2005)	+0.1%	-0.4%
Δ in deforestation rate since 1990	-117.2%	-21.1%
Total forest loss since 1990	-6.7%	-6.9%
Modified natural forest	1,319,000 ha	30,330,000 ha
Semi-natural forest	888,000 ha	n/a
Forest Classification		
Private	75.7%	n/a
Public	24.3%	58.8%
Multipurpose	73.5%	91.5%
Conservation	24.5	6.8%
Protection	1.9%	1.5%
Carbon storage		
Above-ground biomass	112 Mt	n/a
Below-ground biomass	81 Mt	n/a

Source: FAO 2006. *Global Forest Resources Assessment 2005, Main Report. Progress towards Sustainable Forest Management.* FAO Forestry Paper 147. Rome

3.1 The Costa Rican Payment for Environmental Services Programme

3.1.1 Context of Forest Trends

Costa Rica is recognised today as a country with strong environmental goals and a leading proponent of environmentally sustainable development. In contrast, during the 1960's and 1970's, Costa Rica was experiencing one of the highest rates of deforestation and population growth in the world, and total forested land area had declined to as low as 21% of total land area in 1987.

Historically, the largest contributor to Costa Rica's rainforest destruction has been clearing for agriculture and cattle pastures. Deforestation was principally driven by policies (particularly tariff and non-tariff barriers to international trade) including cheap credit for cattle, land-titling laws that rewarded deforestation, taxes to "unproductive" lands and rapid expansion of the road system. These policy incentives have since been removed. Due to the forest and biodiversity conservation policy and economic factors affecting agricultural production, deforestation rates have slowed considerably.

Nevertheless, Costa Rica's remaining forests still face threats from illegal timber harvesting in protected areas and conversion for agriculture and cattle pasture in unprotected zones. One of the priority actions of the Costa Rica National Forest Development Plan (approved in 2001) is the control of illegal logging in the country. MINAE commissioned a series of studies to analyse the root causes of illegal logging and propose

measures to overcome the problem. In 2002 MINAE developed a comprehensive, five-year strategy aiming to:

- promote and strengthen technical, administrative and legal structures that facilitate the control of forest harvesting;
- improve the instruments that are necessary to monitor social behaviour and the use of forest resources;
- strengthen the management capacity of the Forest Administration regional offices;
- promote, coordinate and ensure the active and efficient participation of civil society in the prevention of illegal forestry acts.

The strategy consists of a wide range of measures to prevent, detect and control illegal forest activities. It includes measures to discourage illegal logging (stricter control using geographic information systems [GIS] and global positioning systems [GPS], forest control brigades, internal and external auditing) as well as those designed to encourage legal behaviour (simplifying regulations, reviewing the forestry law, promoting reforestation and forest management). Illegal logging in 2006 is estimated at 15% (down from 33% in 2002, and around 80% during the 1980s) and is due primarily to weak institutional capacity to enforce laws and procedures.

3.1.2 Legal Framework

Costa Rica's efforts to internalise environmental values provided by forest ecosystems date back to 1979, with the passage of the first Forestry Law and the establishment of economic incentives for reforestation. Subsequent laws strengthened incentives for reforestation, broadening opportunities for landowners to participate in reforestation programmes and making the programme accessible to small landowners within rural areas. Costa Rica has ratified various sub-regional agreements, such as the Regional Agreement for the Management and Conservation of Natural Forest Ecosystems and the Development of Forest Plantations. In addition, Costa Rica has promulgated new national laws such as: Forest Law No. 7575, the Public Services and Regulatory Authority Law, the General Law of the Environment, the Soil Conservation Law and the Biodiversity Law, which together provide the framework for the execution of the PES programme (FONAFIFO website).

Forestry Law No. 7575, enacted in 1996, provides the legal and regulatory basis to contract with landowners for environmental services provided by their lands. The Forestry Law explicitly recognized four environmental services provided by forest ecosystems: (i) mitigation of GHG emissions; (ii) hydrological services, including provision of water for human consumption, irrigation, and energy production; (iii) biodiversity conservation; and (iv) the provision of scenic beauty for recreation and ecotourism.

In 1997, Costa Rica introduced the first nation-wide PES programme providing further incentives for forests protection and management. The legal framework for PES establishes the context for the application and payment of environmental services, and for National Forestry Financing Fund (FONAFIFO) funding sources and governing mechanism, thereby guaranteeing the Programme's institutional sustainability. For example, the resources used in the PES programme come from (1) the Ordinary National Budget, as stipulated in Article 5 of the Fiscal Simplification and Efficiency Law No. 8114; (2) the World Bank Loan to the Government of Costa Rica, as established in Law No. 8058; as well as from (3) the German Government's financial contribution through the KfW Bank, ratified through Law No. 8355.

The PES programme sets different regulations for indigenous territories; experience indicates that indigenous territories have clear land boundaries but they do not always hold individual titles to their land nor have legally established associations as representative of the territory. As a result, FONAFIFO exempts indigenous territories from complying with land ownership regulations

3.1.3 Institutional Framework

Since its inception, the PES programme has promoted and facilitated the inclusion of different stakeholders with an interest in developing Costa Rica's forestry sector. The PES programme therefore integrates various institutions including the National Forestry Financing Fund (FONAFIFO), the National System of Conservation Areas (SINAC), the National Forestry Office (ONF)[4], the Forest Regents, the Association of Agronomists, cooperatives, regional (cantonal) agricultural centres, sectoral non-governmental organizations (NGOs) (such as the Foundation for the Development of the Central Volcanic Range, FUNDECOR) and the beneficiaries in general.

FONAFIFO, established in 1991 under the Ministry for Environment and Energy (MINAE), is the implementing agency and financial hub of the PES programme. While the legislative process for the PES was ongoing, FONAFIFO broadened its scope to embrace the objective "to attract financing for the programme of payments for the environmental services offered by natural forests and forest plantations and to develop other necessary activities so as to strengthen the development of the forestry sector". In the late 1990s, FONAFIFO established the PES programme with its own management structure and governing board. FONAFIFO coordinates all activities related to the guidelines (decrees, manuals of PES procedures), technical procedures, statistics and processing of payments to beneficiaries of PES contracts, as well as the monitoring and evaluation of the PES programme.

While FONAFIFO is responsible for financial administration and for the programme's payments to landowners, the National System of Conservation Areas (SINAC) – a general directorate of MINAE established in 1995[5] – is responsible for overseeing project activities. SINAC represents a unified but decentralized system for administering protected forest areas and coordinating conservation activities on a regional basis (Chomitz et al. 1999).

SINAC works in coordination with FONAFIFO, forming part of the National Forestry Authority (AFE), which defines national policies for the investment of PES resources in priority areas. SINAC has been responsible for outreach to farmers and indigenous communities to promote the PES programme, and for establishing the geographical priorities for where the resources should be allocated to. The task of contracting with farmers was initially undertaken by regional NGOs such as FUNDECOR. FONAFIFO took over this role itself in 2003, establishing eight regional offices to handle applications, sign contracts, and monitor implementation. SINAC now works as the policy strategy arm of the PES while FONAFIFO is solely responsible for operational matters. The regional offices have benefited the programme beneficiaries, whereby for example, the time required to process a PES application has been shortened to 75 days between the submissions of an application and the disbursement of the payment, whereas it used to take six to nine months to process an application (FONAFIFO, 2005).

Oversight to the PES is provided by a governing board composed of three representatives of the public sector (one from the Ministry of Environment and Energy, one from the Ministry of Agriculture and Livestock, and one from the national banking system) and two representatives from the private sector (appointed by the board of directors of the National Forestry Office) (Pagiola, forthcoming/2005).

Overall there has been a shift toward "de-bureaucratisation" with more interaction with intermediaries and local bodies.

[4] ONF is a public NGO composed by landowner organisations, environmental NGOs and the forestry industry. Its mandate is to recommend forest strategies and policies in the direction of forest-based development.

[5] SINAC was established via the merging of the National Park Service, the Forestry Department and the Wildlife Service.

3.1.4 Financing

The PES scheme is organized so that land users receive direct flat rate payments for limiting their activities to specified land uses, including forest protection (5 year duration and USD210/ha dispersed over 5 years), sustainable forest management (15-year duration and USD327/ha dispersed over 5 years), and reforestation activities (15 to 20 year duration and USD537/ha dispersed over 5 years) (Sierra and Russman, 2006). Since 2003, payments for sustainable forest management are no longer made. The same year, payments for agroforestry systems were introduced instead. In 2006, the programme also included natural forest regeneration as a fourth eligible activity (Wunescher et al. 2006). The distribution of payments by contract type is shown in Table 3.

Table 3. Distribution of the payments by contract type in 2001

Contract Type	**Distribution by year**				
	1	2	3	4	5
Forest Protection	20%	20%	20%	20%	20%
Sustainable Forest Management	50%	20%	10%	10%	10%
Reforestation	50%	20%	15%	10%	5%

Source: Malavasi and Kellenberg (not dated)

Private forest landowners are required to have a minimum of one hectare to receive payments for reforestation and two hectares in the case of forest protection. It also sets a maximum area that can receive PES of 300 hectares (600 hectares for indigenous people's reserves) (Grieg-Gran et al. 2005).

In return, the landholders cede their carbon and other environmental service rights to FONAFIFO for the length of the contract. Afterwards, they are free to renegotiate the prices, or sell the rights to other parties. However, they commit to manage or protect the forest for a period of 20 years (15 in the case of reforestation). This obligation is noted in the public land register and applies to future purchasers of the land (Chomitz et al. 1999). Bundling of small projects is possible so as to reduce the transaction costs associated with a payment contract. Transaction costs represent 12-18% of the payments in Costa Rica (Miranda et al. 2003; Wunder, 2007).

Funding for the PES programme comes from several sources. The main source is a fuel tax, also referred to as the "ecotax" (see Table 4). This special tax on the consumption of any crude-oil derivates passed as part of the new Forest Law in 1996. Costa Rica is also revising its water tariff to introduce a conservation fee which is expected to generate USD21 million per year, of which USD7.5 million would go to support the PES programme.

"Environmental Service Certificates" constitute another novel financing instrument. These certificates are issued for voluntary contributions by the private sector, and the funds are used to finance the PES programme. The buyers of certificates normally define to which forest areas the funds must the applied. In addition, through agreements primarily with hydro-electric companies and agribusiness, FONAFIFO obtains payments for the protection of water resources. Eleven companies are involved in this programme (Table 5) (World Bank 2006).

The World Bank and the Global Environment Facility (GEF), through the Ecomarkets Project, have provided, respectively, a credit line of USD32.6 million and a grant of USD8 million to help finance the PES programme and to strengthen FONAFIFO, SINAC and the local non-governmental organizations involved in the implementation of the programme. In addition there is the German KfW Grant.

