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INITIAL REVIEW OF POLICIES AND INCENTIVES TO REDUCE GHG EMISSIONS FROM DEFORESTATION

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The ideas expressed in this paper are those of the author and do not necessarily represent views of the OECD, the IEA, or their member countries, or the endorsement of any approach described herein.

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FOREWORD

This document was prepared by the OECD and IEA Secretariats in September-October 2006 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.

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Executive Summary

At COP-11 in Montreal (December, 2005), a two-year process was initiated to consider policy approaches and incentive options to reduce greenhouse gas emissions from deforestation in developing countries. This paper gives a brief overview on deforestation, outlining the economic concepts related to efficient land-use options and providing an introduction to some of the policy approaches and incentive options that are available to reduce emissions from deforestation. These include domestic and international approaches that have been used in the past to capture 'forest values' and options that have been suggested to date to capture the 'carbon values' associated with forests. The paper does not address the substantive scientific, methodological and data issues related to the design of policies and incentives to reduce deforestation.

Deforestation and forest degradation are important contributors to climate change, constituting 20-25% of global anthropogenic GHG emissions, and are the main source of emissions from many developing countries. Deforestation, mainly conversion of forests to agricultural land, occurred at a rate of about 13 million hectares per year during 2000-2005. Considerable efforts to address deforestation over the past two decades have not been effective in mitigating and reversing these trends. The need for new and innovative policy approaches and incentive options is increasingly recognised. Moreover, given the diversity of national circumstances, options to reduce emissions from deforestation should be flexible and targeted to national circumstances. This will enable developing countries to adopt the options that are most appropriate and effective.

A wide range of different policy approaches and incentive options are available to reduce emissions from deforestation including Official Development Assistance (ODA), bilateral and multilateral programmes, international transfer payments, and market mechanisms. Market mechanisms, in particular, have been receiving attention recently as they offer an innovative and promising alternative to more traditional sources of funding by capturing the 'carbon value' of existing forests

However, market mechanisms to capture carbon values or broader forest values have only recently started being applied in the forest sector. Further work is needed to evaluate how these can best be designed, implemented and integrated with traditional policy incentives that aim to reduce deforestation by capturing forest values. More generally, further analysis on the effectiveness of different national approaches and positive incentives to reduce emissions from deforestation and forest degradation would be useful to help policy-makers identify which options are likely to be most successful given their individual national circumstances.

1. Introduction

Deforestation, and in particular the conversion of forests to agricultural land, has occurred at a rate of about 13 million hectares per year during 2000-2005, with regions such as South America and Africa experiencing the largest losses (FAO, 2006). Estimates suggest that deforestation and forest degradation accounts for approximately 20-25% of global anthropogenic GHG emissions, and are the major source of emissions from developing countries (IPCC, 2000).

Efforts to reduce deforestation have been the object of considerable work by organisations including the Food and Agricultural Organisation (FAO), UN Environment Programme (UNEP), UN Forum on Forests (UNFF), World Bank, and International Tropical Timber Organisation (ITTO). Despite these efforts however, deforestation continues to be a major problem. New approaches and options to addressing deforestation thus need to be considered and evaluated.

The UN Framework Convention on Climate Change (UNFCCC) also includes forestry-related provisions. 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. These are limited to afforestation, reforestation and deforestation since 1990 (Article 3.3) and four management activities (forest management, cropland management, grassland management and revegetation), whose inclusion in the Kyoto national implementation framework is optional for the first commitment period (Article 3.4). However, only afforestation and reforestation activities are eligible as carbon sequestration activities under the Clean Development Mechanism; projects to reduce deforestation or forest degradation are not eligible.

Within the UNFCCC process, impetus has been increasing to consider incentives to reduce deforestation, particularly in developing countries. A two-year process was initiated at COP-11 (2005) for Parties to provide input to the Subsidiary Body for Scientific and Technical Advice (SBSTA) and to make recommendations to the UNFCCC COP-13 in December 2007.

This paper provides an initial list of policy approaches and incentive options that are available to reduce emissions from deforestation and forest degradation. Preliminary information for this paper has been drawn from work by the OECD on incentives to promote environmental and other objectives and the literature relating to forestry in particular. It also draws on information made available at the UNFCCC workshop on "Reducing Emissions from Deforestation in Developing Countries" in Rome, Italy (August 30-September 1, 2006). A comprehensive assessment of all the related issues is beyond the scope of this initial review, but will be the subject of further studies. In particular, this paper does not address the scientific, methodological and data issues related to the design of policies and incentives to reduce deforestation.

