NOT TO SINK

BRINGING THE TROPICAL FOREST INTO THE CLIMATE AND OTHER GLOBAL CONVENTIONS, WITHOUT NEEDING THE 'SINK' CONCEPT

Dutch National Research Programme on Global Air Pollution and Climate Change

NOT TO SINK

Bringing the Tropical Forest into the Climate and Other Global Conventions, without Needing the 'Sink' Concept

W.T. de Groot
S.I.D. Sielhorst

Centre of Environmental Science (CML)
Leiden University
P.O. Box 9518
2300 RA Leiden
The Netherlands

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PREFACE

This report has been written in the framework of the National Research Programme Global Air Pollution and Climate Change (NOP) of the Netherlands, by the Centre of Environmental Science (Leiden University).

The report describes the results of a study into the function of forests in non-Annex I countries within the global climate policy. It questions the desirability of the concept of sinks within the Clean Development Mechanism and looks at alternative uses of tropical forestry to halt the emission of GHGs.

The report is based on information gained from a literature survey. Furthermore, a expert workshop organized to discuss the concept report has been proven very valuable. This is true as well for individual interviews held with various Dutch government officials from different ministries and representatives of other organizations. The participants' contributions to this report. are much appreciated. A list of participants, as well as a list of used literature can be found at the end of this report. Thanks are also due to the two anonymus reviewers of the draft report, who supplied many useful comments.

One note of caution concerns the periods of writing and publishing of this report. The report was drafted before COP6-bis in Bonn and the date of publication is after that event. Although the results of CP6-bis have been added to the present version, imperfections of understanding and style may have resulted. Especially with respect to the core issues of this report, however, the results of COP6-bis do not appear to be of major import for the analysis.

For questions or comments on this report, please contact prof.dr. Wouter T. de Groot:
e-mail: Degroot@cml.leidenuniv.nl
telephone: (00) + 31 (0) 71 527 7487

ABSTRACT

This report aims to determine the function of tropical forestry in the climate and other global conventions. Because the Clean Development Mechanism of the Kyoto Protocol is the major instrument linking the developing countries (hence the tropical forest) to the climate issue, CDM will be a major focus. First, the general feasibility of plantations as carbon storage facilities (i.e. sinks) is examined. Formal constraints concerning permanence, leakage and baseline calculation are recognized. Furthermore, the external effects in the tropics are deemed predominantly negative. Plantations included under CDM as sinks may be a hindrance for achieving sustainable development and may contradict other international conventions such as CBD and CCD.

Subsequently, the report explores two alternative implementations of forests in the mitigation of GHGs. Both are based on output financing.

The first concerns using tropical plantations as sources of renewable (biomass) energy or energy saving material. A framework is developed for operating this 'zero pollution' contribution to the global climate, which is compatible with the CDM criteria, in CDM. Doing so, no substantial need exists any more to operate CDM through the sinks concept and with that, key problems surrounding the sink concept are avoided.

Second, a multi-convention global facility is proposed to preserve existing forests. The key principle here is that net forest benefit producing countries receive disbursements from net forest benefit consuming countries on the basis of standing forest per hectare per year. The facility can not be placed in the structure of CDM and disbursements may be based on several global benefits next to carbon storage, such as safeguarding biodiversity, preventing desertification and preserving cultural diversity.

EXECUTIVE SUMMARY

The purpose of this report is to examine the role of forestry in non-Annex I countries (roughly: developing countries) within the framework of the UNFCCC and other conventions. More specifically, it aims to evaluate the application of the concept of forests as sinks (carbon storage facilities) in the Clean Development Mechanism of the Kyoto Protocol, and to identify alternative opportunities in relation to forestry activities. Forests-as-sinks have been examined under the assumption that most of them would be established in the form of plantations. The report has identified formal as well as non-formal constraints of sinks in CDM, besides certain benefits.

Two important constraints of the sinks concept in CDM concern inconsistency with the regulations of the Kyoto Protocol. First, the lack of permanence connected to sinks. Sequestered carbon can be released back into the air as a result of natural or anthropogenic influences. Secondly, the problem of leakage. This means that sequestration benefits can be offset by market effects and activity shifting. Other formal constraints include baseline calculation, additionality and the incentives for moral hazard. The non-formal constraints of including sinks are derived from adverse socio-economic, cultural and environmental effects. The most important are a crowding out effect of projects directed towards transfer of clean technology and the creation of a institutional, technological and economic lock-in effect. On a different scale but no less real, the establishment of carbon storage facilities may result in the impoverishment and/or displacement of indigenous people and rural dwellers. Finally, there is an incentive to replace primary forest for plantations which would accrue to disturbances in the forests' watershed and biodiversity functions.

The overall assessment of plantations as sinks is negative, although it is acknowledged that plantations have certain economic advantages. This justifies the search for alternative use of forestry in CDM.

Alternative ways of implementing forests in climate policy are based on 'output financing'. They comprise plantations treated as sustainable energy resources and a facility directed towards the conservation of existing forests. The former may be incorporated in CDM, while the latter requires a structure of its own.

Most tropical plantations are used to produce biomass energy or other products that substitute for fossil fuel. Such plantations may be (co-)financed through CDM by way of this substitution phenomenon, with disbursements taking place at the actual time the substitution is realized. Fossil fuel substitution projects are normal elements of CDM already. Thus, the need is removed to (co-)finance plantations through the sink concept, which alleviates most of the constraints connected to sinks.

An operational framework has been developed in the report, which essentially has the same conceptual structure as normal CDM projects. The key to the mechanism is the certification of areas of envisaged plantations, which guarantees financial rewards at the moment these trees are converted into energy or prevent the use of fossil fuels otherwise. This conceptualization intrinsically solves the problems of permanence and determination of the baseline. Other formal problems are curtailed to 'normal CDM size'.

Furthermore, the non-formal problems have been strongly reduced. On a small scale (local socio-economic and environmental effects), these problems are offset by including several 'no harm' criteria in the certification procedure, and the (facultative) addition of a development bonus which rewards plantation investors for investing in additional benefits. On another scale, clean technology transfer is promoted instead of being crowded out and the lock-in effects are drastically reduced. Small-scale economic entities such as local communities or farmers will be able to meet the certification criteria easier than large-scale and corporate investors.

Building on the principle of 'paying for functions', a multi-convention global facility is proposed in this report, aimed at the avoidance of irrational conversion of existing forests. It acknowledges the fact that the global forest functions should be financially rewarded. One of these functions is the important role of existing forests in the global carbon cycle. The facility is based on the straightforward principle that countries that are net consumers of forest benefits (such as preventing global warming), reward net producers of these benefits. When put into practice the latter group receives disbursements on the basis of standing forest per hectare per year. The facility may be started on a country-to-country basis.

SAMENVATTING

Dit rapport heeft tot doel te onderzoeken welke rol bossen in ontwikkelingslanden kunnen hebben binnen het kader van de mondiale klimaatconferentie en andere mondiale conventies te onderzoeken. Het maakt een evaluatie van het concept van bossen als 'sinks' (afvangers van koolstof) in het Clean Development Mechanism van het Kyoto Protocol. Verder behandelt het rapport mogelijkheden voor opname van bossen in het CDM en verschillende mondiale conventies. Er is gewerkt met de (realistische) veronderstelling dat bossen als sinks de vorm van plantages hebben. Het rapport identificeert zowel formele bezwaren als niet-formele bezwaren van bossen als sinks in het CDM en daarnaast ook een aantal voordelen.

Het Kyoto Protocol kent rationele en heldere regels voor het CDM. Twee belangrijke bezwaren van het sinks concept hebben betrekking op strijdigheid met die regels. Ten eerste, het gebrek aan permanentie. Opgeslagen koolstof kan weer vrijkomen in de atmosfeer onder invloed van natuurlijke processen of menselijk handelen. Ten tweede, het probleem van 'lekkage'. Dit betekent dat de opslag van koolstof teniet kan worden gedaan door het verplaatsen van activiteiten of markteffecten. Andere formele problemen betreffen de berekening van de baseline, additionaliteit en impulsen voor ongewenst gedrag. De niet-formele bezwaren tegen sinks zijn gebaseerd op sociaal-economische, culturele en milieueffecten. De belangrijkste zijn de verdringing van projecten die gericht zijn op de overdracht van schone technologie naar ontwikkelingslanden en het risico dat ontwikkelingslanden vast komen te zitten in een inferieure en starre plantage-economie. Op een lager niveau planten van grote plantages kunnen leiden tot een het verdrijven of een welvaartsafname van de inheemse bevolking en boeren in ontwikkelingslanden. Tenslotte ontstaat er een impuls om bestaande tropische bossen te vervangen door plantages, met nadelige gevolgen voor biodiversiteit en hydrologie.

De uiteindelijke evaluatie van plantages als sinks valt negatief uit, alhoewel wordt erkend dat plantages ook zekere voordelen kunnen hebben. Dit rechtvaardigt het zoeken naar een vorm van opname van bossen in het CDM die veel van de bovenstaande problemen niet met zich meebrengt.

In dit rapport zijn alternatieve manieren om tropische bossen te betrekken in het klimaatbeleid gebaseerd op 'output financiering', dat wil zeggen, het betalen voor concrete resultaten in plaats van voor onzekere plannen, verwachtingen en beloftes. Output financiering kan worden toegepast als stimulans voor nieuwe bossen en de bescherming van bestaande bossen.

Plantages kunnen worden gefinancierd op basis van hun vermogen om biomassa te leveren die het verbranden van fossiele energiebronnen (en dus CO2) uitspaart. Indien uitbetalingen plaats vinden in de mate en op het ogenblik dat deze besparing optreedt, lost dit de meeste problemen die zijn gerelateerd aan sinks op. Plantages worden dan behandeld op dezelfde wijze als reguliere CDM projecten.

De kern van het mechanisme is de certificatie van gebieden van geplande biomassa plantages, die een financiële beloning garandeert voor het moment waarop de bomen worden gebruikt voor het opwekken van energie of waarop op een andere manier het gebruik van fossiele brandstoffen uitgespaard wordt. Deze conceptualisatie betekent een intrinsieke oplossing van de problemen met betrekking tot permanentie en baseline. Andere formele problemen worden gereduceerd tot het formaat van normale CDM projecten.

Bovendien worden de non-formele problemen gedeeltelijk opgelost. Op lokale schaal worden de problemen voorkomen door het opnemen van enkele 'geen schade' criteria in de certificatieprocedure, en een facultatieve ontwikkelingsbonus. Dit laatste is een beloning voor investeerders die investeren in additionele baten voor de lokale mensen en de natuur. Op een hoger niveau wordt de overdracht van schone technologie bevorderd (in tegenstelling tot het verdringen) en het 'starheidsrisico' worden sterk beperkt. Kleinschalige economische actoren, zoals lokale gemeenschappen of boeren, zullen gemakkelijker aan de certificatiecriteria voldoen dan grootschalige investeerders.

De vernietiging van bestaande tropische bossen wordt (met name vanwege de certificeringcriteria) door het voorgestelde CDM-mechanisme niet sterk bevorderd, maar ook niet afgeremd. Deze ontbossing vormt echter een belangrijke bedreiging voor het mondiale klimaat en tevens voor andere mondiale functies. Op basis van het 'paying for functions'-principe stelt dit rapport een mondiaal mechanisme voor dat wordt ondersteund vanuit verschillende conventies.