Table 4. Sources of funding to FONAFINO for the PES programme (million USD)

Year	Source of Funding		Total
	Forestry certificates	Fuel tax	
1995	9.1		9.1
1996	8.0		8.0
1997	7.7		7.7
1998	9.3	4.9	14.2
1999	5.6	8.5	14.1
2000	4.5	6.8	11.3
2001	3.9	7.2	11.1
2002	3.6	8.9	12.5

Source: FONAFINO

Table 5. Public and private investment to finance the environmental service of water resources protection

Company Name	Watershed	Area covered by contract (ha)	Actual area enrolled as of end 2004 (ha)	Contribution to payment to participating land users (USD/ha/yr)
E. Global	Rio Volcán and Rio San Fernando	2,000	1,493	12
H. Platanar	Rio Platanar	750	396 354	15 30
National Power & Light Company (CNFL)	Rio Aranjuez Rio Balsa Rio Lago Cote	4,000 6,000 900	2,424 4,567 501	40 40 40
Florida Ice & Farm	Rio Segundo	1,000	440	45
Heredia ESPH	Rio Segundo			22
Azucarera El Viejo	Acuifero El Tempisque	550	0	45
La Costena SA	Acuifero de Guanacaste	100	0	45
Olefinas	Acuifero de Guanacaste	40	40	45
Exporpac	Acuifero de Guanacaste	100	0	45
Hidroelectrica Aguas Zarcas	Rio Aguas Zarcas	1,666	0	30
Desarrollos Hoteleros Guanacaste	Acuifero de Guanacaste	925	0	45

Source: FONAFINO data cited in World Bank 2006.

Note: The contract with Hidroeléctrica Platanar has two modalities: USD 15/ha/yr for landowners with land title, and USD 30/ha/yr for landowners without land title. To overcome high local opportunity costs, payments by Florida Ice & Farm and Heredia ESPH are cumulated, so that land users are paid USD67/ha/yr

Between 1997 and 2003 more than 375,000 ha had been included in almost 5500 PES contracts with a total cost of USD96.2 million. Almost 87% of this area was under forest protection contracts (Ortiz, 2004 cited in Sierra and Russman, 2006). By 2005, this had increased to approximately 500,000 ha covered by PES at a cost of USD120 million, of which forest protection constituted 82.53%; forest management 10.23%; reforestation: 7.04%; and private reforestation: 0.20% (Ulate, 2006). In 2006, there were 500,000 ha covered by the PES with at least 8000 beneficiaries, and 10% of the country within the PES programme (Rodriguez, 2007, personal communication).

There has been an excess demand for payments, where approximately 25% of demand can be satisfied with the funds available. The local conservation area offices of SINAC have therefore had to prioritize applications. The regulations offer a broad list of criteria for prioritization, including hydrological importance, presence of significant species, location near an existing protected area, identification as a priority area in the GRUAS report (MINAE 1996), carbon sequestration potential, and others.

3.1.5 Baseline, Additionality and Leakage

Baselines enable the calculation of emissions avoided as a result of reducing deforestation. The choice of baseline methodology can therefore significantly affect the size of emissions benefits derived from a PES programme. Baselines can either be static (i.e. flat) or dynamic (i.e. changing over time). The Costa Rican system implicitly uses a static baseline (i.e., payments with respect to status quo) based on land use.

Data suggests that the true baseline is however increasing: A historical turnaround of deforestation started in early 1990s i.e., before the introduction of the PES system in 1996 (Wunder, 2006). This implies that the programme is likely to be paying for some forest-cover establishment or conservation that would have happened anyway, thus undermining the additional benefits generated from the programme. More specifically, Wunscher, Engel and Wunder (2006) find that the programme's selection process currently pays little attention to actual service delivery of a forest site, and does not consider spatial differences in risk of deforestation and opportunity costs of forest conservation. This implies that funds are allocated to forest sites which provide few environmental services, are in no danger of deforestation and have low opportunity costs. It is likely that many sites could be integrated into the programme with a lower payment because application numbers of forest owners are about three times higher than funds can pay for, showing that today's fixed per ha payment exceeds opportunity costs (see also Sierra and Russman (2006)).

3.1.6 Monitoring, Reporting and Evaluation

FONAFIFO has designed a monitoring and evaluation system supported by modern technology and trained personnel. Monitoring is conducted through various activities: personal visits by FONAFIFO staff of the PES Area and of the Regional Offices to properties enrolled in the PES programme; the review of regency reports submitted by Forest Regents; audits of FONAFIFO and of the PES programme; and the use of a Geographic Information System (GIS) and Integrated Project Management System (IPMS) as follow-up and monitoring tools. The GIS includes equipment such as the Global Positioning System (used to locate coordinates); a digitizer (to convert printed data from maps and plans into digital format); a wide-format printer for maps; a scanner (accessory to capture images); telemeters (equipment to measure horizontal distances); compass (to determine directions); clinometer (equipment to determine the slope of the terrain); digital cameras (photographic equipment), among others. The IPMS is a comprehensive system of administrative and computerized elements for processing PES contracts issued by FONAFIFO through the PES and Environmental Services Certificates (ESC).

These tools, together with the computer platform, make it possible to administer all the information on the PES contracts, combining different elements, such as technical criteria, legal, geographic and financial aspects. This system supports and ensures the transparency of the PES programme (FONAFIFO website).

The main purpose of the GIS is to locate PES contracts, prepare maps of priority areas for investing resources and give reliability to the entire programme. The GIS supports FONAFIFOs different Areas of Action in the preparation and interpretation of data, maps and information to facilitate decision-making and planning tasks. GIS is basically a combination of hardware, software and trained human resources, used to manage spatial data (using coordinates) and facilitating its localization on the earth's surface. Over time, the GIS has been used provide additional support to FONAFIFOs Regional Offices and to other institutions such as MINAE, SINAC, and NGOs.

Through a series of institutional agreements, the generation of information and the purchase or exchange of databases, FONAFIFO has access to spatial data on roads, forest cover, protected areas, life zones, contour lines, human settlements, aquifers, wells and rural water supply systems, biological corridors and facilities of the Agrarian Development Institute (IDA).

The IPMS is considered an extremely useful tool for directors, middle management, operations personnel and financiers. The system is based on administrative, financial, informatics and telematic standards and best practices used in the administration of national and international projects. Basically, the IPMS is composed of the following modules: General Planning, Procurement and Contracts, Financial Administration, Monitoring of Physical Progress, Evaluation of Results and the PES System. These modules are implemented in FONAFIFOs central offices by trained personnel with administrative and technical experience. The Applications Module, linked to the PES Module, can be accessed by the staff of FONAFIFOs Regional Offices. This is where the basic information (data on the applicants and properties subject to PES) is entered in order to begin the process to join the PES programme and continue with the process on line until the respective payment is generated.

The following is a general description of the purpose of each Module:

- **Contracts**: Ensures that contracts and procurements for projects are implemented in a timely manner, to the expected standards, at reasonable prices and using efficient, effective and transparent processes
- **Finance**: Facilitates the efficient flow of project funds, in line with the Implementation Plans and with the requirements of the financiers.
- **Accounting**: Generates useful information on the financial execution of the Projects
- **Fixed Assets**: Facilitating control of the assets procured.
- **Monitoring and Evaluation of Results**: Facilitates the timely identification of achievements, variances, risks, weaknesses and corrective actions in the physical and financial execution of the Projects, to enhance their results.
- **Planning and Budgets**: Facilitates the rational and timely preparation of plans and budgets for the execution, follow-up and quantitative evaluation of the physical and financial outputs of the projects.
- **Payments Environmental Services System**: Facilitates the input of data relevant to the PES contracts, the processing of payments and the monitoring of the areas subject to the PES Programme.

To function well, this requires high quality input data and well-trained and competent staff.

Under the PES programme, participants must present a sustainable forest management plan certified by a licensed forester (‘*regente*’). In addition to the proposed land use, management plans include information on land tenure and physical access; a description of topography, soils, climate, drainage, actual land use, and carrying capacity with respect to land use; plans for preventing forest fires, illegal hunting, and illegal harvesting. Management plans must also include a monitoring schedule. Once their plans have been approved, land users begin adopting the specified practices, and receive payments.

The PES programme has established a state-of-the-art system to monitor land user compliance with payment contracts. The programme remains weak, however, in monitoring its effectiveness in generating the desired environmental services (Pagiola, forthcoming/2005).

3.1.7 Compliance, Penalties and Enforcement

The landholders' contract does not specify an explicit penalty for non-compliance. The only possible response to an offence is to file a civil lawsuit for breach of contract. In the past, prosecution for environmental offences has been a slow, difficult process, in which only a fraction of offenders were actually brought to sentence. An alternative mechanism, the conservation easement, has been used in the KLINKI AIJ/JI project. Conservation easements are legal agreements, inscribed in the public land registry, which restrict land use of one property for the benefit of another. An advantage of the conservation easement, for enforcement purposes, is that the beneficiary of an easement can secure an immediate injunction in case of a violation of the easement terms (Chomitz et al. 1999).

3.2 The Mexican Payment for Environmental Hydrological Services Programme

3.2.1 Context of Forest Trends

Mexico faces a number of environmental challenges, with deforestation and water scarcity being two of the most important. Only four countries (Brazil, Zambia, Indonesia, and Sudan) accounted for more deforestation than Mexico in the 1990s, according to the FAO's 2005 *Forest Resources Assessment*. Various assessments indicate that both the amount and rate of deforestation in Mexico is highest in tropical forests, including areas of high biodiversity value. With respect to water scarcity, according to the National Water Commission, two thirds of the 188 most important aquifers in the country suffer from overexploitation (*Diario Oficial de la Federación*, 2003 cited in Munoz, 2005).

Despite many laws and regulations that have been passed to reduce the over-exploitation and degradation of forests, deforestation in Mexico has continued. Drivers for this include land use changes to produce crops and feed cattle (OECD, 2003). Between 1993 and 2000, 3.1 million hectares of forests were transformed to agricultural uses and 5.1 million hectares had been converted into pasture (Velasquez et al. 2002 cited in Munoz, 2005), an expansion of these land uses of 2.0% and 4.6% respectively.

Some of the conditions that have led to this loss include economic prioritizing of other sectors of the economy. Land tenure laws prior to 1992 together with a rapidly increasing population, exacerbated by *minifundismo*, encouraged the exploitation of forest lands to fulfil a demand for agricultural and ranching lands. The latest titling change in the land tenure laws applies only to private forest and agricultural land, and this may further encourage deforestation as common forestlands are quickly cleared and claimed (World Bank, 1995). Cattle-ranching appears to have been the greatest contributor to deforestation. Second, has been the movement of agricultural populations onto forest highlands with soils ill suited for agricultural purposes. Other factors leading to deforestation include uncontrolled fires in temperate forests, some of which result from out-of-control slash and burn activities, and illegal logging. Finally, deforestation has also been worsened by the almost complete dependence of the nation on fuel wood, uncontrolled road construction, and activities of the mining and oil industries (Tellez Kuenzler 1994; World Bank 1995). With regard to overexploitation of aquifers, a subsidy on electricity for water pumping is said to have led to failure to price water relative to its scarceness.