2. The Causes of Deforestation and Forest Degradation

Deforestation, as defined by the Marrakech Accords, is the direct human-induced conversion of forested land to non-forested land. A forest is defined as a minimum area of land of 0.05-1 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 percent with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ. Actual definitions can vary from country to country.

Carbon loss can also occur from forest degradation (e.g. via thinning or logging). A definition for forest degradation has however not yet been agreed upon. The IPCC has defined forest degradation as "a direct

human-induced long-term loss (persisting for X years or more) of at least Y% of forest carbon stocks (and forest values) since time T and not qualifying as deforestation or an elected activity under Article 3.4 of the Kyoto Protocol" where X, Y and T remain to be determined[1]. It is therefore important to consider the causes of both deforestation and forest degradation.

Deforestation and forest degradation are driven by the relative costs and benefits of different land-use options and complex social and political decisions. Sustainable forest management (SFM), while demonstrated on a small scale, has often proved difficult to achieve on a wide scale in developing countries. This is because converting forest land to alternative land uses generally provides higher economic returns, and is therefore more attractive to landowners (Pearce, 1999; Richards, 2000). Though the conversion of forested land to non-forested land will often be the most efficient land use option, there is a growing concern that the rate of tropical deforestation is excessive in some countries (Kaimowitz and Angelsen, 1998; Bulte et al. 2002). This is due in part to the fact that, under current forest management regimes, the benefits of deforestation accrue largely to a relatively small group –who can affect forest policy and use decisions- while the costs accrue to the society in general and are therefore often omitted in forest use decisions. A key issue is how to capture the high global public good values associated with the environmental functions and services provided by forests and to provide local landowners with sufficient incentives to compensate them for adopting more socially efficient land use practices, and thus mitigating current rates of deforestation and forest degradation.

Economically-efficient land use decisions can be made by comparing the net present values (NPV) of different land use options (e.g. forest conservation, SFM, conventional logging, agro-forestry, agriculture, among others). The land use option with the highest (positive) NPV is considered to be the socially optimal one. The NPVs of land use options will vary depending on factors including location (soil conditions and Carbon/ha associated with the land use, proximity to markets, ownership/land tenure arrangements) and the choice of the discount rate[2]. This implicitly assumes however that land use decisions are made by the owners of the land and that full information and consideration of all the values are taken into account, neither of which is often the case. A common result is that the use of forest lands is often quite different from that which would occur if all social costs and benefits were accounted for. A clear understanding of the proximate and underlying causes of deforestation and forest degradation is therefore a prerequisite for determining how policy approaches and incentive options can best be designed to address and mitigate these trends.

The proximate and underlying causes of deforestation and forest degradation vary from country to country, and over time, in response to different social, cultural and macroeconomic conditions. Proximate causes refer to human activities or immediate actions at the local level, such as agricultural expansion, wood extraction and infrastructure development that directly impact forest cover. Underlying driving forces are fundamental social processes, such as human demographics and population dynamics, poverty, agricultural policies, or economic and technological factors that underpin the proximate causes and either operate at the local level or have an indirect impact from the national or global level (Geist and Lambin, 2002).

Other driving forces include improperly functioning markets and limited institutional capacity (Barbier et al. 1994; OECD, 1996; Bulte et al. 2004). These can operate at the local, national, regional and international level. Markets may sometimes fail to allocate resources efficiently i.e., to their highest valued use, resulting in too much land being allocated to e.g., agriculture, rather than conserved as forests. Ideally, forest land should be allocated to those uses which maximize the aggregate *social value of the forest land*. The existence of market failures however, which arise when the price of goods and services do not reflect the true costs of

[1] In contrast, deforestation as defined by the FAO is "the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold." The depletion of forest to tree crown cover greater than 10 percent is considered forest degradation.

[2] For long-term projects and environmental problems, recent literature suggests the use of a declining discount rate over time (see OECD, 2006).

production and consumption of those goods and services, lead to a divergence between private and social costs.

In practice countries face difficult economic and political choices as they seek to encourage sustainable forest management. For example, countries seeking to reduce their dependence on foreign assistance may chose to deliberately encourage forest exports. Likewise some countries may seek to increase agricultural exports by subsidizing inputs to production such as roads, fuel, fertilizers and loans. In other cases, institutional limitations ranging from under-staffed and ill-equipped forestry bureaucracies, weak enforcement and monitoring capacities, as well as political instability often make SFM practices difficult to achieve.