Het mechanisme is gericht op de bescherming van bestaande bossen. Het erkent dat mondiale bosfunctie financieel moeten worden beloond. Een van deze functies is de belangrijke rol in de mondiale koolstofcyclus. Het mechanisme is gebaseerd op het eenvoudige principe dat landen die netto voordelen van bossen consumeren hiervoor betalen aan landen die deze netto produceren per hectare staand bos per jaar. Dit mechanisme kan al op bilaterale basis worden opgestart.

1

INTRODUCTION

The implementation of UNFCCC's Kyoto Protocol, which has been established at CoP 3, is highly controversial and still in the negotiation phase. One of the most intensely debated issues at CoP 6 has been the degree to which Land-Use and Land-Use Change and Forestry (LULUCF) activities should be included as an instrument to reach Quantified Emission Limitation and Reduction Commitments (QELRCs), the abatement targets of countries included in Annex I of the Protocol. The topic divided Annex I countries, non-Annex I countries and NGOs both externally and internally.

Consensus now appears to be growing (see, for instance, Decision 5/CP.6 of COP6-bis) that LULUCF activities are eligible to reach QELRCs, albeit heavily capped and discounted due to the many uncertainties surrounding baseline, permanence and other aspects of sinks (e.g. Noble and Scholes, 2001). This pertains only to the non-tropical (Annex I) countries, however, and is therewith not directly relevant for the tropical forest that is the focus of present report. For the tropical (developing, non-Annex I) countries, the link with the climate issue runs through Article 12 of the Kyoto Protocol, describing the Clean Development Mechanism (CDM). This mechanism is directed towards gaining emission reductions in non-Annex I countries through finaces from Annex I countries that then may subtract the emission reduction from their own national obligations. Article 12 of the Protocol describes, *inter alia*, the criteria that CDM projects should comply with.

One of the main issues in this respect has been the question if LULUCF activities should be included in CDM. Decision 5/CP.6 of COP6-bis limits the application to forestry (which does not bring problems to the present report), but no further progress is made. The decision only repeats the criteria for CDM projects, which will be discussed lateron in this report. It may be noted here as well that the decision does not necessitate an implementation of CDM involvement in tropical forests in terms of sinks; other ways of implementation are still open.

This report questions the desirability of the sink concept as a cornerstone of implementations in CDM, and will propose an alternative. This is one of three main focus points of the report.
Fist of all, the report provides some background chapters in order to embed the research findings. Chapter 2 briefly explains the different forest functions and connects these functions with existing multinational conventions. Chapter 3 goes deeper into the role of forests in the Kyoto Protocol and introduces the principle of 'paying for functions'. Subsequently a number of questions is posed in order to determine the role of sinks in CDM. In Chapter 4, the report questions the possibility of including sinks in accordance with the criteria of Article 12 of the Protocol, that pertains to CDM. Chapter 5 then goes on to look more generally at positive and negative effects of sinks as plantations. It takes into account economic, social, cultural and environmental effects. These effects are often linked to visions regarding forests in the climate context.

After having thus examined the concept of sinks, the report turns to finding alternative ways to include the tropical forests in the Protocol and other conventions. Two applications are proposed and clarified. Both applications are based on output financing.

The second focus point then concerns the forests and CDM. Plantations and regenerating forests can be deployed as production centres of biomass under CDM. However, for inclusion under the CDM mechanism they need not be treated as sinks. They may also be included while treated as sources of energy that prevent fossil fuel emissions. Chapter 6 develops a framework for these operations and looks at the effect of plantations-as-energy source-concept on the feasibility under CDM and its possible impacts, compared to those of the plantations-as-sinks-concept.

Chapter 7 aims to give a solution for existing forests in non-Annex I countries. There is a clear lack of incentives to protect these forests. A international framework outside the CDM is proposed, based on the principle of 'paying for functions', including the climate.

The report concludes its main findings in Chapter 8. Furthermore, this chapter gives indications for further research.

2

GENERAL FOREST FUNCTIONS

Interactions between humans and forest may be perceived in terms of frontier economics, environmental protection, resource management, eco-development or deep ecology (Colby, 1990).Forests are multiple resources; De Groot & Kamminga (1995) give a systematic overview of the functions of (tropical) forests of their various system levels between the global and the local. Most of the global functions of forests have been recognized and accounted for in various international conventions. This does not only concern resource functions, but dynamic functions in the global ecosystem, particularly the carbon cycle, the nutrient cycle and the hydrological cycle. This chapter gives a bird's eye view of the functions of forest and tries to connect them to these existing international conventions. It may be important to note that the magnitude and size of these functions are subject to spatial variation. This chapter then addresses arguments for incorporating forests in the Kyoto Protocol (including CDM).

2.1 Safeguarding biodiversity

One of the major functions of forests is being a habitat for a huge variety of life forms. This biological diversity is of intrinsic, cultural and economic value. During the 1992 Conference in Rio, this awareness contributed to the formulation of the Convention on Biological Diversity (CBD).

The CBD defines biodiversity as 'the variability among living organisms from all sources, including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species (genetic diversity), between species (species diversity) and of ecosystems'. The knowledge regarding the current state of biodiversity on earth is limited. Most of the world's species have not been described yet. This especially concerns lower plants, fungi, invertebrates and micro-organisms. On the level of ecosystems our knowledge is more complete (Glowka et al., 1994). It is apparent that biodiversity is not evenly spread around the globe, and that there are so-called 'hot spots'. These hot spots show exceptional concentrations of species with high levels of endemism and they include certain tropical forests (Myers, 1988). According to the CBD:

"tropical, temperate and boreal forests provide the most diverse sets of habitats for plants, animals and micro-organisms, holding the vast majority of the world's terrestrial species. This diversity is the fruit of evolution, but also reflects the combined influence of the physical environment and people."

Under the framework of the CBD, countries are obliged to develop national programs for the conservation and sustainable use of biodiversity. Every strategic decision in their policy should formally take biodiversity into account, in accordance with this programme (Raustiala and Victor, 1996). If a country is financially incapable of fulfilling its obligations in this respect, it can request the Global Environment Facility for financial assistance (www.biodiv.com).

2.2 Combating land degradation

The concept of land degradation covers three aspects: soil erosion, soil degradation and watershed deterioration.

Soil erosion is the horizontal transport of soil particles by water or wind. Erosion is often associated with decreasing agriculture productivity *in situ* and with siltation problems downstream. As shown, for instance, in the Universal Soil Loss Equation, forest is the optimum vegetation cover that prevents erosion (e.g. Stocking, 2000; Lal, 1990)

Soil degradation is a deterioration of the nutrient and carbon levels in soils, of which especially the carbon content is connected also to physical properties such as water infiltration and retention capacities. The nutrient cycle is depicted in Figure 2.2. In order to grow, biomass needs elements which are available from water and the atmosphere (C, N). Numerous other nutrients originate from organic litter of biomass. When biomass falls on the ground surface, it is transformed into nutrients by micro-organisms. It subsequently infiltrates the sub-soil as a result of rainfall. The organic matter remains on the ground and prevents the nutrients from washing away during precipitation. The nutrients are then re-extracted from the soil by vegetation and consumed by the biomass.

Nutrient cycles may 'run up', *i.e.* accumulating a net increasing nutrient and carbon level every year, or 'down', *i.e.* with a lower overall nutrient and carbon content every year. The former tends to be the case in forests, and the latter on arable land, especially in the tropics where rainfall is high and/or fertilizer inputs are low. This illustrates the crucial role of forests in the overall sustainability of tropical land-use systems: overall equilibrium is reached if the downward tendency of arable land is connected to the upward tendency of forests, e.g. through fallowing in a forest/field sequence over time, or through cattle and manure in a forest/field connection in space. The survival of the Sahel and the massive soil degradation in Amazonia are both connected to this phenomenon.

The hydrological 'watershed' function of forests usually works on a regional, river-wide scale. The essence of the local hydrological cycle is depicted by figure 2.1. Precipitation may be taken as the starting point of the hydrological cycle. After precipitation has fallen, the water can be intercepted by the canopy cover and evaporate. Part of the water will reach the top soil and will infiltrate the soil to varying extents. Some water will remain at the surface, running of in streams of water. Water from the sub-soil will be partially absorbed by vegetation. The remaining water will eventually be added too springs or other surface water. The water that has been stored in vegetation temporarily, will be released back into the atmosphere by a transpiration process. The surface water will be released back into the atmosphere by evaporation.

It may be borne in mind that due to deeper roots, trees create a higher level of evapotranspiration than grasses and other vegetation. This implies that the first effect of deforestation is often that river discharges increase, both in the wet season and in the dry season ('base flow'). In the course of time soil degradation will set in, resulting in decreasing infiltration rates, which in turn result in even higher wet-season flows, but usually a lower dry-season flow. Then soil degradation will begin to show its effects on the river bed, raising the river bed, particularly in the lower river reaches, so that peak flows, now being discharged over a higher river bed compared to the adjacent land, will result in "flash floods" and create the well-known images of destroyed bridges, crops and human lives.

Figure 2.1: The hydrological cycle

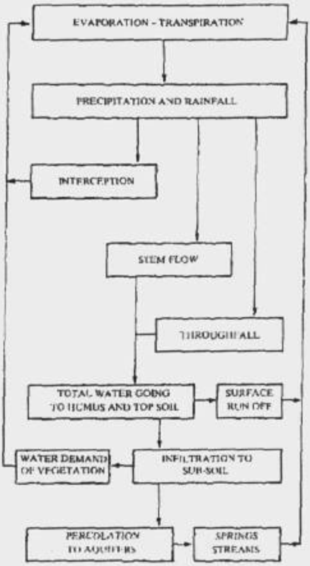
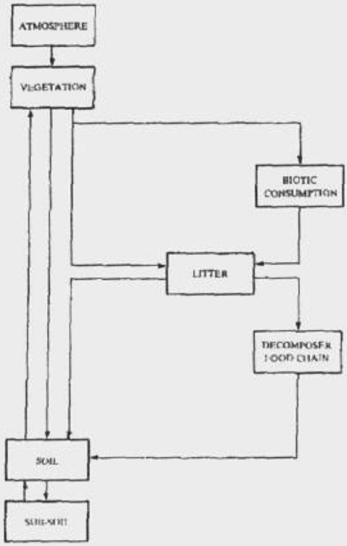


Figure 2.2: The nutrient cycle



Source: Shiva et al., 1991

Against this background it is only logical that protection of forests is a key element in the United Nations Convention to Combat Desertification (CCD). It estimates that more than one billion people are directly or indirectly at risk because of land degradation, the most important risk being a (long-term) lack of food security. The importance of forests for the conservation of fresh water reservoirs and important river basins, has also been acknowledged by the Forest Declaration of 1992 (Agenda 21, 1993). Countries affected by land degradation will implement the CCD by developing and carrying out national, sub-regional, and regional action programs. Developed countries are expected to encourage the mobilization of substantial funding for these action programs. They should also promote access to appropriate technologies, knowledge, and know-how (www.unccd.int). Momentarily, negotiations are taking place to have land degradation accepted as an additional window of the Global Environment Facility.

2.3 Direct economic functions of forests

Forests are essential for economic development, according to the Forest Declaration (Agenda 21, 1993). Indeed, forests have a very high commercial value, especially if they are managed in a sustainable manner. In many developing countries, forestry is a major stepping stone to economic development. Forest yields contain energy as a result of the burning of bio-mass, but also forest products such as food, wood, non-timber products, medicines and increasingly important genetic material, amongst others.