Though recent environmental laws have been strong, Ellingwood (2000) argues the problem is not the wording/presence of laws and regulations but enforcement in the context of non-compliance, bureaucratic subterfuge, business influence, corruption and inefficient public agencies.

Conversely, Mexican forest policy consists of a series of programmes that subsidize plantations and other commercial forestry, help build capacities among poor forest-owning communities so they can have their own community forestry firms, and directly invest in reforestation.

In Mexico, most land is in common property. Private owners control approximately 20% of forests, whereas the remaining 80% of forested land is owned by indigenous communities and *ejidos*. *Ejidos* are a communal form of land tenure established in the revolution of the 1920s to secure rural population access to agricultural lands. *Ejidos* are composed of two different kinds of property rights over land: private parcels and commons. Private land is mostly dedicated to agricultural activities. The commons are mainly dedicated to pasture and forest.

3.2.2 Legal Framework

The current Mexican regulatory framework on forestry is contained in several instruments. The Forestry Law of 1986 promoted the development of stronger and more organized community forestry enterprises and established strict environmental protection regulations of forestry activities. The structural reforms of 1992-1994, established more transparent property rights in individual plots and common property land within *ejidos* and *comunidades*. Reformed in 1992, Article 27 of the Mexican Constitution included fundamental changes in land rights, mainly to allow land under communal property to be sold. This reform, accompanied by radical reforms to the agrarian, forestry, and water use laws, was mainly targeted to create a market for land that never existed before and full property rights over these collective resources can now be legally claimed by peasants.

A combination of legal elements is used by the Mexican government to reduce deforestation. Direct regulation prohibiting land use changes and strategic support for sustainable forestry activities is enforced using three main instruments: Presentation of an Environmental Impact Assessment to obtain an authorization for land use changes, a sustainable forestry management plan that includes extraction limits and fragile areas conservation before initiating any timber extraction operations, and the tougher requirements and additional restrictions imposed on landowners if the forest is within a Natural Protected Area (ANP). That said, the vast majority of deforestation has occurred without authorization, so in a sense the PEHS is paying to give incentives to forest owners to avoid doing something that is considered illegal (Munoz et al. 2005).

The PEHS was established as a working line of the Mexican Forestry Fund (*Fondo Forestal Mexicano)*, in accordance with Article 142 of the General Law for Sustainable Forestry (*Ley General de Desarrollo Forestal Sustenable*) which states: “The Mexican Forestry Fund will be the instrument to promote forestry resources and associated resources conservation, increase sustainable use and restoration facilitating access to available market financial services, promoting projects contributing to integration and competitiveness of the production chain, and developing the appropriate mechanisms for charges and payments for environmental goods and services”. This same law, under Articles 133 and 134 orders the promotion of forestry environmental services.

3.2.3 Institutional Framework

In 2001, the National Institute of Ecology (*Instituto Nacional de Ecología,* INE), a decentralized body of the Secretariat of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales,* or SEMARNAT) was created to promote and coordinate research on environmental issues in order to provide data, proposals, and technical input for decision-making to support the environmental and natural resources management. INE was involved in developing the PEHS programme together with academics from the Iberoamerica University (UIA), the Centre for Research and Education in Economics (CIDE), and the University of California. After much political negotiation, the PEHS was introduced in 2003.

The implementing agency of the PEHS programme is the National Forestry Commission (CONAFOR), also within the SEMARNAT. CONAFOR has 13 regional offices (*Gerencia regional*) that evaluate all the complete and valid applications forms for payment. At CONAFOR there are on average 17 members for each *Gerencia estatal* (state department, of which there are 29) who take part in some stage of the PEHS programme. In addition there are 100 persons working on promoting the programme[6].

In order to provide security to forest landowners that they would receive their funds throughout their participation, the government created a trust fund, the Mexican Forest Fund, to assure participants that the resources to pay them had already been set aside.

The ongoing policy strategy of CONAFOR is to gradually involve more local governments to complement federal funding. A handful of new examples of local PEHS are expected to be launched in 2006 and 2007. CONAFOR is working towards having local authorities take over the programme in their own watersheds to keeps the payments flowing after year 5 for those plots whose period ends, but it is uncertain how many municipalities or State governments will do so (Munoz, 2006).

In 2003, the criteria established for property site selection was the following:

- Forests with more than 80% density (i.e., hectares with more than 80% tree cover);
- Located in overexploited aquifers, as identified by the National Water Commission (*Comisión Nacional del Agua*, CNA) (i.e., high value of water conservation benefits);
- With nearby population centres greater than 5,000 inhabitants (i.e., to warrant sufficient demand).

3.2.4 Financing

Mexico's lakes, lagoons, aquifers and rivers are considered national property and as such are managed by the federal government. The *Ley Federal de Derechos* (LFD) allows charging fees for their use and maintenance as suppliers of the water or repositories of wastewater (Munoz et al. 2006). It was therefore decided that funding for the PEHS programme would come from a fee charged to federal water users, thus making the connection between those who benefit and those who pay. 200 million Mexican pesos (USD18 million) were earmarked each year from the federal budget for the payment of hydrological environmental services. In 2004, Congress increased the PEHS's budget by 50% (approximately USD26 million).These funds are then assigned to the Mexican Forest Fund.

There are currently two levels of payments: USD40/ha for cloud forests; and USD30/ha for other forests. As in the Costa Rican case therefore, the payments are not made for the provision of the environmental service per se, but rather for the land-use that provides them. The Mexican PEHS programme differentiates payment between type of forest as the hydrological services provided are considered to be higher in cloud forests[7].

The allowable area is limited to 200 ha per beneficiary for private owners. This is intended to prevent a unique private owner from monopolising the resource. According to the 2007 Pro Arbol Programme rules, the allowable area for *ejidos* and *comunidades* lies between 20 and 3,000 ha per beneficiary. The upper limit is equal to the Mexican *ejido's* mean surface. The total number of applicants received and hectares offered, along with the number of forest owners and hectares incorporated into the programme are shown in Table 6.

[6] At INE there are currently 3 persons working on the PES programme, an economist, a GIS specialist, and a political and public policy analyst (INE, 2007, personal communication).

[7] The use of an inverse auction for allocation had also been considered but was decided against due to the perceived increase in administrative costs and complexity (Munoz, 2005).

Table 6. Applications and forest owners incorporated into the PEHS programme

Year	Applications received (number of 1000 ha)	Applications incorporated (number of 1000 ha)	Cumulative Area in number of 1000 ha (Cumulative Payment in millions of pesos)
2003	900 (600)	272 (127)	123 (149)
2004	960 (--)	352 (184)	305 (321)
2005	688 (--)	257 (169)	474 (424)
2006	926(--)	173(127)	601 (628)

Source: Munoz, 2006; CONAFOR personal communication, 2007

As in the Costa Rican case, there has been excess demand for payments in the Mexican PEHS programme. INE has been working on a deforestation risk model with the intention of including risk of forest loss as one of the parameters used to evaluate applications for payments. This was made available in the 2005 PEHS selection process, however due to the smaller number of applicants, it was not actually needed. The risk of deforestation index was used in the 2006 site selection process.

3.2.5 Baselines, Additionality, Leakage

Once the areas that will receive payment have been selected, satellite imagery is used to obtain a baseline of forest cover. As in the case of Costa Rica therefore, the baseline used for Mexico is static (payments made with respect to status quo).

Overall, given the site selection criteria that were used up until 2006, the additionality of the PEHS programme is considered to be weak. INE is currently examining plots with and without PEHS with the same predicted risk of deforestation to evaluate what the observed deforestation rate would have been in the enrolled areas if the programme had not existed (i.e., the counterfactual). It is anticipated that the deforestation risk index that was included in the selection criteria as of 2006 may help to address this issue.

To avoid intra-property leakage, in most cases the contracts specify that removal of trees from the community's entire forested area (even outside of the area for which payments were being made) constitute a contract violation and hence subsequent non-payments.

INE is currently comparing satellite images of areas with and without PEHS to identify the existence of intra-property leakage. There is also the possibility for leakage to operate through the market, though whether this has been the case in Mexico remains to be examined. It is possible that the same amount of deforestation has taken place, but occurring in areas that are not as important for aquifer recharge or flood prevention, and hence there would still be environmental welfare gains.

3.2.6 Monitoring, Reporting and Evaluation

The monitoring scheme originally built into the rules of operation included the use of high resolution satellite images. This was initially eliminated however due to the fact that CONAFOR did not have the technical or operative capacity to continuously monitor recipient communities. Insufficient time and staff meant that satellite images of potential properties were not purchased, with the result that properties located in regions where images had not been purchased were not allowed in the programme. In a related problem, if the properties were not already georeferenced, a task requiring significant work and technical support, they could not receive payments since identifying them on a satellite image would be impossible. Finally, in the communities with forest extraction activities, it was often impossible to determine if the area chosen for environmental payments overlapped with area earmarked for tree harvests. Monitoring is carried out once a

year based on several satellite images. In 2003 and 2004 CONAFOR used high resolution images (Ikonos, IRS, Quickbird) (INE, personal communication, 2007).

The annual cost of operation and monitoring for the first year of operation was estimated at USD 714,285 which yields an average cost of USD5.6 per hectare, which is totally absorbed by CONAFOR. Compared to payments of USD30/hectare, this indicates administrative costs that represent 19% of the PEHS budget. In addition, there is an annual evaluation of programme objectives, processes and expenses made by an external institution. For the first year, this evaluation amounted to USD 98,214. By law, the implementation and evaluation costs are required to be no more than 4% of total costs.