2.1 Market imperfections

Forests provide valuable local, regional and global ecosystem services and functions, ranging from water quality control, flood control and soil stability, to biodiversity and carbon sequestration. Missing or incomplete markets for environmental services refer to a situation whereby not all goods and services provided by the resource are marketable. These ecosystem services and functions translate directly into economic goods and services such as flood protection, maintenance of crop productivity and climate stability, which are not reflected in market prices. From a social standpoint, the result is an under-pricing of the resource and thus over-consumption of the good, i.e., excess degradation and conversion from forest to non-forest land-use.

The *total economic value* (TEV) of a forest is composed of all the benefits that are provided to society. These consist of:

- *Direct Use Values*: Values arising from the consumptive and non-consumptive uses of the forest. These include timber (commercial and non-commercial), fuel wood and charcoal, other non-timber forest products (NTFP), genetic information, tourism, recreation and amenity values.
- *Indirect Use Values*: Values arising from forest services including important life-support functions. These include watershed protection (*inter alia*, soil conservation, water flow regulation, water supply, water purification); carbon storage and sequestration; and habitat protection and biodiversity values.
- *Option Values*: Values reflecting a willingness to pay to conserve the option of using the forest even though no current use is made of it.
- *Non-use (or Existence) Values*: Values reflecting a willingness to pay for the forest in a conserved state, and is unrelated to current or planned use of the forest.

These values are not necessarily all additive as some arise through forest conservation and others through forest conversion. The government objective would be to maintain the forest if the net benefits (i.e., benefits minus costs) of conservation exceed the net benefits of conversion. In theory, monetary estimates of these values allow policymakers to make informed tradeoffs about the costs and benefits of conservation of forests vs. those of alternative land use options. In practice, however it is also important to be able to capture the values through market mechanisms. The techniques for quantifying tropical forest benefits and expressing them in monetary terms for cost-benefit analysis have moved forward over the past decade. If the economic values are sufficiently large and can be captured and marketed, then it is possible that these tip the balance towards avoided deforestation. Table 1 presents a summary of the range of economic values based on a number of studies. The important role of carbon is clearly revealed.

Table 1. The Total Economic Value of Tropical Forests

Forest good or service	Value ($/ha per annum)
Direct Use Values	
Timber	200-4400 (NPV for conventional logging) 300-2669 (NPV for sustainable logging) 20-440 (conventional logging)[1] 30-266 (sustainable logging)[1]
Fuel wood	40
NTFP	0-100
Genetic information	0-3000
Recreation	2-470 (general); 1000 (unique forests)
Amenity	--
Indirect Use Values	
Watershed benefits	15-850
Carbon storage and sequestration	360-2200 (GPV)
Biodiversity (other than genetics)	?
Non-use Values	
Existence value	2-12 (4400 for unique areas)
Option value	n.a.

NPV= Net Present Value; GPV = Gross Present Value, since no costs are deducted and assumes compensation for carbon is a one-off payment in the initial period. [1] Annuitised NPV at 10% for illustration. Source: Pearce, 2001.

In practice a lack of data and information causes uncertainty and makes it difficult for decision makes to make proper trade offs. This includes, *inter alia*, a lack of scientific knowledge due to ecosystem complexity (which can impede effective and efficient decision-making policies), a lack of information with regard to the existence of local markets for NTFPs, and a lack of public understanding of sustainable forestry certification processes.

2.2 Government and institutional limitations

Government policies that address the forest and other sectors, such as agriculture, or other macroeconomic policies can provide either incentives for sustainable forest management or perverse incentives to over-exploit forests. Several examples of government policies and institutional limitations that act to encourage deforestation are outlined below.

Timber prices and forestry concessions: When not designed and implemented properly, harvesting fees, royalties, logging regulations and timber concessions provided to private loggers often play a critical role in encouraging non-sustainable forest practices. A timber concession is a contract that provides the rules relating to the rate of deforestation and is the dominant means of allocating harvesting rights in developing countries (Gray, 2000). In many cases, forest fees are well below the value of timber in both developed and developing countries. Low forest fees on timber make commercial logging and processing profitable and attractive for expansion, encouraging wastage of valuable timber, over-cutting and depletion of the forest (Repetto and Gillis, 1988; Karsenty, 2000; OECD, 2002).

Log export bans and related trade restrictions: A number of timber-producing countries have restricted or banned exports of raw logs or semi-processed logs in an effort to encourage value-added processing for export and thus increase foreign exchange. The literature is unclear as to whether this leads to more or less deforestation (Kaimowitz and Angelsen, 1998). According to Barbier et al. (1995), such trade restrictions depress domestic log prices compared with international prices, and provide cheap raw logs to the domestic wood processing industry. Lower log prices discourage the adoption of sustainable practices in timber

harvesting and reduce the incentives to adopt more modern technology for increasing wood recovery ratios in timber processing. They reduce the relative returns to the forestry sector, and thus intensify the pressure to clear forest land for competing agricultural crops.