Forest users include women, men, indigenous people and colonizers. Product extractions, slash-and-burn agriculture and commercial operators in sectors such as logging, tourism and pharmacy, ranging from local to multinational scale are having an adverse impact on the world's forest resources. This will prevent future generations to fulfil their needs and aspirations, which is contrary to sustainable development (Brundtland, 1987). Therefore, the basic problem to be solved by forestry is the lack of balance between social demands on forests and the actual state of forests (Wiersum, 1999). In the non-legally binding Forest Declaration, there is a consensus that this would result in high costs for developing nations because of the uneven spread of forest around the globe and that subsequently, developed countries have an obligation to share in these costs (Agenda 21, 1993; see also Chapter 7).

2.4 Preserving world cultural heritage and diversity.

Forests also have cultural, spiritual, aesthetic and scientific values to mankind. Forests are closely interlinked with a great variety of indigenous cultures around the globe. This has been acknowledged by most international conventions related to forests. For example, the CBD states that "*each country shall subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological* *diversity,..."*(article 8.j). The UN draft declaration on the rights of Indigenous Peoples (1993), which is currently being negotiated in the UN General Assembly, states that "*Indigenous Peoples have the right to maintain and strengthen their distinctive spiritual and material relationships with the lands (etc.), which they have traditionally owned or otherwise occupied or used*". The declaration continues this line of thinking, with articles that should maintain the rights of Indigenous Peoples with respect to land use, restitution of land, conservation, etc.

The aesthetic and scientific value of forest are protected by the Convention Concerning the Protection of the World Cultural and Natural Heritage (www.unesco.org). This convention only protects natural sites or features which are of outstanding universal value. The international community has set up the World Heritage Fund to assist countries to bear the costs of maintaining their heritage.

2.5 The climate functions of forests.

Forests highly influence micro climate conditions. In the dry tropics, for instance, the shade, additional moisture in the air and lower temperatures that are supplied by forests on the micro scale are among the reasons why many villages are surrounded by a protected forest patch.

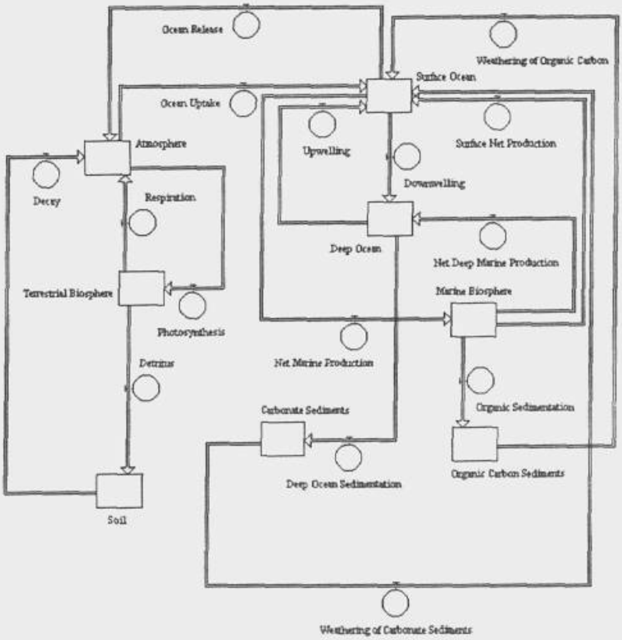
Shade and moisture from forests do not have a measurable effect on large-scale climate, except for very large forests on a continental scale. This has been measured and modeled especially for the Amazonian basin. Deforestation on that scale leads to such an amount of decreased evapotranspiration (see previous section) that, in due course, less rainfall is returned from the atmosphere. The ensuing dryer conditions increase the forest vulnerability for fires, thus reinforcing the deforestation process. In the Open Science Meeting (Amsterdam 2001), a feedback between forest and climate has been discused also with respect to West-Africa.

The major connection between forest and climate is through the global carbon cycle. Carbon is the most important greenhouse gas, capturing sun heat and hence making life on earth possible. Disturbances in the atmospheric concentration of carbon will result in changing global temperature and consequently to other climate changes. Figure 2.3 shows a schematic representation of the global carbon cycle, without anthropogenic disturbances.

The terrestrial biosphere absorbs CO_2 from the atmosphere, which is transformed in a process of photosynthesis into new biomass. The stored carbon is partly released back into the atmosphere through respiration and partly by decaying organic litter (detritus). Finally, a part of carbon will remain captured in the soil. Recent research has indicated that this effect is smaller than scientists have assumed over the last years (Oren et al., 2001). The described cycle is called "the short carbon cycle".

The long carbon cycle includes the ocean. There remain a lot of questions about the relevance of the ocean in the total carbon cycle, although it is acknowledged that this process is of major importance. The ocean absorbs and releases carbon from the atmosphere as well. The absorbed carbon is retained in marine biomass or other organic life forms. In time this will be either released back into the atmosphere or be transformed into stable and long-term lithospheric carbon sinks through a process of sedimentation. The carbon sinks that originate from these processes remain largely in place over extensive periods of time.

Figure 2.3: The global carbon cycle.



Source: http://plaza.ufl.edu/mrosenme/Carbon.htm (University of Florida). See also Noble and Scholes (2001) for an overview with more emphasis on quantification and human influence.

Human activities have an impact on carbon stocks, through land use, land-use change and forestry (LULUCF) and other activities. This affects the short-term carbon cycle. Large amounts of carbon have been released as a result of forest clearing. In recent decades this mainly concerned tropical forests. IPCC (2000) estimates that this deforestation has contributed substantially to the emission of carbon into the atmosphere. Although the estimates are uncertain, IPCC mentions a contribution of 1.7 Gt C (+/- 0.8) and 1.6 Gt C (+/- 0.8) for the 1980s and the

1990s respectively. Nevertheless during this period forests may have functioned as a small net sink. This can be attributed to land-use change activities and natural regrowth in the middle and high latitudes as well as the changing climate (IPCC, 2000), e.g. the 0.2 Gt C per year stored in net growth of forests in Annex I countries, mentioned by Noble and Scholes (2001) . The effect of deforestation differ between different types of forests. Table 2.1 shows the amounts of carbon contained by aboveground and below-ground stocks of biomass.

Table 2.1: Global carbon stored in forest vegetation and soil down to a depth of 1 meter, in G t C.

Area Global Carbon Stocks				
Forest type	Hectares	Vegetation	Soil	Total
Tropical forests	1.76 billion	212	216	428
Temperate forests	1.04 billion	59	100	159
Boreal forests	1.37 billion	88	471	559

Note: Considerable uncertainty exists in the numbers given, e.g. because of ambiguity of definitions of biomes, but the still provides an overview of the magnitude of carbon stocks in forests. Source: IPCC (2000).

The long-term carbon cycle is disturbed by the burning of carbon (i.e. fossil fuels), which have been formed over extensive periods of time, but are now released back into the atmosphere within two generations time (Metz, 2001).

The attention will now again be focussed on the negative and positive impact of forestry activities on climate change. It is evident that anthropogenic activities with respect to forests strongly impacts the carbon cycle. This has been acknowledged by the Kyoto Protocol. The next chapter will discuss the place of LULUCF activities in the Protocol.

3

LAND-USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES WITHIN THE KYOTO PROTOCOL

From the foregoing chapter it may be clear that forests play an important role in the regulation of the climate. This function of forests has been acknowledged by the Kyoto Protocol. Throughout the Protocol, the reduction of emissions is treated in a similar way as enhancing GHGs uptake through sinks. Still, many issues are to be resolved. The IPCC Special Report on Land-Use, Land-Use Change and Forestry (IPCC, 2001) gives an extensive assessment of the state of the current scientific knowledge on these issues. This chapter will focus on these issues briefly. Furthermore, it will try to add some remarks on the political context surrounding LULUCF. Section 3.1 looks at the function of forests as sinks within the Protocol framework. Forests, or broadly speaking any biomass has another function in the Protocol. It may also substitute for some energy-intensive products. Moreover, in the form of biofuel it can prevent the use of fossil fuels. This is the topic of section 3.2. Subsequently the politics of sinks will be briefly highlighted. Inclusion of sinks as a means of combating climate change can be categorized as highly politicized. The final section looks at the integrated function of forests and introduces the idea of "paying for functions".

3.1 Sinks and the Kyoto Protocol

In Chapter 2, attention has been paid to the functioning of the carbon cycle. Forests and other biomass play an important role in this cycle, and consequently biomass is an integral part of the Kyoto Protocol. According to Article 3.3 of the Protocol:

"The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation reforestation and deforestation since 1990, measured as verifiable changes in carbon stocks in each commitment period, shall be used to meet the commitments under this Article of each Party included in Annex I. The greenhouse gas emissions by sources and removals by sinks associated

with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8".

In this Article, several principles surrounding sinks and sources have been addressed in a way, which leaves little room for differences in interpretation. Though not directly connected to the present report's main subject, it is worthy to note that the Article has become the centre of some controversy. On the one hand this results from the use of different definitions. On the other hand, certain regulations of the Article have been a fierce topic of debate in recent years.

It is rather easy to point out the relevance of using definitions which have been commonly agreed upon. Indeed, complete forests can be "lost" or "gained" in the process of defining them. The IPCC (2000) mentions land-use change, forests, forestry (including afforestation, reforestation and deforestation), carbon stocks, human-induced and direct human-induced as issues that have to be defined by the Parties to the Protocol. These terms form the very basis of the Article. For example, there are many possible definitions of a forest. The choice how to define a forest will determine how much land should be accounted for by Annex I countries, when they assess the extent to which the have fulfilled to their QELRCs. Countries define forests in terms of their legal or cultural stature and measure them in terms of canopy cover or biomass density. These definitions were not designed with the Protocol in mind. This means their is an institutional gap which has to be treated. This can only be the result of international agreement on the standards and the instruments used to measure the developments of forests and on the extent to which these developments have to be accounted for. Comparable problems surround the other issues mentioned. COP6-bis has made progress on definitory issues (see, for instance, the Annex of draft decision FCCC/CP/2001/L.11.Rev.1, where terms such as forest, cropland management etc. are discussed).

Although under the regulations of Article 3.3, land-use change and forestry activities have been restricted to afforestation, reforestation and deforestation (ARD) since 1990. It seems that other LULUCF activities will now be considered for inclusion in Article 3.4 (Schlamadinger & Marland, 2000). Article 3.4 states that:

"The CoP,......, shall decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources

and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I,...."

The decision which is made as a consequence of Article 3.4 will apply in the second and subsequent commitment periods, i.e. after 2012. The set of eligible LULUCF activities is likely to be enlarged in these commitment periods, although it is far from clear what these activities will be precisely. Excluding other activities than ARD in the first commitment period allows further research to reduce uncertainties surrounding LULUCF activities (Metz et al., 2001)

3.2 Bio-energy and the Kyoto Protocol

Another forest function which is acknowledged within the framework of the Kyoto Protocol is the potential to convert biomass into a sustainable form of energy. Hence, when this biofuel displaces fossil fuel, the mitigation of GHGs is captured as a decrease in the use of fossil fuels. According to the IPCC (2000): "*Article 3.3 of the Kyoto Protocol clearly distinguishes between biofuels and fossil fuels, establishing that biofuels are part of the cycling of carbon in the biosphere*". This fuel substitution could entail large-scale land-use change and the creation of a large production apparatus, as will be further elaborated in Chapter 6. This has both positive and negative potential effects with regards to sustainable development, biodiversity, land availability and productivity, etc.