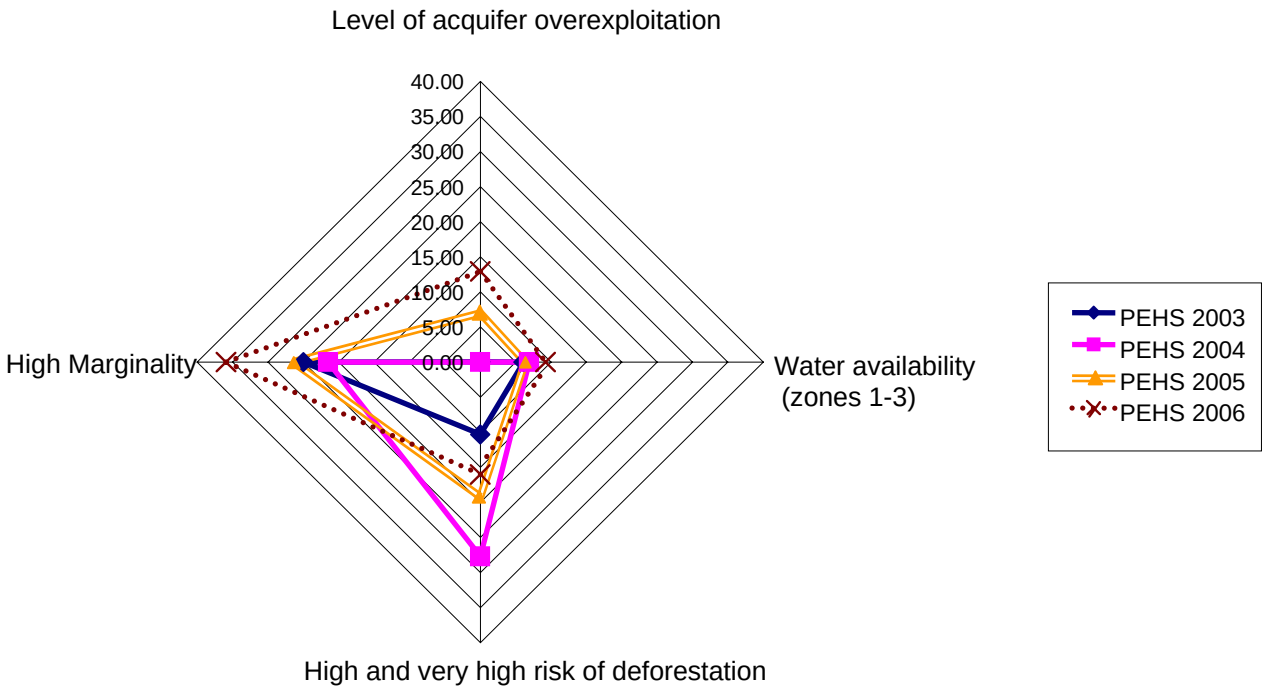
Excess demand for payments led to an ad hoc allocation mechanism that created several targeting weaknesses. In 2003, only 11% of the participating forests constituted areas with high or very high risk of deforestation. For 2004 this increased to 28% but then fell to 20% in 2005 (Munoz et al, 2006). To achieve better targeting and efficiency, the Mexican PEHS Technical Committee has recommended that an explicit grading system for evaluating proposals is incorporated in the rules of operation; one which would help identify those areas more valuable for their environmental benefits, and where true modification of conduct would be achieved by the economic instrument. For the latter objective, the deforestation risk analysis and resulting index is a fundamental piece of information (Munoz, 2005).The application grading system reform was introduced in 2006 which is expected to deliver more value to water users for the same budget.

Between 2003 and 2005, satellite images showed that less than 0.01% of the nearly 300 thousand hectares paid by the programme was deforested. Areas that were lost were due mainly to forest fires, not intentional land use changes. In comparison, the rate of deforestation in the rest of the country is estimated at 1% per year (Munoz et al. 2006).

This figure below shows the distribution of PEHS regarding four main characteristics: (1) level of aquifer over-exploitation, (2) water availability zones (water scarcity is higher in zones 1-3), (3) marginality, and (4) deforestation risk.

Targeting has improved over the years (gradually the focus is moving towards higher over-pumped aquifers, higher marginality communities and low-water availability zones) with one exception: the risk of deforestation. The percentage of hectares with high or very high risk was larger in 2004 than in 2006, even though the criterion was included as a selection process in 2006.

Figure 3. Targeting PEHS in Mexico



Source: INE (2007) personal communication

3.2.7 Compliance, Penalties and Enforcement

The Mexican PEHS includes specific penalties for non-compliance. If there is a purposeful land-use change, then there is no payment at the end of the year, irrespective of how small the land-use change is. If deforestation occurred for other reasons, e.g. forest fire or timber theft, then the participating community is still responsible and does not get paid for what was lost, but does get paid for whatever was preserved.

Further Developments in PES in Mexico

In 2004, as a complement to the PEHS, Mexico created CABSA (Programme to Develop Environmental Services Markets for Carbon Capture and Biodiversity and to Establish and Improve Agroforestry Systems). CABSA supports reforestation activities and land use changes in Mexico and links them to national and international markets/financing for carbon capture and biodiversity. While the programme has had initial success in attracting proposals, it also faces some challenges: (i) sustainability is limited by the 5-year on payments; (ii) international carbon and biodiversity markets are new and lack well-established prices and rules, (iii) transaction costs may be high, and (iv) there is not adequate information and clarity on how communities will benefit from CABSA (World Bank, 2006).

More recently in 2006, a total of USD156.56 Million has been allocated to update the PEHS in Mexico. The funding comes from a number of different counterparts including a loan from the IBRD, a grant from the GEF and government funds and contributions. The projects main objective is to enhance the provision of environmental services of national and global significance and secure their long term sustainability (World Bank, 2006). To ensure success of this programme lessons learnt from the PES and CABSA (addressing the weaknesses), the Costa Rican *Pago por Servicios Ambientales (PSA)* and other GEF supported biodiversity and sustainable use projects have been used to enrich the project design. Eight pilot sites have been selected identified by CONAFOR that include Natural Protected Areas, Priority Terrestrial Ecoregions and Important Bird Areas. These areas will be used to test all five components if the scheme which include; sustainable finance mechanisms, development of PES delivery mechanisms, support for the PES, new payment channeling and a new project management structure.

Major developments being made in the new PES are directed towards local conditions rather than the previous more general framework. For example, finance can still be channelled thought the PES however the set up of stand alone local PES mechanisms means that financing can also be channelled though these organisational bodies, where appropriate. This is essential as having financing is not sufficient, local mechanisms can be used as intermediaries between service users and service providers. They will have the responsibility of determining how best to generate the services that users are paying for, recognizing critical areas and land use practices to be targeted, monitoring impacts and compliance, making payments, and negotiating with the contracting of service providers (World Bank, 2006).

Table 7. Relative areas under the PEHS and the CABSA

Number of ha	2003	2004	2005	2006	Cumulative*
PES-H	126,818	184,240	169,128	127,016	607,202
PES-CABSA		30,526	26,843	18,876	76,245
Total	128,821	155,819	304,770	307,205	683,447

* The total area 2003-2006 does not reflect the figures in the project design phase

Table 8. Comparative design of Costa Rican and Mexican PES programmes

	Costa Rica	Mexico
Purpose and Framework		
Policy Goals	Reduce deforestation	Reduce deforestation; improve water quality
Overlapping Regulation	Law banning clearing of forest land	Regulation prohibiting land-use changes and support for Sustainable Forest Management.
Field of Operation		
Geographical Scope	National	National
Covered Services	Hydrological services, scenic beauty, biodiversity, carbon sequestration	Hydrological services
Eligibility	Private landowners, indigenous reserves	Private landowners, ejidos, comunidades
Size restrictions	1-300 ha (600 ha for indigenous reserves)	200 ha (20-3,000 ha for ejidos and communidades)
Mode of Operation		
Baseline	Status quo	Status quo
Additionality		Poor; use criteria
Leakage	N/A	No measures
Monitoring and Reporting		
Contracts	IPMS	--
Environmental services	--	--
Equipment	GIS	Satellite imagery (Ikonos, IRS, Quickbird)
Enforcement		
Automatic penalties for non-compliance	No	Yes (non-payment)

4. Towards a Carbon Instrument for RED

Several proposals for including RED incentives in a post-2012 climate change framework have been put forward, including both non-market and market based approaches[8] (see Annex 1 for a brief summary). Non-market based proposals include the use of voluntary funds (ODA and private sector sponsorships) and others. The focus here is on market-based approaches to RED.

[8] FCCC/SBSTA/2006/MISC.5 and Add.1, and http://unfccc.int/methods_and_science/lulucf/items/3896.php. To support the discussions, the UNFCCC has held a workshop on "Reducing Emissions from Deforestation in Developing Countries" in Rome, Italy (August 30-September 1, 2006) and another more recently in Cairns, Australia (March, 7-9, 2007). SBSTA has been requested to make a recommendation to the UNFCCC COP-13 in December 2007.

In essence, an international market-based instrument exclusively designed to RED would either be project-based or would constitute a sectoral crediting mechanism (SCM) for forestry. Both cap-and-trade and baseline-and-credit fall under the latter category (Baron and Ellis, 2006). As Baron (2006) points out, a sectoral crediting mechanism could bring incentives for mitigation in developing country sectors, without requiring economy-wide emissions reductions. Such an approach could be linked to the global carbon market and, while not being the first-best approach to emissions reductions, would move towards widening and deepening the carbon market internationally. Ideally countries would take on more stringent emissions reduction commitments in a post-2012 climate change framework to reflect this new potential supply of cost-effective emission reductions[9].

At the domestic level, national governments that participated in an international sectoral crediting mechanism, could either devolve their sectoral cap or baselines to individual land users, or presumably would undertake emissions reductions via domestic policies and measures.

Irrespective of how such an instrument might be incorporated into a post-2012 climate change framework, a RED instrument would require participants to establish a base year or forestry baseline, development of internationally comparable and consistent monitoring and reporting methodologies, establishing national systems to apply these, and developing a national or regional mechanism to engage all players in the forestry sector. This approach would thus require significant capacity beyond what is in place today (technical, institutional, and regulatory – including effective enforcement measures), and thus capacity building efforts and time.

4.1 Legal Framework

Any incentive instrument agreed under the UNFCCC to capture the carbon values of forests would be designed to be applicable at the global level. This would require legal frameworks at both the international and national level.

International: Incorporating a RED instrument into the existing climate change regime (UNFCCC and the Kyoto Protocol) should not be problematic from the point of view of public international law. Although it might call for important modifications to the existing structure and design of commitments, for example under the Kyoto Protocol, nothing in international law prevents states from doing so provided that they are able to agree on such alterations (Kulovesi and Keinanen, 2006). Suggestions for example include introducing a "Voluntary Annex-C" in the Kyoto Protocol designed to address deforestation and establishing a new Protocol under the Convention.

Establishing such an instrument internationally will require fundamental decisions to be reached regarding the nature and design of the instrument. For example, credits could be distributed/auctioned by developing country governments based on the adoption of reduced deforestation targets (caps) as with the design of the current international emissions trading system under the Kyoto Protocol. Alternatively, tradable credits could be generated (as in CDM) from some sectoral or project baseline, essentially extending the range of project-types that could be included in any CDM-type mechanism of the future. Under the former, the cap is a legally binding limit on annual sectoral emissions for a country. If the national government devolves emissions limits for individual landowners, then they could participate in both a domestic and international trading system. Under a "baseline and credit" system, the emissions limit is a baseline and the GHG reductions below the baseline generate credits. The baseline can be a fixed level of emissions (i.e., flat or 'static') or can be changing over time ('dynamic'). Caps can also be static or dynamic. Baselines do not necessarily need to be legally binding. The national government may also choose to set baselines for its

[9] Note that a sectoral baseline-and-credit approach is not exclusive to market-based approaches. One proposal for example is to distribute ODA funds ex-post in proportion to the national emission reductions achieved by each developing country, relative to some sectoral baseline or so-called reference rate.

individual areas, so that the land users/participants can partake in both domestic and international trading systems.