Land tenure policy/ property rights: Deforestation is greater under open access regimes than when there are full property rights allocated, and even greater when forest clearing allows people to obtain additional property rights (Kaimowitz and Angelsen, 1998). For example, in some countries, farmers are eligible for land rights if they clear forested land for agriculture. Insecure property rights are also associated with higher discount rates. The higher is the discount rate, the less likely that sustainable land uses will be favoured. Property rights need to be defined as well as enforceable in practice.

Illegal logging: Illegal logging refers to a number of activities including logging outside concession boundaries; logging timber species protected by national law; removing under/over-sized trees; timber smuggling and illegal processing; and the evasion of royalties, taxes and other fees. These types of activities are prevalent in many developing countries to the extent that in some countries illegal forest production dwarfs legal production. Contributing factors to the occurrence of illegal logging include immature policy and legal frameworks, minimal enforcement capacity, insufficient data and information about forest resources, illegal operations and corruption in the private sector and in government (FAO, 2005). A number of national initiatives are underway to combat illegal logging, but an assessment of their impact on forest degradation and deforestation is still premature.

Extra-sectoral policies: In the agricultural sector, policies which seek to improve the terms of trade for agriculture, such as currency devaluations, trade liberalization, reductions in agricultural export taxes, agricultural price subsidies, and reduced fiscal spending on non-agricultural sectors tend to raise prices received by farmers, and hence increase incentives for deforestation (Kaimowitz and Angelsen, 1998). Problems associated with real currency evaluations are most likely to arise where export producers are important agents of deforestation, such as in certain countries of Central America (beef), South America (soybeans), and West Africa (cocoa) (Kaimowitz, Byron and Sunderlin, 1998). Other policies such as poorly planned transport infrastructure in frontier areas and greater access to roads generally also lead to more deforestation. In some cases, settlement schemes have resulted in the replacement of forests with marginally productive subsistence farming. This suggests a need to place a greater emphasis on policy integration and cross-sectoral co-operation.

Resource limitations: Many countries lack trained personnel, infrastructure and equipment. Forestry departments and ministries are often under-funded and ill-equipped to supervise and monitor logging activities and forest management on forest concessions, with little field capability for on-the-ground inspection and monitoring (Grut, Gray and Egli 1991; Hardner and Rice 1999). Public sector forestry institutions are constrained due to the difficulties associated with effectively and equitably designing, implementing, monitoring and enforcing programmes and policies to address deforestation and forest degradation.

Studies indicate that the causes of deforestation and forest degradation vary regionally and that there is no single or universal policy that can address current levels of forest loss (Geist and Lambin, 2002). This suggests that effective policy intervention will require that the causes of forest decline are determined on a case by case basis, and that a package of policy measures and instruments will be necessary to address this issue accordingly.

3. Policy Approaches and Incentive Options

Once the specific causes of deforestation and forest degradation in a particular region have been identified, policies may be needed to create markets when they are altogether missing and to correct markets when they are incomplete (OECD, 2004). The overarching objective is to maximise the social values of forested land and to compensate the (often vulnerable) forest-dependent communities, so as to promote socially efficient land use decisions.

Currently, approaches to support developing countries in addressing deforestation include ODA, bilateral and multilateral programmes, and assistance by non-governmental organisations (NGOs). Though there are many cases where these have been effective at the project level, national rates of deforestation remain largely unabated. This section provides a synthesis of some of the policy approaches and incentive options that are available to capture the local, regional and global *public* values provided by forests. Though the capture of forest market values via policies and incentives can provide an innovative and important stimulus for local landowners to manage their forests in a more sustainable manner (where well-defined property rights exist), the discussion above illustrates that there are a host of other issues, both within and external to the forestry sector, that must be addressed simultaneously. For example, more effective legal instruments may need to be put in place to address illegal logging, such as clarifying property rights, providing for appropriate land tenure arrangements, providing means of resolving property disputes by due process, and making concessions allocations more transparent; national policies may need to become more cohesive; and capacity building efforts strengthened. Effective regulation and institutions may also be necessary to complement policy approaches and incentive options, both of which will be undermined in a setting where other distortions are prevalent.

3.1 Capturing forest values

A number of measures can, and have in some countries, been employed to ensure that forests are properly valued. Some of these are listed below:

Timber Values: For state owned/ managed forests, arguably the most important incentive mechanism to stimulate more SFM practices is appropriate forest pricing or the setting of forest fees combined with concession tenure (Richards, 2000). Repetto and Sizer (1996) argue that the forestry sector could be self-financing through effective taxation of forest rent.