IPCC (2000) recognizes that mere storage of carbon in sinks may not always be the most effective strategy for mitigating GHG emissions. IPCC considers that over time, greater mitigation is possible by managing the entire system. This may be done in three ways, next to carbon storage in standing biomass: (1) carbon stored in wood products and landfills, (2) using biofuels instead of fossil fuels and (3) by replacing fossil fuel-intensive materials for forest products and other bio-products. Recently, the debate around "cascading" has produced new ideas in addition to the substitution of energy-intensive products for biomass. The principle of cascading is based on efficiency. Biomass is used for different function in different stages of existence. It may first be put to use in construction, where it stores carbon for a number of years. After its function as construction wood has faded, the construction material can be transformed into paper, which after having been recycled for a number of times will be used as a bio-fuel.

3.3 *The politics of sinks*

The Kyoto Protocol considers sinks to be a legal manner of offsetting carbon emissions by Annex I countries. There is agreement on the fact that carbon sequestration by sinks is eligible under Joint Implementation as well. Still, sinks have become a debated topic in the climate negotiations. Both within the Annex I countries and the non-Annex I countries disagreement exists on certain issues. This disagreement is of political origin rather than of scientific, although there are still many scientific uncertainties that exacerbate the political ones (e.g. Richards and Andersson, 2001).

Annex I countries are divided over the question to which extent they should be allowed to offset their emissions by the use of Joint Implementation and the Clean Development Mechanism, i.e. finding solutions in non-Annex I countries abroad. It may be obvious that the outcome of this discussion is of great importance to the relevance of LULUCF activities implemented in order to mitigate climate change.

An other dispute is of direct importance for the tropical (non-Annex I) forests. It concerns the question whether or not LULUCF activities (in their role as carbon sinks) should be included in CDM. Proponents of inclusion are motivated by pre-existing commitments, by forest management concerns, or by the belief that they might not be able to attract CDM otherwise (Hare, 2000). Opponents of inclusion often use arguments, which can be found throughout this report (especially in Chapters 4 and 5). The latter group finds itself supported by the European Union. The EU is opposed by other Annex I countries. In COP6-bis, the inclusion of forestry (not other land use) in CDM has been upheld, however without visible progress on the implementation.

One other route to relate forests to CDM is through the Adaptation Fund under CDM, directed towards financing measures, taken by developing countries to offset the adverse effect of climate change. These measures could then include forest activities. The Adaptation Fund will involve only a small percentage of the CDM proceeds, however, and this 'detour' for reaching the tropical forest will not be pursued in the present report.

Another option to bring the tropical forest under CDM would be to focus on the substitution of fossil fuel by renewable (biomass) bio-fuels (Metz *et al.*, 2001) rather than on the sink concept. This solution will be the focus of Chapter 6.

3.4 Paying for functions

As indicated in Chapter 2, forests fulfill a wide array of functions. Some of these are expressed on the local level (e.g. soil fertility maintenance), while others accrue at a regional (e.g. watershed functions) or global scale (e.g. climate, biodiversity and cultural diversity). Some of these functions are supported by well-developed markets, such as the market for agricultural products and fertilizers supporting soil fertility. Other markets are only partially developed. The market for eco-tourism, for instances, captures only a small portion of the global value of tropical forest biodiversity. And finally, other forest functions are presently not supported by any market at all, such as the value of carbon sequestration for the prevention of climate change.

"Paying for functions" is a concept in which all forest functions are expressed financially. One recent development in this respect is, for instance, a mechanism applied in Costa Rica, where upstream communities are remunerated for their watershed function maintenance by downstream communities (dr. P.A. Verweij, pers. comm., 2001). Especially with a view on Chapter 6 and Chapter 7 it may be noted here that paying for functions may be carried out on a one-to-one basis, that is, one financing mechanism for one function (as in the Costa Rica example). In Chapter 6, a one-to-one solution will be proposed, while Chapter 7 will focus on a multi-functional ("all Conventions") mechanism.

Principles to be adhered to in paying for functions especially concern the risk of double-counting. This develops into two rules:

- *Lowest possible system level*: Intercommunity benefits should preferably be settled intercommunally, as in Costa Rica, going from the regional, national, international to the global level. This implies that a global mechanism such as CDM, or a global clearing house such as in Chapter 7, should function on the truly global functions.

- *New mechanisms should not duplicate existing markets*, such as those of timber, agriculture or ecotourism. Insofar these markets do not express external effects these may become part of paying for functions mechanisms. This may include, of course, levying of negative external effects.

One other point to note with respect to paying for functions is the issue of "who gets paid for what". Since the functions of forests are performed by standing forest, a logical answer would be to remunerate on a per hectare per year basis, irrespective of human activities. On the other hand, there is logic in paying for human activities (e.g. by compensating opportunity costs). This rises the question who actually owns the forest. Paying for functions mechanisms have to make clear choices in this respect.

Finally, it may be borne in mind that there is no moral and ethical obligation to pay or get paid for every forest function. A beautiful tree in one's private garden also beautifies the town; yet we do not get paid a beauty bonus by the municipality. In other words, what to remunerate depends on what may be regarded as basic obligations of lower-level entities (individuals, communities, states) towards the higher-level collective good (communities, nations, global level).

4

FORESTS AND THE FLEXIBLE MECHANISMS OF THE KYOTO PROTOCOL

4.1 General aspects

The Kyoto Protocol states that Annex I countries shall ensure that their anthropogenic carbon dioxide equivalent emissions of GHGs do not exceed their assigned amounts. These amounts are equal to the GHG emissions an Annex I country contributed in 1990, minus its Quantified Emission Limitation and Reduction Commitments (QELRCs) as agreed under Annex A of the Protocol.

Domestic GHG emission and uptake resulting from land use, land use change and forestry (LULUCF) activities are included in the calculations of both the baseline and the results. The question arises whether the Kyoto Protocol permits Annex I countries to pursue emission reduction objectives through LULUCF activities abroad, using the flexible instruments. The Kyoto Protocol includes three instruments that give Annex I countries the opportunity to reach part of their abatement targets in other countries. The logic behind these instruments is based on optimizing cost efficiency. Since the purpose of this report is to shed light of the role of forests in the Clean Development Mechanism (CDM) instrument, this chapter does not elaborate on the flexible instruments in general. Before dealing with the issue of emission reductions in CDM, the role of forestry with respect to International Emissions Trading (IET) and Joint Implementation (JI) will be addressed only briefly. Since the introduction of the Kyoto Protocol many countries have experimented with the use of these instruments under the guidance of the UNFCCC. These projects are referred to under the name of Activities Implemented Jointly (AIJ). Many of them are LULUCF activities. The United States' LULUCF projects, for example, involve about 4 million hectares up till now (IPCC, 2000). They are conducted in Annex I countries as well as in non-Annex I countries. The final section of this chapter will elaborate on these AIJ projects.

4.2 Forests in the International Emission Trading regime

The first of the flexible instruments to be highlighted is the International Emissions Trading (IET). This instrument is only described briefly in the Kyoto Protocol (Art. 17, 3.10, 3.11). Relevant principles, modalities, rules and guidelines have not been decided upon yet. Nevertheless, the principle is clear. If an Annex I country has reduced GHG emissions further than it had committed itself to under the Kyoto Protocol, it is allowed to sell this 'surplus' to another Annex I country which has emitted more than its amount (Jepma et al, 1998). In much the same way, credit accruing from projects implemented under the other instruments can be bought or sold on this market.

Since changes in carbon stocks are accounted for in the compliance regimes, it is likely that any GHG emissions or reductions associated with LULUCF activities can be part of IET. It should be borne in mind, though, that there are no final agreements with regards to this issue. It is important to be aware that only Annex I countries are eligible for IET. This reflects the view of the OECD (1997) that participation in a trading system by non-Annex I countries (i.e. countries that have not adopted QELRCs), could reduce the value of allowances and raise the risk that overall greenhouse gas emissions reductions will not be achieved. This implicates that, under present conditions, tropical forests can not be included in IET.

4.3 Forests in Joint Implementation

The concept of Joint Implementation (JI) is described in Article 6 of the Protocol. According to this article, Annex I countries are permitted to transfer Emission Reduction Units (ERUs), resulting from projects aimed at reducing anthropogenic emissions, to other such countries. These projects can either contribute to emission reduction by sources or to enhance anthropogenic removals by sinks (Art. 6.1).

LULUCF activities are an integral part of JI. However, in the absence of a general agreement which LULUCF activities should be included, the issue is surrounded by vagueness.

4.4 Forests in the Clean Development Mechanism

The purpose of the Clean Development Mechanism (CDM) is twofold. On the one hand, countries not included in Annex I will be assisted in achieving sustainable development and in contributing to reducing global emission levels. On the other hand, Annex I countries will be assisted in achieving compliance with their QELRCs (Art.12.2). By reducing emission levels in non-Annex I countries, Annex I countries receive Certified Emission Reductions (CERs) which they can deduct from their QELRCs.

Although Article 12 of the Kyoto Protocol, which concerns CDM, is unclear in this respect, the results of COP6-bis indicate that forestry is included in CDM, insofar, logically, it complies with the generic regulations, modalities and procedures of CDM as outlined in Article 12. This means that emission reductions should be "real", "measurable" and yield "long-term benefits related to the mitigation of climate change". Furthermore, reductions should be "additional"[1] to any that would occur in the absence of the certified project activity (Art.12.5). Finally, the projects should be characterized by "transparency of reporting, accountability, efficiency and verifiability of results" (Art. 12.7; see also Decision 5/CP.6 of COP6-bis).

Many of these conditions are already difficult to fulfil with regular CDM activities. This is even more complicated for sinks to be included in CDM. The two main concerns in this respect are leakage and permanence. Furthermore, baseline calculation and the requirement of additionality complicate the process of verification (IPCC, 2000).

4.4.1. Leakage

Leakage problems in LULUCF projects can occur as a result of (1) market effects, (2) activity shifting (Richards and Andersson, 2001).

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[1] The concept of additionality is subject to different interpretations. In this report an activity is additional only if it would not be economically viable without earning CERs (Sugiyama and Michaelowa, 2001).

(Ad 1) There is a possibility that large-scale sequestration operations might have negative impacts on the world timber prices, thereby reducing the incentives of traditional suppliers to invest in forest management and new timber production (Sedjo & Sohngen, 2001). This is merely one of the possible market effects to occur.

(Ad 2) Activity shifting is the spatial shifting of activities. This may occur if farmers are excluded from a project area designed for LULUCF activities. It is likely that these people then shift their activities elsewhere, possibly to a forest frontier. The subsequent emission of GHGs would not be accounted for in the baseline calculation of the LULUCF project.

4.4.2. Permanence

Another serious concern is that of a lack of permanence. This is unique for LULUCF activities. It is contradicting the requirement that emission reductions should be long-term in nature. Carbon sequestration in forest and other types of land cover is potentially reversible because carbon contained in terrestrial ecosystems is vulnerable to disturbances such as wildfires or pest outbreaks, as well as subsequent changes in management that would return some or all of the sequestered carbon to the atmosphere in addition to what would have been released if the sequestration activity had never taken place. This situation contrasts with the case of avoided fossil fuel emissions because fossil fuels left in the ground in a given year will not be accidentally released in a subsequent year, even if the emission reduction activity itself is of a limited duration (Ipcc, 2000). A question of major relevance in this respect is that of liability for the loss of stored carbon. This can be borne by the investor, the investing country or the receiving country. The subsequent question would be what the consequences would be in terms of disbursements, distributed CERs, etc.