An international legal framework would need to address the issues that require harmonisation across countries to ensure comparability and consistency to promote environmental and financial integrity. Above all, this would include:

- Defining comparable and consistent monitoring procedures that meet acceptable levels of accuracy, as well as reporting procedures;
- Defining rigorous and consistent penalties for fraud and non-compliance at the international level (if targets are binding);
- Defining minimum entity non-compliance penalties (if national governments devolve the targets to individual sources, or land users, minimum non-compliance penalties would need to be defined to avoid competitiveness and distorting issues in the carbon market).

If developing countries are to participate in such an instrument, clear rules would need to be established at the outset for the entry of new participants into the trading regime.

Other issues to be determined include defining minimum eligibility requirements for participation (in particular for monitoring and reporting procedures), and defining the unit of trade from reduced emissions (e.g., in tonnes of CO_2-equivalent, providing the holder to emit one tonne of CO_2 in any country with an emissions reduction target) and the nature of credits (permanent or temporary). Many modalities of operation could be drawn from the existing framework of flexible mechanisms under the Kyoto Protocol.

Attention should be paid to reforming existing international policy distortions that have adverse implications for deforestation. This would aim to reform or eliminate agricultural subsidies or other policy measures that provide incentives for continuing deforestation, and would therefore involve collaboration with multilateral trade institutions, such as the World Trade Organization (WTO). Potential overlapping legislation needs to be identified and clarified. For example, given that avoided deforestation is not allowed in the CDM, there would not be any overlapping jurisdictions between the current CDM and a RED crediting instrument.

National: Domestic legislation would need to stipulate the rights and responsibilities of different levels of government and the land users (if any) that would be eligible to participate in the system. Legislation would be needed to assign/authorise an implementing agency that would be responsible for running the day-to-day operations of the programme.

As was undertaken in the case of Costa Rica in the PES programme, as well as in certain JI host countries[10], a mandate could also be provided for the creation of a national oversight body/steering committee, including stakeholders from the relevant Ministries (e.g., Forestry/Environment, Finance, Energy, etc) and other national institutions. Such bodies serve to increase transparency and awareness across the different national sectors, and to raise the level of political awareness at the national level for climate change and deforestation. They can also help to identify and eliminate counter-productive national policies in place, such as those that support the conversion of forest lands to other uses (e.g. agriculture), by improving co-ordination among stakeholders. Working across national government and stakeholders to clarify how the international framework will be implemented domestically and operate in synergy with existing domestic regulations and sector policies could also be facilitated through such a consultative process. For example, how would existing PES programmes, e.g. the CABSA in Mexico, interact with a RED scheme? Legal aspects of a carbon incentive for RED at the national level may require adjustments to forestry law, property law, and/or other laws governing investments and financial transactions, depending on national circumstances.

[10] For example, Romania and Bulgaria have established national Steering Committees for JI, each including 12 members from relevant ministries and institutions (Karousakis, 2006).

The establishment of clear, well-defined and secure property rights will be key. The case studies from Costa Rica and Mexico illustrate that it is possible to operate a PES programme on land that is both privately-owned as well as communally-owned. Community ownership of, or rights to, forests is common in several other non-Annex I countries, such as Tanzania, Thailand, Philippines, Bolivia and Brazil (Ellsworth 2001).

A lack of secure property rights is also common with illegal logging. In many developing countries, illegal logging constitutes a large percent of round wood production (see Table 8). The implications/ effects that illegal logging may have on a carbon instrument need to be considered.

Table 9. Estimates of illegal harvest (as percent of production)

Country	Illegal logging as percent of production	Source
Africa		
Benin	80	SGS, 2002
Cameroon	50	European Commission, 2004
Ghana	At least 66	Birikorag, 2001
Mozambique	50-70	Del Gatto, 2003
Asia		
Cambodia	90	Global Witness, 1999
Indonesia	Up to 66% 73-88	World Bank, 2006 Schroeder et al. 2003
Malaysia	Up to 33	Dudley et al. 1995
Myanmar	80	Brunner et al. 1998
Latin America		
Bolivia	80	Contreras-Hermosilla, 2001
Brazil	80 in the Amazon	Vianna, 1998
Colombia	42	Contreras-Hermosilla, 2001
Ecuador	70	Thiel, 2004
Honduras	75-85 of hardwood 30-50 of softwood	Richards et al. 2003
Nicaragua	40-45	Richards et al. 2003
Costa Rica	25	MINAE, 2002

Source: OECD, 2007. Round wood refers to wood felled for both industrial use and use as fuel wood.

A key question is therefore what design features of an internationally agreed RED incentive would best help to strengthen a system to monitor and curb illegal logging, as well as providing incentives for reduction in (legal) activities that result in net deforestation. For example, in the tropics, wood removal for fuel wood can be as high as 80% suggesting that illegal logging for fuel wood would only decrease if and when adequately priced modern energy alternatives become available in combination with effective poverty alleviation policies (OECD, 2007). With the right institutional and policy framework, including well-defined and secure property rights, a carbon incentive approach could provide a compensatory measure for the poor. In all instances, the monitoring infrastructure that would be required to operationalise a carbon mechanism would most likely facilitate the detection of illegal logging and therefore assist with the design and implementation of preventative measures.

To encourage small and medium-sized landowners to participate in the Costa Rican and Mexican PES programmes, legal provisions for size restrictions were placed on the number of hectares of land for payment a private landowner could apply for (1ha – 300ha for Costa Rica and up to 200ha for Mexico) with other size restrictions made for communal ownership of forests. However a similar size restriction may not be advisable for an international RED instrument. If national governments choose to devolve emissions limits or baselines to land users, size restrictions in an international RED mechanism could impose artificial constraints on the market and could be counter-productive to achieving emissions reductions in the most cost-effective manner. Instead, to encourage small-landholders to participate, bundling may be desirable (as is the case in the Costa Rican PES programme) to help reduce the transaction costs of complying with the programme. Bundling of project activities is also possible in the CDM (decision 4/CMP.1) and experience gained from this mechanism could be used to feed into the modalities of any RED instrument.

At the international level, equity issues may also arise, e.g., in the distribution of RED units/credits. In the case of the Costa Rican PES for example, certain exemptions from land-ownership and size regulations were made to encourage indigenous reserves on equity grounds.

4.2 Institutional Framework

Functional institutions to support an international carbon incentive for RED would need to be established at the international, national, and local levels. The institutional framework, the type of institutions required, and the relative share of responsibility between the international and national level would vary depending on the nature of the instrument. For example, a project-based mechanism is likely to be institutionally more demanding at the international level, whereas a sectoral crediting mechanism (cap-and-trade or baseline-and-credit) is likely to be relatively more demanding at the national level[11]. Some of the necessary institutional elements required at the international, national and local levels are examined in turn.

International: Depending on how negotiations with regard to the post-2012 commitment period evolve, reaching agreement on an instrument to RED would most likely include one or more institutional bodies, such as the UNFCCC Secretariat, to:

- Provide the platform for negotiating the agreements, with input from the SBSTA (as already requested).
- Ensure that accurate and consistent monitoring and reporting mechanisms are in place across countries. This could involve accreditation bodies to certify national monitoring institutions and exchanges, and the preparation of standard documentation such as GHG unit transfer forms and confirmation notices.
- Operate the compilation and accounting databases related to national forestry accounts and any necessary modifications to the international transaction log (ITL).
- Ensure proper links with any national registry systems (e.g., for “Reduced Deforestation Units” - RDUs).
- Ensure compliance and resolve disputes.

Once the international functions required to operate an international RED instrument are agreed, it will be necessary to identify or establish institutional bodies to carry out those functions. For example, for a sectoral mechanism, a special oversight body could supervise the implementation of a RED instrument, to ensure that developing countries fulfil all the monitoring and reporting requirements necessary to participate. This is likely to be more similar to the institutional process for international emissions trading (IET) under Article

[11] Many of the institutions required for a project-based RED instrument may be able to build directly from existing institutions in place for CDM projects.

17 of the Kyoto Protocol. For project-based mechanisms to RED, it is possible that these could fall under the CDM procedures and guidelines directly, and would therefore be subject to baseline and monitoring methodologies approved by the Executive Board.

Building on existing carbon market services, brokers and financial intermediaries to match buyers and sellers of such credits are likely to emerge quickly, facilitating bilateral trades or exchange trading. Other information services would also likely emerge, quoting prices and quantities of units sold, thereby assisting the market to function smoothly and to reduce transaction costs. These functions are already provided by a growing set of private sector actors and companies for the three existing Kyoto Protocol mechanisms. Ensuring these services for a RED instrument is therefore unlikely to be difficult, or to require significant set-up costs.

Ensuring national capacity building efforts to assist developing country governments and entities to successfully access RED markets may be an important international function. This might include guidance for the relevant national authorities/experts, technology transfer, including monitoring technologies and geographic databases, and providing technical workshops and training. This work could build and expand upon existing capacity building courses, for example, those set up by the World Bank for Payments for Environmental Services that have been held in Ecuador, Venezuela, South Africa, and Senegal. Though these capacity building efforts currently target environmental services other than carbon mitigation, they could be adapted to include this new "climate change" set of goals.

National: A number of design and implementation issues would need to be addressed at the national level which, as above, may vary depending on the type of instrument that is adopted. A national institutional framework for a sectoral crediting instrument for example is likely to be similar to those of national frameworks that support the EU ETS and that are being developed in Annex I countries for the first commitment period of the Kyoto Protocol. Key design issues to be determined at the national level include:

- Whether emissions caps or baselines would be passed on to forest land users directly or not. If caps are passed on to forest land users, the allocation methodology (e.g. grandfathering or auctioning of permits) and eligibility criteria to participate will need to be determined.
- If sectoral baselines are passed on to forest land users, baselines and monitoring methodologies would need to be established within the country as well at the land user level.
- If sectoral emissions caps or baselines are not passed onto forest land users, then national governments would presumably engage in domestic policies and measures to reduce emissions from deforestation.
- Whether emissions penalties and/or criminal and civil penalties will apply in the case of non-compliance. If a cap-and-trade instrument is adopted, penalties will be necessary to ensure the integrity of the environment and the market.