Forest prices can be set by regulation or by the market, though the former usually results in under-pricing and rent-seeking behaviour by concessionaires. Innovative methods that have been suggested include:

Competitive allocation of concessions i.e., auctioning of concession rights. Auctions and sealed tenders have been used to varying degrees in allocating forest concessions in Venezuela, a number of peninsular Malaysian states, as well as in Sabah and Sarawak, Ghana, Cote d'Ivoire, and the Congo.

Performance based bonds. A performance bonding system stipulates a set of regulations on a forest firm's behaviour. Before beginning operations, the firm is required to give a large deposit of money to the government. If the firm adheres to the regulations, the value of the bond is gradually returned to the concessionaire; if not, part or all of the bond is kept by the government (e.g. the Philippines [Anderson, 2002]).

Alternative incentive options include a differential land use tax whereby pasture or newly cleared land is taxed more heavily than forests or long-settled land (Richards, 2000). Taxing the tropical timber trade, or redirecting existing taxes, so that a transfer is made from consumer to producer countries, can provide another option for financing SFM practices but faces political opposition from importing nations, difficulties in ensuring the money is well spent and effective monitoring. One idea has been to make area-based payments to forest managers to compensate them for the additional costs of SFM. Other forms of international taxation that have been proposed to help finance tropical forestry and biodiversity conservation include the Tobin tax on international foreign exchange transactions, carbon taxes, and air travel taxes (Richards, 2000).

Forest certification and eco-labelling. Another option to stimulate SFM is forest certification schemes, akin to eco-labelling, which serve to improve market information. Essentially, consumers are willing to pay a 'premium' for sustainably harvested timber. In theory, the creation of markets for certified sustainable timber would channel revenues to private forest-owners that would compensate them for foregone earnings from

alternative land uses. The Forest Stewardship Council (FSC) for example has certified nearly 70 million ha worldwide[3], where countries such as Brazil, Bolivia, and South Africa have the largest areas of certified forests in developing countries. The FSC has identified existing good practices in forest management, it has not offered incentives to significantly improve forest management. Though the early rationale for certification was to improve poor practices, the current focus of the FSC is on the gap between very best and good practices (IIED, 2002). A number of problems with certification schemes have been identified and would need to be overcome to improve the effectiveness of this option (FAO, 1999). Among these are that increasing globalisation in forest products markets means that end products often mix wood and fibber inputs from a number of sources that are increasingly difficult to verify, wood is also only a small part of the end product in some of its most important applications (e.g. in construction and furniture manufacturing) and the distance between the forest and end-user is becoming increasingly large; the benefits to the end-user from purchasing certified wood are poorly understood and difficult to market; markets for certified forest products in developed countries are relatively limited and the prospects for price premia are poor; and that the majority (80 percent) of wood and wood products produced in developing countries is also consumed in developing countries, where willingness to pay for environmentally friendly forest products will be constrained by ability to pay.

Non Timber Forest Products (NTFPs): NTFPs include fruits and nuts, rattan, medicinal plants and bush meat. NTFPs present a direct income to many locals, contributing to their food supply and livelihoods. According to the FAO, it is estimated that 80% of the population in developing countries depends on NTFPs for subsistence, both economically and for nutrition. Successful promotion of markets can help to raise the value of a forest as compared with alternative land uses, and prevent the conversion of NTFP plantation into agricultural land, thereby reducing emissions from deforestation. Markets for NTFPs however tend to be complex and are characterized by small, dispersed producers who have little experience in marketing, restricted access to credit and often face high costs of delivering the goods to the market (OECD, 2003). Lack of market contacts and knowledge of the market are identified as key barriers to NTFP market developments, as is lack of infrastructure (Marshall et al. 2006). Better coordination of national government, private sector and NGO activities can improve NTFP commercialization, as can the provision of local training and support e.g. technical know-how and organizational skills, including help with environmental impact assessments and management plans.

Recreation/Eco-tourism: Recreation and tourism revenues related to nature and the desire to visit natural areas are estimated to be between USD80-250 billion per year[4] (OECD, 2003). Eco-tourism is considered to be one of the most promising activities for biodiversity conservation and can therefore also play a significant role in deterring deforestation. Recreation/eco-tourism benefits can be captured via the introduction of conservation entrance fees to national or privately-owned parks, concession fees, licenses or permits, and other tourism related fees and taxes which can be implemented at the domestic level. In Belize for example, funds for conservation are collected by charging all tourists US$3.75 per visit, generating about US$ 750,000 per year. The degree to which such policy measures can contribute to significant and sustainable sources of forest funding will depend upon national circumstances and more likely to be effective in countries where tourism constitutes an important source of GDP revenue, such as in Costa Rica and South Africa.