Possible solutions for the problem of permanence as identified by IPCC (2000), primarily focus on risk reduction approaches like good management systems, project diversification, self-insurance reserves, standard insurance services and involvement of local stakeholders. However well these approaches may help to mitigate the problem, they do not address its core. Other solutions to the problem may be debits for all releases, project replacement or delayed/partial credit initially (tonne year accounting). All of these measures would bring about a wide variety of administrative operations.

4.4.3. The need for verification

The need for verification is inherent to the use of the CDM mechanism, since it has been explicitly mentioned in Article 12. This need stems from three problems. (1) The requirement of additionality; (2) baseline calculation and (3) moral hazard.

(Ad 1) Article 12.5.c clearly states that reductions in emissions should be additional to any that would occur in the absence of the certified project activity. This concerns a measurement problem in first instance. It has to be determined if a project would be economically viable without financial support from CDM. Even if truly measurable, however, a deeper dilemma appears. Very cost-effective and multi-functional projects will have great difficulty to prove that they are additional, while poorly designed projects will easily cross the threshold, thus creating a perverse incentive. Sugiyama and Michaelowa (2001) analyse this problem and propose to solve it in the way as practiced *de facto* in other institutions that work with a *de jure* additionality criterion (such as the GEF), namely, by open negotiations and party's dicretion. We will return to this in Chapter 6.

(Ad 2) Measurement can be an obstacle for successfully implementing forestry activities in CDM. Measurement of carbon stocks concerns a number of technical aspects. More importantly it includes the issue of baseline calculation. The difficulty with the baseline is twofold. Firstly and most importantly, it is nearly impossible to objectively calculate the baseline, because it would imply making assumptions about what would have happened to the allocated land in the future. Secondly, it is not entirely calculable how much GHGs will be emitted in the process of site preparation in the case of establishing a plantation. The latter problem is of technical origin and may be resolved by technical solution. For a further discussion, see Andersson and Richards (2001) and Noble and Scholes (2001).

(Ad 3) Assuming that agreeing over forest sinks in CDM is technically feasible, the success of implementation will be heavily dependent on the degree to which this agreement will be carried out. This, in turn depends on the integrity of social and institutional organization of people, corporate structures and governments of the various geographic entities they operate in. In this respect it should be acknowledged that taking non-Annex I countries as a point of departure for CDM has far-reaching consequences. In order to avoid incentives to locate projects in areas with less stringent criteria regarding sustainable development, a system of criteria and indicators should be developed. This need is absent for JI projects, because in that case the ERUs gained, are merely transferred from one Annex I country to another. These are all subject to the same set of criteria. Especially under Article 12 there are incentives for both the Annex I investor and the non-Annex I host to exaggerate the benefits projects. The investor would receive more credits toward its national commitment and the project host would sell more certified emission reductions. As pointed out by Noble and Scholes (2001), the risk of moral hazard is especially prevalent if financial flows are connected to to outset of projects, as most proposals seem to imply if they say that CDM should support the establishment of plantations and suchlike activities. Once the money is in, the investor has little incentive to assure the long-term success, i.e. the actual carbon sequestration. As a result, the demand for independent verification and precise monitoring may be staggering if carbon storage facilities are included in CDM, thus severely increasing transaction costs.

4.4.4. Conclusion

When taking a second look at the conditions a CDM project has to comply with according to the Kyoto Protocol, it becomes apparent that carbon storage facilities (sinks) will possibly meet with insurmountable compliance problems. The Protocol states that emission reductions should be "real", "measurable", "additional" and yield "long-term benefits related to the mitigation of climate change" and that the projects should be characterized by "transparency of reporting, accountability, efficiency and verifiability of results". The two core problems, leakage and permanence, undermine these requirements to a large extent. Emission reduction will be difficult to measure, because baseline calculation is problematic. Hence, the additionality of a project can not be measured sufficiently and it remains unclear whether emission reductions are real. The problem of permanence is intrinsic to carbon storage in biomass. In order to control the process of developing and performing such projects in CDM, rules and regulations will turn out to be very complex and require extensive verification and monitoring.

4.5 AIJ projects

In the pilot phase of Activities Implemented Jointly (AIJ), countries co-operated in JI as well as CDM projects in order to learn more about these flexible mechanisms (Jepma et al., 1998). The effects of this leaning process have remained limited, as a result of the small number of projects, the uneven geographic distribution, the short period of field operations and most importantly, the absence of an internationally agreed set of guidelines to operate the mechanism (Ipcc., 2000).
All of the countries participating in AIJ worked according to their own standards. According to the IPCC (2000), LULUCF projects implemented as AIJ may be divided into six subcategories: (i) reforestation, afforestation, and restoration; (ii) soil carbon management; (iii) forest conservation; (iv) forest management and alternative harvest practices; (v) agroforestry; and (vi) multi-component or community forestry projects that combine several of these activities. Strikingly, this set of activities exceeds the original ARD activities of Art. 3.3.

The next chapter will use the data that have become available as a result of AIJ projects, to assess the question if plantations as sinks are economically, socially, culturally and environmentally desirable.

5

THE GENERAL PLANTATION DILEMMA

The objective of the flexible instruments is to be cost-effectiveness in achieving global benefits. This means that the costs for project participants and public institutions should be kept as low as possible. It is likely that this is one of the major considerations for Annex I countries with regard to the allocation of funds to mitigate their GHG emission.

Experience with AIJ projects shows that the establishment of plantations for carbon storage is the one of the most cost-efficient solution for a country to reach its QELRC. However, there is a widespread concern with regard to the social, economic and environmental effects of plantations. The top-down structure of sinks in the CDM may lead to a tendency to neglect these effects. Article 3.14 of the Kyoto Protocol, determines that '*each party shall strive to implement commitments mentioned in paragraph 3.1 in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties,...*'. The aim of this chapter is to examine if plantations can be established without violating Article 3.14.

5.1 Summary of formal problems.

This short section serves as a reminder of the formal problems that surround the inclusion of LULUCF projects in CDM. These problems have been treated extensively in Chapter 4. Large technical problems, resulting in risks and high transactions cost, surround the issues of baseline, additionality and verification. Two main problems of a more substantive nature are leakage and permanence. Leakage is caused by human action and reaction resulting from LULUCF activities. The mitigation of the problem of leakage requires substantial verification and monitoring. This is the case for regular CDM projects as well, although to a lesser extent. The second problem, that of permanence, concerns the fact that it cannot be guaranteed that carbon is sequestered on the long term. Carbon may be released because sinks may be afflicted by natural or human-induced fires, pest outbreaks or other human action. This is contradicting the regulations of Article 12 of the Kyoto Protocol. Again, accounting combined with extensive monitoring and verification could be a partial solution to the problem. Still, is impossible to solve it entirely.

With the formal problems in mind, the attention is now directed towards less tangible problems related to the inclusion of plantations in CDM. One of the primary objectives of CDM is the promotion of sustainable development in developing countries. Article 3.14 reinforces this objective. These considerations form the basis of the rest of this chapter.

5.2 Plantations versus clean technology.

There is a concern among NGOs, supported by some scientists, that rent-seeking behaviour of investors would lead to large investments in plantations. Consequently, this would crowd-out CDM projects based on technology transfer. This concern is based on the opinion that plantations would be the cheapest way to create CERs and hence for Annex I countries to meet their QELRCs. Crowding-out of clean technology transfer by plantations would have two effects. The first effect is that a clear-cut emission reduction would be changed into a *net* emission reduction: gross emissions would stay the same but would only be offset by a carbon storage facility, i.e. the plantation. The question arises whether such a net reduction is just as real, to put it in Kyoto terms, as a gross reduction. The second effect of the possible crowding-out is the possibility that it may hamper a country's long-term sustainable development. This effect is being reviewed in this chapter.

When comparing the costs of carbon sequestering in forests or plantations and technology transfer, it is apparent that the estimates vary widely. This means that the cost price of CERs could vary as well. There are several explanations for this feature.

First of all, no standard method of evaluation has emerged and come into wide use (Ipcc, 2001). The input for estimation is based on a wide variety of AIJ projects, and the methods such as discounting, measuring the carbon stock, vary greatly. For example, using tonne/year accounting, a methodology employed to make corrections for the duration of such projects, would increase the costs of LULUCF projects (ref. Table 5.1) by at least 50% and maybe even several times (IPCC, 2000; Smith, 2000).

Secondly, it depends which costs are included in the calculation. IPCC (2000) distinguishes between direct costs, opportunity costs and transaction costs, although the latter category is not referred to as such. Direct costs incurred by the project developers include land purchase or rental, land clearing or site preparation and operating costs. Opportunity costs are equivalent to the present value of alternative forms of future land-use. Finally, transaction costs are costs that are connected with the organization of the project. Controversy exists as to which costs should be included as transaction costs. IPCC mentions infrastructure costs, maintenance and monitoring data collection and interpretation costs. Many NGOs (e.g. Goldberg of CIEL, 1998) point out that independent verification will lead to higher costs, especially with regard to LULUCF activities which are surrounded by a lot of uncertainty. This is recognized by the UNFCCC as well. According to FCCC, excessive transaction costs have been identified as a primary cause of failure of previous project based emission offsets programs (UNFCCC, 2000).

Thirdly, it is important to know to which extent project developers have externalized the costs of their project. If a significant proportion of the costs would be borne by governments and/or international organizations, this would lower the costs of CERs altogether.

As a result of these differences in regulations and methodologies, the costs of GHG benefits in LULUCF projects range from USD 0.1 to 28 per t C. Most estimates lie in the range of USD 1 to 15 (IPCC, 2000). Table 5.1. represent the costs of LULUCF projects implemented under the AIJ scheme (IPCC, 2001). It is clear that agroforestry offers a relatively cheap option (USD 0.2 to 10 per t C) among the various possibilities of sequestering carbon. However, caution should be taken, bearing in mind the foregoing comments.

In order to justify the concerns of those who predict that plantations would come at the expense of clean technology, it is necessary to compare these costs with those of regular CDM projects. Some of the difficulties surrounding LULUCF activities also concern the calculation of costs and consequently the cost price of CERs for regular CDM projects in the fields of energy efficiency and renewables. Still, these are not as controversial as costs of LULUCF activities. In an analysis of AIJ projects, ECN (1999) has calculated that 99 percent of Annex I countries' abatement can be realized below USD (1990) 10 per t C, when utilizing CDM in the energy sector. However, other researchers come to different conclusions. Stuart and Moura-Costa (1998) estimate the average costs of fuel-switch projects to be as high as USD 25 per t C.

Table 5.1: *Undiscounted cost and carbon mitigation over project lifetime of selected AIJ* Pilot Phase and other LULUCF projects.

Project Type (number of projects)	Land Area (Mha)	Total Carbon Mitigation (Mt C)	Costs (USD per t/C)
Emissions Avoidance via Conservation:			
Forest Protection (7)	2.8	41-48	0.1-15
Forest Management (3)	0.06	5.3	0.3-8
Carbon Sequestration:			
Reforestation and Afforestation (7)	0.10	10-10.4	1-28
Agroforestry (2)	0.2	10.5-10.8	0.2-10
Multi-Component and Community Forestry (2)	0.35	9.7	0.2-15

Source: IPCC, 2000

The uncertain conditions surrounding both the cost estimation for regular as well as LULUCF activities, makes it impossible to predict with certainty if plantations would be the most popular means of implementing the CDM, crowding out clean technology transfer options. Obviously, this risk is clearly present, however even if technology transfer would have a competitive edge at the moment, this advantage will diminish because incremental costs will rise over time (ECN, 1999). This implies that it is just a matter of time before plantations under CDM become economically viable. Hence, it remains necessary to look at the positive as well as the negative implications that including plantations in CDM would have. This will be done in the following section.