For a RED instrument that is project-based, the national institutional framework could be similar (or even identical) to that of the CDM host-countries.

Potential lessons regarding institutional arrangements can be drawn from experience with CDM and JI (such as the establishment of national Steering Committees, discussed above), and the PES case studies in Costa Rica and Mexico. For example, if the RED instrument were project-based, the "designated national authority" (DNA) under the CDM at the national level could be made responsible for reduced deforestation activities. Alternatively, if a sectoral crediting mechanism for forestry is developed, a designated National Forest Focal Point could be required to report to a CDM Executive Board / JI Supervisory Committee equivalent of the RED mechanism on domestic activities, promote RED at the national and international level, and facilitate information exchange for interested investors, among other responsibilities.

An implementing agency to operate the programme will need to be identified. Ideally, the agency selected should have political clout, with a clear understanding of incentives and of social issues in the forestry/agricultural sector, and similar objectives and constituency. As with policies at the international level, there would also be a need for coherent cross-sectoral *national* government policies (e.g., agriculture, transport, education, poverty reduction) so as to eliminate and prevent any counter-productive incentives for deforestation in place at the domestic level.

National institutional capacity and legal frameworks to monitor and protect forest areas in developing countries are likely to need to be strengthened to implement such an instrument. General experience from Mexico indicates that even if stringent environmental laws are in place, inadequate institutional capacities can result in limited enforcement of the law. Maximum transparency, a critical component of accountability, will be necessary. This would need to be fostered by rigorous monitoring, periodic review, and evaluating institutional performances in developing countries. Depending on the procedures, rules, and criteria that would be established, land users may be required to prepare management plans and other reports to comply with domestic and/or international requirements.

Sufficient coordination and control across different national/local institutions will also be important to ensure that there is a clear and consistent policy towards RED activities. This will require good communication between different actors and the various levels of government. Major outreach efforts would be necessary. Support and capacity building would need to be provided to government entities, as well as small and medium-size land owners. Education and awareness-raising will be important to ensure that landowners understand the aims and objectives of the mechanism and what it is they are getting compensated for. Experience from the Costa Rican PES has shown that some landowners did not understand what they were being compensated for (Miranda et al. 2003).

It is important to note that any arrangements for a carbon incentive scheme for forests in developing countries would likely be as resource-intensive as or more so for domestic governments than the existing arrangements under the CDM. National governments will be required to take on new mandates and programmes, and to adapt existing ones. This is particularly so in countries where illegal logging is already a problem, as it is notoriously difficult to monitor and difficult to address. Lack of national and/or local resources and technical capacity may be further hindered by corruption, lack of capacity, and other governance challenges common in many developing countries (Ellis and Kamel, 2007). Even JI, based predominantly within the economies in transition, has faced significant institutional challenges, and these challenges are likely to be at least as large in developing countries.

Local: There will also be a need for local institutions to increase capacity building, and to provide education and raise awareness of the environmental values of forests and the potential economic opportunities associated with these. In the Costa Rica PES case study, local institutions were also helpful in bundling small landholders together to apply for the necessary contracts and thereby reduce the transaction costs associated with the programme. The lessons learned from Costa Rica indicate however that, although intermediaries can be helpful, excessive reliance on intermediaries is not recommended. In some cases, landowners did not know the practical, legal and other organisational details of the PES programme because the intermediaries dealt with these processes (Miranda et al. 2003).

4.3 Financing

Several design issues would need to be addressed with regard to the financing of a market-based carbon incentive for RED. These include a number of key questions, such as:

- Will payments for emissions reductions be made to developing country governments, directly to individuals/ land users, or to both? If non-government participants are allowed to trade, would this include forest landowners with private property rights, communities with common property rights, and/or government in the case of government-owned land?

- Who are the eligible buyers? National governments with emission reduction targets, private entities, citizens?
- A financing mechanism that collects payments and manages funds may be necessary. Would there be national funds in the buyer countries?
- A payment mechanism or "tax" on projects may be needed to support promotion, contracting with land users, and monitoring of implementation. Would this be undertaken exclusively by the host country or by the buyer of credits?
- Will payments be made up-front, only for ex-post verified emissions, or in staggered format (e.g., as in the Costa Rican PES programme)?
- Would the carbon payments cover the administrative and capacity building costs that would be associated with setting up the required national institutions in developing countries, or would that be covered separately, for example through ODA or GEF financing?

These questions will need to be carefully considered in the design of a system to capture carbon values in order to reduce emissions from deforestation. The PES case studies from Costa Rica and Mexico illustrate that it is possible to compensate land-users directly for the environmental services they provide. This requires strong institutional capacity and the ability to monitor individual land-user behaviour to ensure that they are complying with their contracts. Depending upon national circumstances, developing country governments could distribute the RED funds to individual land-users, or could devolve the emission caps/baselines and enable international trading of units directly between land-users and entities.

Experience from Costa Rica and Mexico also indicates the importance of establishing appropriate criteria for distributing the funds in an efficient and environmentally-effective manner. In the Costa Rican PES programme for example, the payment is a fixed amount per ha, independent of the quantity and quality of environmental services (Wuenscher et al. 2006). Incorporating a sites' opportunity cost, which might be lower in remote or less productive areas, can help to target payments more efficiently. Obtaining opportunity cost data may be difficult to obtain however. It may be feasible instead to gather information that is correlated with opportunity costs, such as distance to road and markets, soil type, forest type and assessed value, etc. Alternatively, inverse (or reverse) auction systems (which had been initially proposed in Mexico) can help to address these issues (see Ferraro, forthcoming). A targeted auction ranks bids by both price and quality of environmental service and the cost-effectiveness of an auction depends on the cost heterogeneity of providers. The implementation and operating costs of different approaches need to be carefully estimated and weighed against efficiency gains.

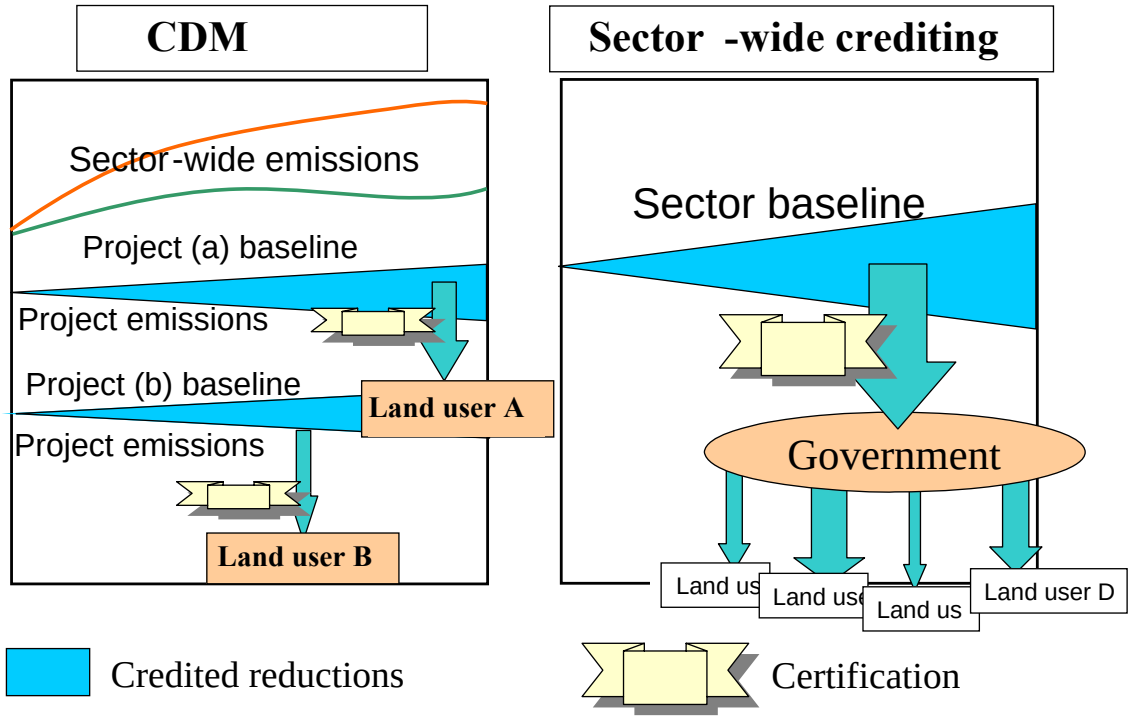
On another issue, if payments are made only for ex-post emissions reductions, would small-landholders be restricted from entering the programme because of the lack of up-front financing? Small properties may be at greater risk of deforestation because of owners' low incomes, high discount rates, and lack of alternatives. Lessons learned from PES programmes in general indicate that it is important to ensure that the financing process occurs smoothly and efficiently to avoid long waiting times for contract approval. Long waiting times may constitute a significant transaction cost that prevents small landowners from entering the system. For example, some PES schemes require that the land area subject to a new proposal be subject to strict conservation measures while the management plan and PES contract are pending approval. This may be impossible for small landowners who cannot afford to place a portion of their land out of production (Mayrand and Paquin, 2004). Though this may indeed be a disadvantage for small landholders, payment-upon-delivery increases the environmental integrity of the instrument and minimises the risk to the buyer of credits. Payment-upon-delivery is the method of payment used under the Mexican PES programme, as well as for CDM projects. In JI, certain national funds help to overcome this barrier by offering partial up-front payments on a case-by-case basis to JI project developers, thereby helping to eliminate the financial constraints associated with setting up a project (e.g., Japan).

4.4 Baselines, Additionality, Leakage

The choice of a baseline or cap will have important implications for whether emissions reductions are real (additional) or not. As can be seen from the PES case studies, the static baseline selected for the Costa Rican PES is considered to be overly generous. Evidence suggests that deforestation was on the decline prior to the introduction of the PES, thus the baseline ideally should have reflected this trend (Wunder, 2006). Also in Mexico there is no indication that the development of the baseline had considered existing and future trends in deforestation. The degree of additionality achieved via the PES schemes is therefore questionable. Though this may not seem to be a huge problem in the national PES programme (as in the worst case scenario, payments are made for environmental services, whether these are additional or not), lack of additionality in an international RED instrument would undermine the environmental integrity of the international carbon market. This is because non-additional reductions would displace real reductions made elsewhere, e.g., in the Kyoto Protocol this would trade-off with reductions achieved under the Annex I emissions trading, JI and CDM.

Baseline setting requires reliable emissions data and projections at the forestry-sector level. The difference between project baselines and sectoral baselines is illustrated in the figure below.