Payments for Genetic Information: The global value of genetic information can be harnessed via biodiversity prospecting. This refers to the process whereby firms collecting genetic material from the wilds pay directly for the material, which is subsequently screened for pharmaceutical, agricultural, cosmetic or industrial use. Despite initial optimism with this market creation mechanism, there seems to be mixed evidence on whether the returns to holding genetic resource assets are large enough to create significant conservation incentives

[3] http://www.certified-forests.org

[4] The wide range in estimates is due in part to the lack of a universally accepted definition of eco-tourism. The International Ecotourism Society (2001) defines this as “responsible travel to natural areas that conserves the environment and sustains the well-being of local people”.

(Rausser and Small, 2001)[5]. There is currently a lack of an internationally agreed framework on access and benefit-sharing. Nevertheless, bioprospecting can be established between individual countries and pharmaceuticals, to provide an additional source of revenues for conservation. In Costa Rica, for example, any profits from bioprospecting deals are used to fund environmental service payments.

Incentives for Biodiversity Conservation: Incentives to capture the global benefits of biodiversity conservation include tradable development rights, conservation easements, tree-planting subsidies or subsidized credit (e.g. Chile), tax breaks for reforestation (e.g. Panama), biodiversity offsets (e.g. Brazil Forest Code), and payment for environmental services (Vietnam, Programme 661) (OECD, 2004; UNFCCC, 2006).

Incentives for Watershed Protection: In many contexts the continued existence of forest habitat may be closely related to the continued flow of watershed services at the national level (e.g., flood control, groundwater recharge, water purification). The development of a market in watershed services may be capable of contributing to the preservation of the forest in the same watershed (Heal, 2002). Such markets exist in Chiapas, Mexico; Quito, Ecuador; and Sierra de la Minas, Guatemala. Other examples include Colombia, which has linked several charges (e.g. electricity and water) to ecosystem maintenance and restoration, and Costa Rica which adopted its water tariff structure to take into account financing of investments in natural capital, thus compensating landowners for conservation measures (Castro, 2001). At the World Summit on Sustainable Development in 2002, all countries agreed to develop Integrated Water Resources Management plans. Some have suggested incorporating payment for ecosystem services, such as the UN ECE (2006).

Option and Existence Value: The global nature of option and existence values may be captured through debt-for-nature (DfN) swaps, official aid, donations to conservation agencies, and pricing mechanisms (Pearce, 2001)[6]. DfN swaps refer to the purchase of discounted foreign debt which is converted to local currency and proceeds are used to fund conservation. Between 1987- 2003, there have been a total of 102 DfN swaps, accounting for a total face value of debt of US$4,840 million and a total discounted value of debt of US$1,153 million[7] (Pearce, 2004). DfN swaps can therefore provide an important supplement to traditional means of conservation finance (UN ECLAC, 2001).

Official aid includes programmes such as the Global Environmental Facility (GEF) and other National Environmental Funds (NEFs). The GEF, established in 1991, focuses on biodiversity conservation, climate change, ozone depletion, land degradation, international waters, and persistent organic pollutants; GEF has funded more than 1,300 projects in 140 countries with a cost of more than US$6.2 billion in grants. Additionally, the GEF has generated over US$20 billion in co-financing from other sources. The international financial requirements at Agenda 21 were estimated at US$125 billion. Despite this, the GEF has been an important mechanism for forest conservation. However, it cannot currently finance sustainable logging and related activities without major structural changes (Moura Costa et al. 1999). NEFs include conservation trust funds, endowments and green funds, and have been set up in about 20 tropical countries (e.g. Mexico and Ecuador). They are most frequently in the form of up-front payments which are used exclusively to earn interest to generate the funds operating capital. As with the GEF, this option for international transfer payments does not have an impact on user incentives.

In total, Mayrand and Paquin (2004) indicate that by 2004, more than 300 environmental payment schemes had been implemented globally, most for watershed and water conservation purposes, followed by biodiversity protection and carbon capture. Such mechanisms provide innovative approaches for

[5] See also Simpson et al. 1996; Barbier and Aylward, 1996; and Craft and Simpson, 2001.

[6] These are mechanisms to protect forests in general and are not exclusive to capturing option and existence values.