5.3. Plantations versus sustainable development.

One of the primary objectives of CDM is 'to assist Parties not included in Annex I in achieving sustainable development ...'. This has to be taken into account when considering the question of including LULUCF activities in CDM. In this section, the effects of LULUCF activities on sustainable development prospects of non-Annex I countries will be dealt with. Obviously, this is not the place for a discussion about the definition of the concept of sustainable development. The main focus will therefore be on development, although sustainability will not be kept out of the discussion entirely.

As mentioned by Austin *et al.* (1999), the development effects of the CDM have been underrepresented in the body of research that has developed around CDM. Most of the existing research has been based on case studies. This means there are still many controversial issues related to this question.

Proponents of including plantations under CDM for reasons of economic development, rarely take opportunity costs into consideration. The focus is on the revenues generated by stimulating plantations. First of all, CDM plantations can provide new sources of income in the receiving countries. They generate employment opportunities and might enhance the standard of living for the local population. Secondly, it is expected that learning curve effects will arise as a result of the build-up of plantations. In the field of land management or the development of institutions that work to address local needs, large improvements can be realized. Several case studies support these arguments (www.cifor.org/news/carbon2.htm). Thirdly, plantations have positive spill-over effects for those that do not profit directly from them. The local service base could be strengthened and the infrastructure could be improved.

Finally, proponents argue that plantations as well as other forms of land use will improve the productivity of land. The soil quality of heavily degraded land, may be enhanced as financial flows accrue as a result of CDM. This is all the more important, since ODA flows are decreasing. CDM could function as a substitute in this respect (Van Bodegom *et al.*, 2000).

It may be clear that plantations lead to economic development in a certain manner. However, as Evans (1986) notes, any kind of development that does not respond to the needs of the local population ultimately fails. This is the primary argument of many NGOs from different backgrounds, to oppose CDM plantations. Two groups of people that are likely to be affected directly as a result of plantation activities. First, the indigenous peoples might be displaced from the land to which they claim ancient ownership and which they value on a cultural and spiritual level, in addition to its economic value. Especially with the problem of leakage in mind, this becomes a realistic option. Secondly, rural dwellers who conduct farming activities on heavily degraded lands may be displaced. The increased pressure on available land may lead to crowding-out of other land-use and forestry activities than sinks (pers.comm. G. Huppes, 2001). Inequity in land ownership could be enlarged in this way. This may lead to food shortages in the long term. There are more social effects of developing regions on the basis of forestry. For example, the composition of the population may change dramatically, as the plantations will attract migrants looking for employment. This could lead to ethnic or cultural disruption.

On a different scale, other potential threats enter into the discussion. These have to do with the opportunity costs of CDM plantations. As said, plantations may replace the introduction of clean technology in non-Annex I countries. With many of these economies growing at a high pace, emissions will be on the rise as well. This means the demand for clean technologies would grow as well and it might then appear to have been a missed opportunity, in retrospect, that these technologies would not have been transferred already under CDM. Developing countries would have sold the cheap opportunity to sequester carbon in plantations to developed countries and would subsequently have to buy the clean technology from developed countries at market prices (Gupta & Bhandari, 2000). Especially for those countries that will reach a certain level of economic development which compels them to comply to abatement targets, this is a point worth considering.

Finally, the introduction of large-scale plantations might lead to what is called a technological, institutional and economic lock-in effect. This means that the institutional structure and the allocation of available resources, would prevent countries to adjust to changing (economic and social) situations.

5.4 Plantations versus preservation.

This section deals with the matter of preventing deforestation. It tries to compare the impact of preservation with the impact of plantations. First, the potential benefits of preventing deforestation will be touched upon. After that, the focus turns to the possible positive and negative effects of plantations in non-Annex I countries.

On a global scale, deforestation is one of the most important contributors in terms of carbon emissions. IPCC (2000) estimates that it is currently responsible for approximately 25 percent of the total emission. Emissions vary between different kinds of forest. Estimated averages vary from 400 t/C per ha per year in boreal forests, 150 t/C per ha per year in temperate forests, and 250 t/C per ha per year in tropical forests. In this case aboveground as well as below-ground carbon stocks are included in the calculation. If only aboveground carbon stock would be included, this would enlarge the emissions of tropical forests relative to the other types of forests (Ipcc, 2000).

It is clear that the potential benefits of preventing deforestation to take place are substantial in terms of emission reduction (Noble and Scholes, 2001). Besides the positive effects in this respect, preservation has other, non-carbon related, benefits. Preserving biodiversity, combating desertification and the socio-cultural functions of forests are some of the issues in case. These have been dealt with in Chapter 2, and will not be further elaborated upon now.

Forest plantations are inferior to existing old-growth forests on many accounts. They contain far less biodiversity. They do not contribute to the maintenance of indigenous cultures, nor to the survival of the poor. Inclusion of plantations in CDM, combined with an exclusion of the protection of existing forests in CDM (e.g. because of additionality or other technical problems) would give plantations a perverse advantage over forest protection, which will draw away attention and funding from the rainforest and hence result in diffuse and adverse effects on biodiversity, indigenous people and the poor. Thus, CDM would *de facto* work against Article 3.14 which provide that '*each party shall strive to implement commitments mentioned in paragraph 3.1 in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties,...*'. Moreover, the effect of inclusion of plantations under CDM may seriously violate other Conventions, such as CBD and CCD This possibility is ruled out by Article 2.1.a.ii of the Kyoto Protocol, which says that countries can only implement policies directed towards the reduction of GHGs or enhancement by sinks '*taking into account its commitments under relevant international environmental agreements*;'

CDM could be an incentive to destroy existing tropical forest, to clear the way for plantations. Thus, under the current set of regulations, a country's elite could first reap the benefits of cutting and selling the natural riches, and subsequently make profits again by turning the deforested land into a CDM plantation. This would not be beneficial to the mitigation of GHG emissions, nor to the sustainable development of these developing countries. It is hard to imagine that normal principles of accountability, transparency, third-party monitoring, etc. may counterbalance the strength of these perverse incentives.

It may be clear that plantations for carbon storage are not an appropriate way to mitigate GHG emissions and to promote sustainable development. Indeed, many of the effects contradict the regulations of the Kyoto Protocol itself. In the next chapter, two alternatives are proposed. The first is directed towards the use of plantations. In this view, they serve as a source of renewable energy instead of a carbon storage facility. The second alternative addresses existing forests. A global forest facility is proposed in order to finance the safeguarding of existing forests.

6 A SOLUTION FOR PLANTATIONS: NOT AS SINKS, BUT AS RENEWABLE ENERGY IN CDM

As has been demonstrated in the preceding chapters, inclusion of forestry activities in CDM, in particular plantations as conceptualized up till now, has several serious drawbacks. In this chapter an alternative option of the use of plantations in order to mitigate GHG emissions is presented. This solution has been briefly touched upon in Chapter 3. The key of this option is to view plantations under CDM not as a carbon storage facility, but as a source of renewable energy instead, derived from the burning of the wood in solid, liquid or gasified form. As stated in section 3.2, renewable (bio-fuel, biomass) energy is accepted in the Kyoto Protocol for use within the Annex I countries. Furthermore, forestry is accepted in the protocol's Article 12 on CDM. A combination of these two, *i.e.* to bring forest biomass energy under CDM, has as yet hardly been conceptualised. Fossil fuel substitution is meanstream thinking in CDM but as yet associated only with industrial-type projects, such as transition from coal to gas combustion. What we will propose in this chapter is to bring forestry in CDM under the mainstream 'fossil fuel substitution umbrella', *in lieu* of under the problematic 'sink' conceptualisation.

To our knowledge, Schlamadinger *et al.* (2001) are the first authors that have connected biomass energy production and CDM. They propose *to "credit sinks primarily or exclusively in association with bioenergy projects under the CDM*", inspired by a proposal of P. Read *that "sink projects should carry a concomitant biofuel obligation"*. These authors have not fully taken leave of the sink concept for the implementation of projects under CDM. Acknowledging that possibly, this may have reasons that we cannot fathom here, what we propose in the present chapter is one step further and essentially much simpler. We propose not to credit sinks under a biofuel condition, but to credit biofuel.

Section 6.1 elaborates on the principle of biomass energy, identifying opportunities and threats that come with it. Section 6.2 presents a mechanism for including biomass plantations in the CDM. The following section 6.3 then compares the effects of biomass plantations and sinks. Finally, section 6.4 focuses compatibility of bioenergy plantations with the Kyoto Protocol.

6.1 Biomass as a renewable source of energy

Biomass is used as a term for all organic matter of plants, trees and crops. It has been recognized as a source of renewable energy by institutions such as IPCC, the World Energy Council and Shell (Faaij, 1997). If burned or slowly decomposed, the carbon dioxide emissions from biomass are almost entirely equal to what has been taken out of the atmosphere and stored in the plant tissue, thus resulting in the production of energy with a net GHG emission close to zero. The slight discrepancy between the uptake and the emission of CO2 results from the need to use a limited amount of energy to produce biomass in the first place (Cushman *et al.*, 1995). However, this is analogous to the production of other sources of sustainable energy such as wind or solar energy. Therefore, bioenergy is a substitute for fossil sources of energy in much the same way as other forms of durables.

Recent technological developments in the field of conversion technology have increased the applicability and efficiency of bioenergy, thereby increasing its competitiveness *vis-à-vis* other energy sources (Faaij, 1997). Besides burning biomass directly, it may be converted into solid, gaseous and liquid fuels (Hall and House, 2001). This creates the opportunity to apply bioenergy in existing technologies, hence limiting the implementation costs and increasing the acceptance in the energy sector.

The introduction and demand for biomass energy will largely depend on its competitive edge. Biomass energy will have to compete in various markets. On the one hand, for output is has to become a player in the energy market, for which the price is momentarily set by oil. On the other hand, biomass energy will have to compete on input markets. The most important is the timber market. The price on this market is the result of demand for timber from the construction sector, the furniture sector, etc.; Sedjo and Sohgen (2001) have elaborated on the effects of biomass energy on the timber market.

Prior to using biomass for the creation of energy, it can be used for other purposes thus improving the energy-efficiency of the biomass. This process of 'cascading', which has been highlighted in Chapter 3, is based on three broad principles: (1) carbon may be stored in wood products, (2) biofuels may be used instead of fossil fuels and (3) fossil fuel-intensive materials may be replaced for forest products and other bio-products. According to its possible functions, the life cycle of biomass may be extended and serve different markets through time.

Obviously, using biomass as a source of energy, possibly in combination with cascading, is an opportunity to mitigate GHG emissions. Still, the feature of bioenergy arguably has wider socio-economic implications than solar and wind energy. Moreover, it should be taken into consideration that the desirability of bioenergy plantations ultimately depends on the local circumstances (Hall and House, 2001).