Figure 4. Sectoral crediting versus the CDM



Source: Adapted from Baron 2006

A sectoral crediting mechanism could create an incentive for countries to implement domestic policies to generate credits (i.e. carbon revenues) on a sector level. Such an approach has the potential to generate a large magnitude of credits (i.e. greater than project-based emissions reductions), which in effect could offset emissions in countries with emission commitments. This problem can be handled by adopting baselines that are below BAU, such as non-binding targets (see Baron, 2006; Philibert and Pershing, 2001). With non-binding targets, countries can be made responsible to buy back any selling of allowances beyond what they have left at the end of the commitment period. A commitment period reserve, similar to the one under the Marrakesh Accords, would also limit excess emissions above the target.

Leakage is less of a problem with a sectoral baseline rather than project-based emission baselines because under the former, the activity boundary is the entire country. Migration of activities across national borders, i.e., international leakage, is still feasible (analogous to the pollution haven hypothesis[12]).

The transaction costs of estimating a sectoral baseline (or an emissions cap) are expected to be much lower because repeatedly estimating individual project baselines is not necessary; rather the focus is on the development of a single sector-wide baseline.

Finally, perverse incentives can arise in the case of project-based credit trading, due to the need to demonstrate "additionality" of emissions reductions. Any RED instrument could establish perverse incentive for developing countries not to undertake good practice policy reforms on deforestation, in the expectation that they may be paid to do so under the RED instrument (for example, there are claims that the desire to not forgo potential investment from CDM projects has hampered the implementation of more stringent environmental legislation in countries such as S. Africa, Mexico, China, and Brazil (Wara, 2006, and Worthington, 2005 cited in Ebeling, 2006; Heller 2006).

Several different design options for a forestry instrument have been suggested to date, with implications for base year/baseline methodologies. These are:

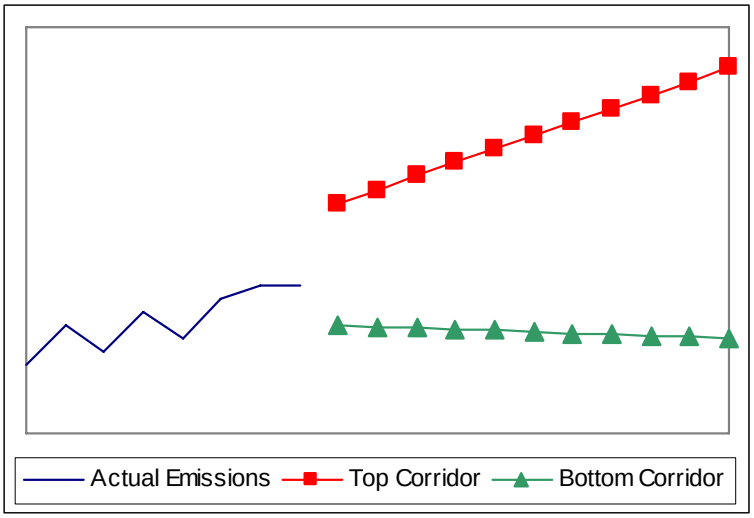
- Absolute emissions target (cap and trade): this would first quantify total carbon stock in a base year or averaged over a base period. A quota of credits would then be made available for trading, with the remainder set aside, similar to the commitment period reserve (Rainforest Coalition, 2005; Prior, Streck, O'Sullivan, 2006).

- Sectoral CDM Approach: A national or regional "sectoral" credit-based trading system, whereby a national deforestation or emissions baseline is established below which developing countries generate emissions reduction credits (ERC) for sale. The ERCs are produced ex-post.

    - As part of this, a 'No Regrets' target could be established using a 'corridor approach' for national baselines. The corridor could be derived using historical emissions, emissions trends, and trends in underlying causes. If actual emissions are above the corridor, no credits would be generated and no penalties would be incurred. If actual emissions are within the corridor, the amount of ERCs earned per ton of emissions that the country "undershoots" the ceiling varies between zero when at the top of the corridor and one when at the bottom of the corridor (see Figure 4). To compensate for possible years when emissions exceed the corridor ceiling, a fraction of credits in other years could be kept in a buffer, to make up for any 'shortfalls' when emissions are above the ceiling (Schlamadinger et al, 2006). To provide greater incentives for emissions reductions, one could have zero ERCs at the top of the corridor, 1 at the bottom, and rising at an increasing rate in between.

[12] The hypothesis predicts liberalized trade in goods will lead to the relocation of pollution intensive production from high income and stringent environmental regulation countries, to low income and lax environmental regulation countries.

Figure 5. The corridor approach



Source: Schlamadinger et al. 2006

- Global average rate of deforestation baseline: Countries whose baseline deforestation rates are above half the global average would be rewarded for any reductions in their national rate of deforestation during the commitment period (Achard, 2005).

Under a baseline and credit system, potential host countries will have an incentive to set the baseline as high as possible in order to generate more credits (and thus revenue). Some countries may argue that good past performance should be rewarded by using more generous baseline scenarios. The global averages reference baseline, for example, inherently rewards "good performers" (Achard et al. 2005).

However, if the baseline overestimates deforestation in the business as usual (BAU) scenario, the issue of additionality will arise, and the environmental effectiveness of the mechanism will be undermined. Use of a dynamic baseline (rather than a static one) can help to address this problem. If there is an Environmental Kuznet Curve for deforestation i.e., a trend wherein deforestation increases at low levels of economic growth, but then begins to decline after a turning point (see Cropper and Griffith, 1994; Bhatterai and Hammig, 2001), assuming a static baseline would generate "hot air" and create the risk of issuing credits for reductions that would have happened under a BAU scenario. Alternatively, economic growth or shifts in agricultural demand may lead to future emission increases from deforestation.

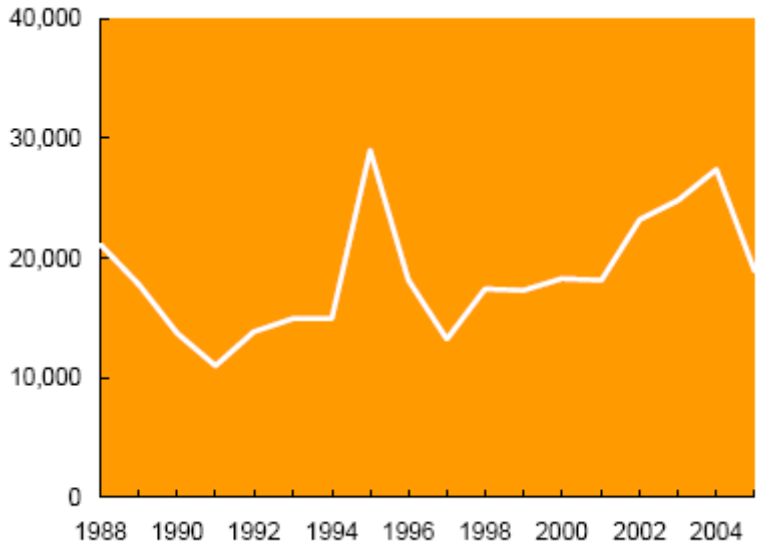
Integral to an additionality analysis is identifying forests which could be preserved through means other than environmental services (in this case, carbon) payments, i.e., through changes in the incentive structure created by forest policy. Ideally, one would not want to be crediting emissions reductions from deforestation that could have been mitigated if other market and government impediments were effectively removed (e.g., agricultural subsidies). The carbon payments are meant to compensate landowners for the non-market carbon values that the forests provide. Once national and international perverse incentives have been eliminated, the carbon payments are intended to internalise the (remaining) carbon externality of forests, providing an additional incentive for reducing deforestation.

Permanence may not be considered an issue if reversals (i.e., removal of trees) are compensated for. Approaches for compensation include the issuance of temporary credits (which would therefore represent a continuous source of funds to land users), reducing future credits, insurance systems or banking a portion of generated credits to cover any future losses.

The data requirements for setting a sectoral baseline involve time series data on changes in land cover. These can be based on a combination of remote sensing data and forest inventories, although most tropical countries have no recent regional or national forest inventories. Another alternative is to use rules of thumb

to estimate deforestation rates e.g., rates of deforestation tend to decline with distances to roads. Since host country governments would be involved in developing and negotiating a baseline, some independent technical body or expertise may be useful to assess whether a country's underlying assumptions on demand growth rates, agricultural prices, and other assumptions, are appropriate and consistent with other participating countries (Baron and Ellis, 2006). Moreover, if a base year were to be established for the purpose of a cap-and-trade mechanism, since countries can exhibit large inter-annual variability of emissions from deforestation (see Figure 5), the use of multi-year averages for a base "period" may be best. This large inter-annual variability of emissions from deforestation also suggests that countries may need multi-year commitment periods.

Figure 6. Annual deforestation in Brazil (km^2 per year)



Source: INPE, 2006

Even if national sectoral baselines or emissions caps are established, a question remains as to how a national system would devolve payments to individual land users so as to provide direct compensation for the carbon benefits they provide. The case studies in Costa Rica and Mexico illustrate how this is undertaken in these particular PES programmes, along with some of the issues that arise. Monitoring and reporting at the land user level would be necessary. How feasible this is will depend on monitoring capabilities and the associated costs of implementation, which will vary depending on national circumstances. Top-down and bottom-up methods for estimating emission reductions would need to be comparable (which at present they are not). Alternatively, a country could provide reduced deforestation emissions into an international market mechanism through domestic policies and measures, such as changing its laws.

If a sectoral baseline and credit approach is adopted, ex-post payments could be made exclusively to the government of the country that has reduced its emissions from deforestation below the baseline. The government could then either use the funds to implement policies and measures to further reduce emissions from deforestation in the next commitment period, or, if it decides to devolve the commitments to land users directly, it would need to ensure that incentives are paid only to forest areas that are about to be deforested. In other words, project level baseline approaches would need to be developed to ensure that payments were made to forests with the highest deforestation risk. Lessons learned from Costa Rica and Mexico suggest that efficient distribution of funds requires spatial differentiation with regard to costs and benefits (see Wuenscher et al. 2006)

With a sectoral cap and trade, the government could allocate allowances to all forested land, and land users that wished to emit more (i.e., deforest more) than the initial allocation permits, would be required to purchase additional allowances from land users that decided to reduce emissions from deforestation below their cap.

Questions such as whether a carbon instrument for RED would encompass only forest land that is converted to non-forest land (i.e., deforestation), or whether credits would be generated for changing to less CO_2 emitting land uses (i.e., forest degradation), should take into consideration scientific expertise, for example that of the IPCC, and would depend on the reliability and accuracy of monitoring. Including forest degradation can have important co-benefits including for biodiversity and livelihoods. However, there is not yet a clear definition on forest degradation for UNFCCC related activities. Inappropriate consideration of forest degradation could lead to perverse incentives whereby payments are made to reduce emissions from deforestation on lands that remain "forested" but are losing carbon stocks due to forest degradation.