[7] The total face value of debt excluding the two DfN swaps in Poland is $1,943 million and the total discounted value of debt is $582 million. DfN swaps have been used in Colombia, Belize, the Philippines, Madagascar and Bangladesh, among others.

compensating local landowners for sustainably managing their forests. However, most environmental payment schemes are relatively recent and only a minority are more than a few years old. Further studies are needed to assess the effectiveness of different national policy approaches and incentive options, and the conditions under which these are likely to successfully reduce emissions from deforestation. Challenges identified for effective environmental service payments include land tenure security; availability of sufficient funds; support for monitoring and compliance; easement in the payment mechanism; law enforcement and effective institutions; and transaction costs (Wunder et al. 2005).

Box 1. Halting Deforestation in Costa Rica

Costa Rica offers one national level example of where the introduction of direct payment for environmental services in 1997 has been claimed to effectively reverse deforestation. The system is operated on the principle that beneficiaries of environmental services pay, while the producers of services benefit. Land users receive direct payments for limiting their activities to specified land uses, including forest protection (5-year duration and US$210/ha dispersed over 5 years), SFM (15-year duration and US$327/ha dispersed over 5 years), and reforestation activities (15 to 20 year duration and US$537/ha dispersed over 5 years).

Funding is provided by the local government (via a gasoline tax and a tax on wood products), the World Bank and the GEF. By mid-2000 over 2000km2 of forest had been incorporated in the programme at a cost of about US$ 47 million. However, the programme has been oversubscribed indicating that payments exceed farmers' opportunity costs, and another recent study questions the degree to which the payment for environmental services were responsible for the change in land use options (Sierra and Russman, 2005). Further analysis of this and other such programmes would provide useful insights and important lessons into how such programmes can be effectively designed.

3.2 Capturing carbon values

There is a growing recognition that the capture of the (global nature of) carbon values (carbon storage and sequestration) associated with forests can contribute to stimulating SFM and reduce emissions from deforestation. Estimates indicate that these benefits represent the largest proportion of total economic value of the non-market values of tropical forests (Pearce, 2004). Options for preserving carbon reservoirs include forest protection, forest management, harvest management (e.g. reduced impact logging), and cropland management. For example, cropland management measures that mitigate GHGs include agronomy, nutrient management, tillage/residue management, agro-forestry, rice management and set-asides. Mitigation potential estimates for cropland management range from 0.17-10.53 tCO_2e/ha/yr depending on the practices used and on the climate zone/region in which they are adopted (Smith et al. 2006). In comparison, carbon mitigation potential for avoided deforestation in India for example is 182tC/ha, and for low impact logging methods in Mexico the mitigation potential is 141-188tC/ha. See Richards and Stokes (2004) for a review.

In order to operationalise a programme to capture the carbon values of forests, it will be necessary to quantify the GHG emissions averted from reduced deforestation, which requires the measurement of changes in forest cover and associated changes in carbon stocks. A combination of remote sensing, ground/field surveys and/or forest inventories, as well as the use of IPCC GHG inventory guidelines can be used to estimate GHG emissions resulting from deforestation. Though technical capabilities have advanced and the costs of remote sensing have declined over the past decade, capacity issues for undertaking such measures remain a challenge, particularly in developing countries. In addition, the tools and methods available have limitations under different national circumstances, such as scale of forest cover (DeFries et al. 2006; UNFCCC, 2006b). Any (remaining) difficulties in quantifying avoided emissions from reduced deforestation will have important implications for the cost of setting up a system and/or the credibility of such a scheme.

Several approaches have been suggested thus far, both within and external to the UNFCCC, to implement measures that capture the carbon values of forests. These are:

- Official Development Assistance (ODA) and other dedicated funding sources to promote policies and measures: policies and measures present the broadest option for incentives to reduce emissions from deforestation and degradation and have no current link to the carbon markets under the Kyoto Protocol. ODA can play an important role, for example by providing up-front financing for technological resources and capacity building though it may be less able to affect user incentives.

- Reference Emissions Rate Proposal: this preliminary "voluntary" proposal, put forward by Brazil, would estimate the net reductions of GHG emissions from deforestation relative to a reference emission rate. The reference emission rate is the average rate of deforestation in the country over a defined time period, using an agreed carbon tonne per hectare, according to each biome or vegetation type (e.g., Amazon: 90 tonnes C/ha). An assessment of annual (or periodical) emissions from deforestation for comparison with the reference is required. If emissions from deforestation have decreased, the difference is converted into a financial incentive to be received (credit). If emissions have increased, the difference is converted into an amount to be subtracted (debit) from future financial incentives. The emissions reductions over a certain period for all countries would be added, with Annex II countries voluntarily sharing the bill (taking into account e.g. ODA commitments towards developing countries). The collected amount is then divided among the participating developing countries based on the ratio of the emissions reductions they achieved.[8]

- Bilateral/Multilateral Trading Agreements: parties, through the development of independent bilateral or multilateral agreements, could support efforts to reduce emissions from deforestation in developing countries. A variety of regional and national emissions reductions markets are currently in place or under development that could be leveraged by Parties to reduce emissions from deforestation in developing countries[9].