According to Faaij (1997), *'if biomass is to make a substantial contribution to the world's energy supply it will have to include not only biomass residues – such as from commercial forestry (e.g. thinning) and agriculture (e.g. straw) – and organic wastes, but also energy crops'*. Often these energy crops are perceived to be fast growing trees, such as willow or Eucalyptus. These monocultures, though, might have an adverse impact on other and more localized environmental parameters, as is highlighted for the case of eucalyptus in an article by Gaster (2000). Apart from that, other environmental considerations should be borne in mind when addressing bioenergy plantations.

Cushman *et al.* (1995) have looked at the most efficient way to reduce atmospheric carbon dioxide. They found that while it is favourable to plant bioenergy plantations on land that can support high growth rates, the net carbon balance on degraded lands with low productivity is best when they are turned into carbon storage facilities. Furthermore Cushman *et al.* advise to leave slow-growing old forests in place, since destroying them would only enlarge the level of atmospheric carbon dioxide. It remains clear however, that plantations can form a significant contribution to reduce net carbon emissions at a global scale.

Chapters 4 and 5 have given an overview of formal and non-formal problems connected to carbon plantations. Many of these problems seem intrinsic to the plantation idea as such. This is not the case, however. Rather these problems are intrinsic to treating plantations as a sink.

6.2 Bringing biomass plantations in CDM

6.2.1 The core notion

The core notion of plantations as bio-energy under CDM is to disburse CERs-based funding to plantation investors at the moment and to the degree that burning of fossil fuel is actually avoided, that is, the moment the plantation wood is actually combusted in a combustion facility that produces energy, taking into regards the efficiency rates of combusting.

The following sections will show to what extent the problem identified in the preceding chapters are avoided this way. In section 6.2.2. to 6.2.4. the mechanism is explained in some more detail.

6.2.2 Actors

Five types of actors play a key role in the proposed mechanism. They are put in CAPITALS here, to underline their categorical character.

- *First, INVESTOR is the entity owning the plantation in a non-Annex I country. INVESTOR may be a multinational corporation or a local firm, but it may very well be a local community or even a single farmer.*
- Second, COUNTRY is any Annex I country that disburses to INVESTOR on the basis of the expected CERs in the first or later commitment periods of the Kyoto Protocol. COUNTRY may be represented by a specialized agency in the non-Annex I country. It may reach small investors, for instance, through a development NGO.
- Third, CDM is CDM in its identity as actor, e.g. its board or secretariat.
- Then, THIRD PARTY are institutions that play a vital role in verification or other services in which an objective, truth-oriented function is required.
- Finally, BANK may be any banking agency geared towards financing of projects if necessary; this may be a commercial bank, a 'green' bank, a development bank, a rural credit scheme or a NGO's revolving fund, to mention just a few possibilities.

It may be noted that the wood-combusting energy plants are not part of the actors scheme here. Of course, this does not imply they do not exist; in fact they are necessary for INVESTOR to prove that the wood has actually prevented fossil fuel combustion. For that very reason, new wood combusting energy plants may be part of INVESTOR's strategy or else might be so lucrative as to stimulate other (specialized) companies to invest. It is not necessary to certify the plant under CDM. It is only necessary to verify its combustion efficiency, which should be conducted by THIRD PARTY, connected to fossil fuel prevention and hence COUNTRY's disbursements.

Not certifying energy plants has the advantage that an important perverse incentive is avoided, namely, a temptation for certified plants to burn other than certified biomass, e.g. non-additional biomass or even wood from natural forests, and yet earning CERs. Even more importantly, it avoids the need to certify the multitude of wood-combusting plants that exists already, of which the firewood cooking ovens of local populations are possibly the most important. These family fires prevent the use of fossil fuels just like high-tech combustion plants, albeit with low efficiency. If certified plantation wood is used for this most basic process, CDM will allow disbursement based on the lowest-of-all efficiency. This implies that firewood plantations may become economically viable under CDM even for poor communities and a small INVESTOR. This would benefit, for instance, drylands suffering from land degradation and desertification, such as the Sahel. Moreover, the INVESTOR will be stimulated to provide or at least to encourage the use of ovens with higher efficiency levels, as it will yield more CERs.

Another actor that seems to be absent here, is the country in which the plantation is located. This is not the case, however, the recipient country plays an important but passive role by setting the juridical boundaries for operating the investment.

6.2.3 Operating the mechanism

Between these actors, the proposed mechanisms works as follows.

At the request of INVESTOR, THIRD PARTY is put to work for the certification of a (planned) plantation at a specific place. Sustainably managed secondary forest might be eligible for certification as well, as long as it complies with the certification criteria. This may well be to the advantage of local communities. Certification criteria are based on the following guidelines:

- *Additionality*: the non-viability of the plantation investment without the prospect of CERs.
- *No harm for biodiversity*: this criterion, connected to CBD, clearly prevents that existing valuable tropical forest is converted into plantations through CDM.
- *No harm for indigenous peoples*. CBD and the UN Draft Declaration on the Rights of Indigenous Peoples prevent that sites if value for indigenous cultures are turned into plantations under CDM.
- *No harm for local population*. This criterion prevents that an area used for local livelihoods is turned into a plantation of less such value. Evictions, of course, are excluded as well.
- Finally, a plantation should be *in accordance with (national) government policies* and the country's juridical framework (e.g. land zoning) and general principles of law (e.g. against land grabbing).

As a result of large differences in local socio-economic and environmental conditions, it is not desirable to develop a blue-print for measurement and certification of plantations. Eventually, the certification procedure has to be carried out using more specific criteria which are derived from the guidelines of existing conventions. It may be noted that already in the very simple form specified above, the criteria exclude the certification of "nightmare plantations" (i.e. plantations replacing virgin forest, evicting local people, etc.). Moreover, local communities and to a certain extent private owners that decide to turn part of their land into a plantation will be able to have their sites certified with ease. This is contrary to large (corporate) investors who do not yet own or rent the land. Such investors may of course enter into contracts with communities and individuals who do.

What is the effect of the certification? **Certification implies that CDM vows that COUNTRY earns CERs, which can be used in the commitment period, at the time and to the extent that biomass from the certified plantation has actually been used to substitute fossil fuel combustion. For COUNTRY, these CERs have a monetary value and it is this monetary value that COUNTRY can use to pay INVESTOR (again at the time of actual fossil fuel substitution). Thus, COUNTRY and INVESTOR enter into a contract of that effect, either directly or through representation. This contract may be negotiated on an *ad hoc* basis, or**

standardized to the effect that COUNTRY announces its general intention to pay a certain amount per kg of avoided carbon from certified plantations. With the contract, INVESTOR may go to BANK to negotiate a loan, if necessary.

THIRD PARTY will verify the plant's combustion efficiency and social policy with fixed time intervals, always allowing the baseline "household cooking oven efficiency" in the absence of a technologically more advanced combustion plant. THIRD PARTY will encounter more difficulties when verifying the degree to which the plantation's wood is actually used to prevent fossil fuel use. There is a perverse incentive for INVESTOR to bring all the wood of the plantation under this heading, meanwhile selling it for other purposes, such as furniture production or construction. Selling the biomass for divergent purposes is not illegal in the CDM plantation mechanism; INVESTOR has not promised to use the plantation for bioenergy and consequently, the plantation's certification only implies that disbursements will take place when and if fossil fuel prevention has occurred. But selling the biomass on a non-fuel market and at the same time claiming disbursement under CDM is illegal, naturally, and the prevention of this action is a major task for THIRD PARTY.

As said, INVESTOR may call in BANK to finance its investment. This does not differ from any other investment. In developing countries, however, many investments are done directly by local capitalists or local communities, used as they are to imperfect capital markets Local communities may be assisted by NGOs, green banks, etc.

In this stage of implementing the instruments of the Kyoto Protocol the discourse above is one of the possible ways of structuring CDM investments. The creation and maturing of IET may alter this practice altogether. CERs themselves could become the prime incentive for investment. The investor could then sell the CERs on the market, without any interference from Annex I countries. The price for CERs will be determined by simple demand and supply, instead of mutual agreement.

6.2.4 The development bonus

Avoiding negative social and environmental consequences of plantation establishment as discussed in Chapters 4 and 5, has been included in the certification procedure. This certification should be a sufficient basis for disbursements under CDM. Plantations may have additional development benefits as well. For instance, INVESTOR may allow local people to hunt, gather fruits, graze cattle, carry out bee-keeping and so on, or allow farming between young trees after clear cutting on the part of the plantation, thus stimulating a sustainable shifting cultivation on the improved plantation soil. Plantations may bring many more benefits to the local population and the environment, like watershed regulation and the prevention of wind erosion.

Realization of the additional social and environmental benefits brings about extra costs for INVESTOR. As a result, there is no incentive for INVESTOR to invest in these social benefits any more than is compulsory under the certification criteria. For that reason, an additional 'development bonus' might be considered to stimulate INVESTOR.

It should be borne in mind that such a development bonus is not a primary responsibility of CDM, because the stimulated activities do not have a direct impact on the reduction of atmospheric carbon. The CDM plantation mechanism, once established, could be used by development-oriented institutions, however, for doing efficient development work. Thus, a 'development bonus', financed through non-CDM sources but disbursed through the structure established under CDM, could be allowed to be added to the normal CDM based disbursements of COUNTRY.

The 'development bonus' should not be disbursed at the start of a project, because that would amount to input funding (i.e. paying for promises). Rather, THIRD PARTY could assess the compliance to the additional development bonus conditions, such that these are added to the disbursement routine.

6.3 Solutions and remaining problems

6.3.1. Solutions to formal problems

One of the problems connected to plantations as carbon storage facilities is permanence. This relates to the fact that sequestered carbon can be released back into the air, by forest fires or processes of natural decay. This problem is not mitigated, but intrinsically *resolved* if plantations are treated as a source of bioenergy with disbursements connected to the time and degree of actual substitution of fossil fuel.

It may be noted too that this way, forestry projects now have a conceptual structure equal to any other project of technology improvement in CDM. Whether dealing with a switch from coals to natural gas, or solar energy projects or forestry (or any other biomass project, for that matter), CDM will be an mechanism with a unified conceptual structure.

Treating plantations as a source of energy will make the plantations normal economic investment projects. This ensures the owner and/or project developer will be motivated to protect the investment in order to maximize returns on investment. Forest thinning, for instance, instead of presenting a difficult monitoring problem of a sink, will just be an early benefit to the owner; he burns some early wood, and receives some early disbursements.

Experiences with biomass plantations have shown that the long duration of the pay-back period poses a risk that many potential investors are not willing to take. This often has a negative impact on the competitiveness of investments in biomass plantations. This may result in investments in different types of land-use instead. In order to avoid this problem, bridging loans should be given through green banking, the GEF and international banking corporations such as World Bank.

As a result of unifying the structures for biomass energy plantations along the line of regular CDM projects, the liability question which is connected to the issue of permanence (who bears the brunt if a plantation burns?), is solved as well.

Having thus solved the permanence problem, which is indeed unique to forests under CDM, plantations continue to have, 'baseline', 'additionality' and 'leakage' problems just like any other CDM project type.

Baseline calculation is now completely similar to other CDM projects. The point of departure here is a business-as-usual scenario whereby fossil fuels are used to generate energy. The difference between the consequent level of GHG emissions and the level of emissions generated by biomass energy, will form the basis of CER calculations (see fig. 6.1). This intrinsically solves the problem of having to make assumptions about future allocation of the land on which the plantation is settled, as is the case with establishing sinks.