Table 10: Features of different market-based approaches to RED

	Sectoral cap and trade	**Sectoral baseline and credit**	**Project based mechanism**
Cost minimisation	Yes	Yes	Yes
Data requirements	Single base year or period of emissions	Single sectoral baseline	Multiple project baselines
Domestic leakage	Minimised	Minimised	Yes
International leakage	Yes	Yes	Yes
Administrative and transaction costs	Low	Low	High
Perverse incentives	Possibly	Possibly	Yes
Potential to limit total emissions	High	Medium to High	Low to Medium
Payment recipient	Government/Land user	Government/Land user	Land user

Source: EPA, 2003; author.

4.5 Monitoring, Reporting and Evaluation

Accurately and consistently monitoring the reduced emissions from deforestation is key to the successful implementation of a carbon incentive to reduce emissions from deforestation. National systems for accurate monitoring and reporting of GHG emissions from forests will be required. A monitoring framework may be composed of the core technical functions, the management process, and the institutional context within which it operates (OECD, 2000). The technical functions refer to the choice of monitoring methods, data collection, handling and reporting. The management process refers to planning and documentation and quality assurance/quality control, as well as organisation and staffing. The institutional context refers to the institutional arrangements that are necessary to support a carbon instrument for RED at the international, national, and local level. Monitoring will involve estimating the following:

- Changes in forest and vegetation cover, including deforestation and forest degradation
- Change in carbon stocks
- Changes in other GHG producing activities that arise from the RED activities
- Estimates of emissions

In general, this will require a combination of remote sensing (satellite imagery) and ground measurements. Various methods are available to use satellite data to measure changes in forest cover. However, carbon

stock estimates of forests undergoing deforestation and the subsequent carbon dynamics are uncertain for many developing countries (DeFries et al. 2006).

Brazil and India are two examples of developing countries with systems in place to monitor forest cover. These countries have receiving stations to acquire remote sensing satellite imagery and/or national satellites. A key constraint in other countries in developing similar capabilities is access to satellite imagery data at reasonable cost, as well as the technical infrastructure (hardware, software, and internet access) to access and process this data. Technical capabilities vary, but many countries are developing sufficient expertise to enable monitoring systems (DeFries et al. 2006).

Non-Annex I countries have been required to estimate national GHG inventories for the first and second national communication (for the year 1994 or 1990, and 1994 respectively), using the Revised IPCC Guidelines for National GHG Inventories. The use of the Guidelines is enhanced by the inventory software developed for use in calculating and estimating emissions. Moreover, Good Practice Guidance on Land Use, Land-Use Change and Forestry (LULUCF) was adopted by the IPCC in 2003 to be used by Parties to prepare their inventories. These could be expanded upon and modified as appropriate to support the implementation of a RED instrument and would entail:

- Standard reporting format
- Review audit function to periodically check each country's forestry emissions accounts. The review/audit function could be performed by expert review teams, similar to those under the National Inventory Review Process.

A number of monitoring issues remain to be resolved to develop and implement a RED instrument. Several organizations are already working on tackling these issues. FAO for example has outlined a three-pronged approach for monitoring consisting of:

1. The development of a global forest monitoring framework (the FRA 2010 Remote Sensing Survey);
2. Support to developing countries to set up national forest monitoring systems (support to National Forest Assessments and the capacity building as part of the FRA 2010 Remote Sensing Survey);
3. Improved guidelines for carbon accounting (FAOs contribution to the IPCC Guidelines and the use of these for FRA 2010 country reporting).

Monitoring forest degradation, which can also lead to carbon emissions, is considered more challenging than monitoring emissions from deforestation.

At the national level, the PES case studies provide information on the kind of monitoring and reporting methodologies that are required to implement a domestic PES programme (e.g. the GIS and IPMS tools in Costa Rica), and that are likely to be necessary if national governments were to devolve their RED caps or baselines to individual land users.

4.6 Compliance, Penalties and Enforcement

The existence and type of penalties in place for non-compliance should depend upon the design of the instrument (i.e., cap-and-trade or baseline-and-credit and binding or non-binding targets). Issues for consideration include:

- Is the penalty above and beyond non-payment for reduced emissions?
- If targets are binding and are devolved to individual land users, would there be a need for minimum entity non-compliance penalties at the international level?

- If non-compliance is due to accidental fire or illegal logging, would there be insurance mechanisms in place to address this?

Options include the introduction of a reserve, similar to the commitment period reserve under the Kyoto Protocol, other type of carbon credit buffers, non-payment, criminal and civil penalties for fraudulent reporting and non-compliance at the landowner level, and other approaches. Some of these options are mutually exclusive.

5. Concluding Remarks

An incentive instrument to capture the carbon values of forests in developing countries, and thus to reduce emissions from deforestation, could serve to:

- Address a large fraction of global anthropogenic GHG emissions – approximately 20% come from forest activities – thus contributing potentially significantly to climate change mitigation;

- Minimise the economic costs of achieving the emissions reduction targets of countries with specific commitment targets – since carbon mitigation in forests is often more cost-effective than mitigation options in other sectors – making more stringent emission reduction commitments politically feasible;

- Potentially provide incentives for developing countries to take on voluntary forestry sector emission reduction targets – by introducing a system based on the "beneficiary pays principle".

Many design and implementation issues would need to be resolved in order for a successful international RED instrument to be introduced. A market-based approach could be project-based or sectoral, with the latter either as a cap-and-trade or a baseline-and-credit system. The choice of approach would have implications for the institutional frameworks that may be necessary, and the relative share of administrative responsibility between the international and national level. There are also important technical ramifications which affect the environmental integrity and cost-effectiveness of each of these approaches, including leakage, administrative and transaction costs, and perverse incentives.

Fundamental to any type of market-based approach to RED are standard monitoring methodologies and reporting requirements that would be needed. Monitoring may also help in the enforcement of property rights in developing countries, which is another important prerequisite for a carbon instrument to work effectively. The institutional capacities in participating developing countries for introducing and maintaining these systems are likely to need strengthening. The compilation of existing satellite imagery for quality and suitability for developing accurate base periods for major countries is possible and would significantly improve the quality of monitoring. Moreover, national capabilities and capacities for analyzing data on land cover change and carbon stocks will be essential. At the practical level, the introduction of pilot schemes to develop monitoring schemes at a sub-national and national scale so as to obtain experience and lessons learned from the ground would be helpful.

Finally, if accurate and consistent monitoring methodologies for estimating emissions from reduced deforestation are indeed technically feasible and economically viable, it is then important that further discussion on RED is conducted in congruence with discussions on a post-2012 climate change framework. Any potential new source of emission reductions in the emerging carbon market must be accompanied with a sufficiently strong increase in new demand and thus more stringent emission reduction commitments.

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Glossary

AFE	National Forestry Authority (Costa Rica)
CABSA	Programme to Develop Environmental Services Markets for Carbon Capture and Biodiversity and to Establish and Improve Agroforestry Systems (Mexico)
CDM	Clean Development Mechanism
CIDE	Centre for Research and Education in Economics (Mexico)
CONAFOR	National Forestry Commission (Mexico)
ES	Environmental Service
FAO	Food and Agricultural Organisation
FONAFIFO	National Forestry Financing Fund (Costa Rica)
GIS	Geographic Information System
GHG	Greenhouse Gas
IET	International Emissions Trading
INE	National Institute of Ecology (Mexico)
IPMS	Integrated Project Management System
JI	Joint Implementation
lCER	Long-term Certified Emission Reduction
LULUCF	Land-use, Land-use Change and Forestry
MINAE	Ministry of Environment and Energy (Costa Rica)
ODA	Overseas Development Assistance
ONF	National Forestry Office (Costa Rica)
PES	Payment for Environmental Services
PEHS	Payment for Environmental Hydrological Services (Mexico)
RED	Reducing Emissions from Deforestation in Developing Countries
SCM	Sectoral Crediting Mechanism
SEMARNAT	Secretariat of Environment and Natural Resources (Mexico)
SINAC	National System of Conservation Areas (Costa Rica)
tCER	Temporary Certified Emission Reduction
UNFCCC	UN Framework Convention on Climate Change

Annex 1. Summary of Selected Submission of Views on RED

Country	Summary
Australia	Five key principles: 1) robust 2) complete 3) comprehensive, transparent, verifiable 4) simple and consistent 5) effective, efficient, appropriate.
Brazil	Do not support a mechanism Distribute financial incentives from Annex I countries based on ex-post results using a reference emissions rate (RER) Proposal focuses on reducing gross emissions from deforestation, not net emissions: [emissions from sources (D) – removals from sinks (A/R)] Positive financial incentives on annual basis. If ADt = REDt – RER > 0, then no positive incentive, plus discounting from next RED that is below RER.
Costa Rica and others	Non-market and market instruments a) Credit for early action b) Avoided deforestation fund c) Enabling fund d) Market-based instruments, including CDM and others
EU	Effective land use policies coupled with economic incentives Pre-2012 –activities to improve monitoring and reporting capacities, process to define baselines/reference scenarios, positive incentives pre-2012 including voluntary funding, AIJ, others Post-2012 – prefer national baselines or reference level scenarios to minimize national leakage; notes that non-permanence is not an issue when possible reversals are compensated. Encourages SBSTA 27 to draft a decision for COP 13, recognizing deforestation as source of global emissions and encouraging pre-2012 actions described above, inter alia.
India	Compensated Conservation Not linked to Kyoto Protocol or CDM
Malaysia	To encourage Annex I countries to invest in REDD credits, consideration could be given to using REDD credits for meeting part of their commitments. Concerned that the determination of baselines or reference scenarios may result in providing perverse incentives to countries. See advantages of national based approach for REDD mechanism, however project based approach should also be considered.
New Zealand	Support incentives rather than funding.
PNG and others*	a) REDD mechanism b) REDD stabilization fund c) REDD enabling fund The mechanism can be non-market or market based. The stabilization fund could be supported through a levy on ERUs, AAUs, a tax on carbon intensive goods and services or new ODA
South Africa	Favour consideration of incentives to reduce or avoid deforestation, as well as incentives to reduce emissions resulting during the process of deforestation. Need clear objectives which might include the achievement of certain targets in relation to avoided deforestation. Objectives of slowing deforestation as well as process of regeneration and restoration could also be defined at this range of scales.
Thailand	Supports REDD should be rewarded on national basis through international system, with the use of a voluntary fund, not counting towards ER commitments of Annex I countries during the first commitment period. Suggests that rates of degradation should also be taken into account. Increases in net forest area should also be subject to compensation.
Tuvalu	Forest Retention Incentive Scheme (FRIS) composed of: 1) Community Forest Retention Trust Accounts 2) Forest Retention Certificates 3) International Forest Retention Fund

* Bolivia, Central African Republic, Costa Rica, DR Congo, Dominican Republic, Fiji, Ghana, Guatemala, Honduras, Kenya, Madagascar, Nicaragua, Panama, Solomon Islands, Vanuatu.