- Sectoral CDM Approach: a national or regional "sectoral" credit-based trading system, whereby a national deforestation or emissions baseline is established in developing countries. Any deforestation below this baseline would generate emissions reduction credits (ERC) for sale. The ERCs are produced ex-post. A 'No Regrets' target would be established using a corridor approach for national baselines: 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 (Encofor, 2006).

- Voluntary Annex C (national cap and trade): developing countries could participate in a 'Voluntary Annex-C' specifically designed to address deforestation. In exchange for an assigned amount unit (AAU)-type emissions allowance, this approach could incorporate voluntary 'national targets' for emissions reductions utilizing a cap and trade methodology similar in structure to that applied for Annex-B Parties. By using a national baseline approach to overcome the project-based leakage issues and project performance risk there would be minimal transactional or performance risk issues remaining that currently justify certified emission reduction (CER)-type valuation discounts. Therefore the emissions credit issues under the 'National Approach' should be fully fungible with AAU emissions allowances (as proposed by the Rainforest Coalition).

- Compensated Reduction (CR): developing countries that elect to reduce their national emissions from deforestation during the 5 years of the first commitment period (i.e., taking average annual deforestation over some agreed period in the past, measured with robust satellite imagery techniques, as a baseline), would be authorized to issue carbon certificates, similar to the Certified Emissions Reductions (CERs) of the CDM, which could be sold to governments or private investors. Once having received compensation, countries would agree not to increase, or to further reduce,

[8] http://unfccc.int/methods_and_science/lulucf/items/3764.php

[9] UNFCCC/SBSTA/2006/MISC.5

deforestation in future commitment periods (provided that Annex I countries fulfil their obligations). A country that committed to reducing deforestation and was compensated, but instead increased deforestation, would take the increment increased as a mandatory cap in the next commitment period (Santilli et al. 2005).

- Avoided Forest Conversion Approach: this approach builds on the CR concept but uses a global average rate of deforestation as the baseline. According to this proposal, 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. This approach also includes three land-use changes, from intact forest to non-intact forest to non-forest (where for example, the carbon stock of non-intact forest is considered to be half that of intact forest). The carbon benefits, expressed as tCERs, are proposed to be fully exchangeable on the world market (Achard et al. 2005).

The success of these approaches in reducing emissions from deforestation and forest degradation will depend on a number of issues including their ability to address national and international leakage issues, additionality, permanence, and to ensure long-term and sustainable funding for carbon compensation, as well as on the size of the incentives that are provided10 and the distribution of (carbon) benefits.

4. Conclusions

Forests provide valuable local, regional and global ecosystem services and functions, ranging from water quality control, flood control and soil stability, to biodiversity and carbon sequestration. However, deforestation (and forest degradation) is occurring in some countries at rapid rate and is among the most important sources of greenhouse gas emissions, constituting 20-25% of such emissions. The proximate and underlying causes of deforestation and forest degradation vary from country to country, and over time, in response to different social, cultural and macroeconomic conditions. Underlying driving forces include social processes, population dynamics, poverty, agricultural policies, or economic and technological factors that operate at the local, national or global level. Imperfect markets which fail to properly value forest products and services, conflicting (and sometimes contradictory) government policies and limited institutions also contribute deforestation.

This suggests that effective policy interventions will require that the causes of forest decline be determined on a case by case basis, and that a number of policy measures and instruments will be necessary to address the issue, including official development assistance (ODA), bilateral and multilateral programmes, international transfer payments, and market mechanisms. Market mechanisms, in particular, have recently been receiving attention as they offer an innovative and promising alternatives to more traditional sources of funding by capturing the 'carbon value' of existing forests. However, historically used for timber, market mechanisms have only recently started to be applied to other forest services and functions. Further work is needed to evaluate how these can best be designed, implemented and integrated with traditional policy incentives that aim to reduce deforestation by capturing forest values.

[10] Under a market mechanism, the prices for carbon would be determined by the emission reduction targets selected (if any) in a post-2012 era. For example, to estimate the potential for avoided deforestation to help reduce GHG mitigation costs, Sohngen and Beach (2006) use a Global Timber Model (i.e., a market model that accounts for above- and below-ground vegetative carbon stock) and find that mitigation ranges from an average of about 0.1 Pg C per year at $5/metric ton of carbon (t C) up to 1.6 Pg C per year at $100/t C.

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