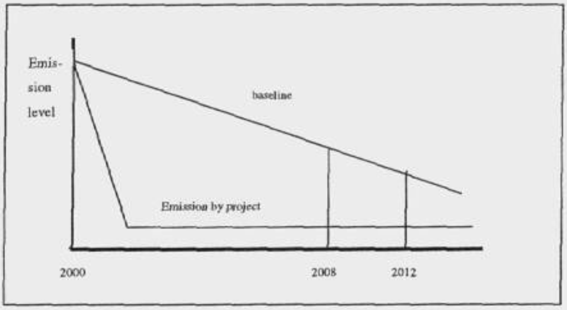

Figure 6.1: The calculation method of prevented GHG emissions under CDM.

The problem of additionality is more difficult to solve, though it does not pose additional problems compared to other CDM projects. An *ex ante* assessment is needed to determine if a biomass plantation project would not be economically viable without the support of CDM. If this is the case, the plantation can be certified under CDM according to the Kyoto Protocol. [2] This naturally includes multi-purpose plantations, burning of residual agrarian waste and so on. See Sugiyama and Michaelowa for a general discussion of baseline problems in CDM.

[2] In fact, any project activity is eligible under CDM, as long as it has been proven *ex ante* that it would not have taken place in the absence of the Protocol.

The only remaining formal problem is that of leakage which, as discussed in Chapter 5, has two components: leakage through effects on markets and leakage through activity shifting. Market leakage occurs if plantations have a substantial price effect on energy, due to increased supply of energy. Part of the gains through fossil fuel substitution would then be lost because of reduced incentives for energy saving, etc. This is no different from other JI and CDM projects, however. If it is accepted there, then it should also be accepted for plantations.

As for shifting of activities, the situation stays the same. By allocating land for plantations, people who use this land as source of income will be displaced. This is potentially harmful to (tropical) forests. Since there is no natural incentive to offset the costs of preventing these social en subsequent environmental problems, an incentive should be created within the CDM framework. This incentive could take the form of a financial bonus, as menstioned in section 6.2.4.

As discussed in Chapter 4, a final set of formal problems connected to plantations as sinks under CDM, concern verification and monitoring. It may be obvious that most of these problems have evaporated along with the surmounting of the permanence, baseline and additionality problems. Under the output financing regime, only technical verifications remain. The first is the *ex ante* test regarding the viability of projects without CDM; this is a matter of ordinary cost-benefit analysis. The second verification concerns the actual amount of avoided GHGs emission, in order to calculate the amount of CERs; plant combustion efficiency is a key factor here. This measurement comes down to a single assessment of GHG emission, thereby taking into account a possible difference between combustion efficiency of wood versus the avoided fossil fuel. Of course this verification should be carried or by an objective third party.

6.3.2 Solutions to non-formal problems

Chapter 5 has identified a number of other, non-formal drawbacks of carbon storage in sinks. These are (1) carbon stored in sinks may be seen as less 'real' emission reduction than actual reductions; (2) in a later stage of development, non-Annex I countries may find that they are forced to buy expensive technology; (3) countries may become locked-in to a static plantation economy which they cannot restructure due to the incurred sink obligations, and (4) plantations as sinks under CDM while excluding the protection of existing forest from CDM may result in perverse incentives, detrimental to biodiversity, cultural diversity, socially marginilized groups and the climate itself.

Below, these problems are revisited, under the assumption that plantations function as input for biomass, which is capitalized on after this has been transformed into energy ('output financing'). Since establishing biomass plantations is an approach, which can be adjusted and reversed in the course of time, several problems can be solved to a large extent.

(Ad 1) The first problem has been solved. Avoided emissions are just as real as those from other carbon neutral energy sources, such as wind energy, hydroenergy, etc.

(Ad 2) In an output financing regime, non-Annex I countries (or the forestry investors in them) have not fixed their plantations for biomass fuel use under CDM. They only have certified plantations, meaning that if the biomass is actually transformed into energy, Annex I countries will credit through CDM. If they decide for an other use of the wood or to convert the plantation into something else altogether, they do not violate any promise but only forego the CDM crediting. Also, if a country develops to the level it has to attain QELRCs for its own, these may be more easily realized as a result of having an economy based on biomass energy. The country may then use the biomass for its own carbon obligations.

(Ad 3) The same reasoning holds, with a broader application, for the lock-in effect. Certification and benefits under CDM do not oblige an investor or a country to keep these plantations eternally. They can be used for any purpose deemed necessary, or converted. Usually this decision will be taken by market parties that own the plantations instead of governments.

(Ad 4) Some problems of perverse incentives eventually remain, especially when the protection of existing forests is not guaranteed. Still, these can be largely offset by CDM regulations. The social costs connected to avoiding these incentives to occur can be partly covered in the investment, enhanced by the possibility of gaining financial support from CDM if this would make a project economically unviable.

Finally, it may be remarked that the simple system of *ex ante* certification and disbursements at the actual moment of fuel substitution works not only for large commercial plantations. Also communities may participate, especially if helped by NGOs and possibly a new GEF window on land degradation. Natural regrowth on degraded land is essentially certifiable as well.

6.3.3 Remaining problems

As far as can be overseen at present, no conceptual or practical problem is now left unaddressed. Some, such as permanence, have been resolved intrinsically. Others are reduced to proportions normal to regular CDM and JI projects. Finally, there are problems which have to be included in a distinct certification procedure, which is carried out and subsequently verified by a objective third party, that may be selected on a basis of scientific and economic capabilities and incorruptibility. Probably the greatest struggle for the third party will be the verification of the end use of the plantations biomass. This stems from the temptation that any investor is subject to, which is to bring all the biomass under the fossil fuel prevention umbrella, while actually selling it for other purposes. This temptation will always exist.

6.4 Should sinks be entirely excluded from CDM?

With the implementation of plantations in CDM as sources of alternative energy, the question may arise if plantations that are not able to serve energy substitution purposes should be left out of CDM altogether. These forest, after all, will still act as sinks during their growing stage. As Cushman *et al.* (1995) have indicated, such forests may indeed exist, since it is not feasible everywhere to operate new forests as energy plantations. This is especially true on sites of high vulnerability with regards to soil erosion and exhaustion of nutrients. In certain sites of very steep slopes, poor soils and risks of desertification, for instance, all attention should be on establishing and keeping the forest as such, without objectives or great possibilities for energy production. (This may also hold for non-forest ecosystems such as large wetlands, for instance those where water management is changed such that the build-up of peat or other organic storage is enhanced, without envisaging to use the peat as biomass fuel.)

Exclusion of such forests (or other ecosystems) from CDM appears to be risking to forego a good opportunity to stimulate climate problem prevention. If they would be included under CDM one way or another, however, they should comply with the criteria of Article 12 with the same stringency as do the forests-for-energy. In view of the analyis of the first chapters of the present report, these forests-as-sinks will not be able to meet these CDM criteria on a routine-like basis as do the forests-for-energy.

Allowance of forests-as-sinks, if any, should therefore be considered only on an *ad hoc* basis, connected to clear-cut evidence on permanence, baseline, social acceptability, biodiversity arguments and additionality, focusing on large tracts of land on which forest is the most rational use. Additionality here includes the non-viability of using the land for energy purposes (i.e. the normal CDM routine). Thus, non-Annex I countries could be allowed to each bring forward a small number of such sinks-to-be for inclusion under CDM. (China, for instance, may be expected then to bring forward its large-scale anti-desertfication forest plans.) CDM's (co-)financing decision may then be established in a process of *ad hoc* negotiation focusing on these specific cases. We then follow the recommendation of Sugiyama and Michaelowa (2001) who, although focusing on the additionality criterion only rather than on the whole CDM set, make a plea for the allowance of *ad hoc* negotiations under CDM.

After the net uptake of carbon of these plantations has ceased to exist, they may be regarded as existing forest as any other and worthy of protection for that reason (but outside CDM).

The protection of existing forests from the climate point of view is not accommodated for yet. Indeed, without formulating and implementing policies with respect to existing forest, the introduction of large-scale biomass energy could even work counterproductive for the global climate. Therefore, Chapter 7 is dedicated to addressing the problem of the current loss of existing forests in non-Annex I countries.

7

A SOLUTION FOR EXISTING FORESTS: AN OUTPUT-BASED GLOBAL FOREST FACILITY

In Chapter 5, it has been concluded that very serious problems surround the inclusion of forests in CDM. The previous chapter has focussed on plantations and indicated that for this forest type, *the structure and basis of inclusion of CDM has to be reconceptualized. The outcome of this* reconceptualization has been to treat plantations as producers of fossil fuel combustion prevention, similarly to regular CDM projects. In this chapter, a solution is sought for the existing forests in non-Annex I countries. It builds on the principle of 'paying for functions', which has been elaborated on in Chapter 3.

7.1 A 'multi-convention' global facility

As said in Chapter 2, the forests in non-Annex I countries are a large carbon pool; deforestation therefore influences the global climate. In view of the current rate of tropical forest loss, preventing this carbon pool from becoming a source of GHGs is of obvious relevance for the global climate. This cannot lead to a solution analogous to that of plantations, however, since the opportunity to derive benefits from energy production are absent. Moreover, the problems of permanence, baseline and additionality cannot be solved by such a structure. Assessing a baseline for forest protection would be based on highly uncertain and subjective assumptions. Another undesirable effect of trying to preserve existing forests in CDM results from the CDM requirement of additionality. In order to prove that protection would not have taken place without CDM, countries would be tempted to declassify protected forest areas, or at least not establish any new protected areas; this is the "inborn paradox of the additionality concept", discussed by Sugiyama and Michaelowa (2001). It may be concluded that the protection of existing forests in *non-Annex I countries cannot be brought into compliance with CDM requirements.* Since CDM is the only instrument in the Kyoto Protocol where non-Annex I countries are involved, the protection of these forests cannot find a significant place in the framework of the global climate negotiations.

The first step towards a solution for tropical forests is the consideration that tropical forests are multi-functional on a local, national and a global scale. The climate function is but one of these functions, as has been reviewed in Chapter 2. In fact, forests are the prime area of synergy of the conventions on biodiversity (CBD), climate (FCCC), land degradation (CCD), cultural heritage (Paris Convention) and the UN draft decision on the rights of indigenous peoples supported by the general Forest Declaration (UNCED).

Following this line of reasoning, the establishment of a global forest facility, geared towards the protection of existing forests and structured to serve the objectives of all these conventions, would be a logical step forward. The principle of paying for the various forest functions can be regarded as the basis for operating the global forest facility. The facility could be incorporated, for instance, in the Global Environment Facility (GEF). Although GEF is structured along the lines of the separate global conventions, it could open a 'forest synergy' window. However, the remainder of this chapter will explore an option that is differently structured and potentially more substantial in hectare terms.

7.2 Output financing

In the previous chapter, key problems in the CDM-plantations nexus disappeared due to the reconceptualization of the disbursement mechanism in the direction of output-financing. This will also be the key of the present section.

In a regular economic buyer-supplier relationship, transactions are based on output financing. The buyer thereby pays the supplier on the basis of the product or service that is provided. A supplier that lacks the necessary funds to initiate the production process may turn to investors, e.g. banks or shareholders, in order to finance the production of the service or good that needs to be provided. The buyer pays the supplier after the product or good has been supplied. Subsequently, the supplier pays off the bank.

Current practices in global environmental policy are often different. They are based on input financing. Here, investors pay the suppliers of a projected service in advance. Buyer and supplier agree on an a bundle of plans and promises, and evaluate the extent to which these have been realized in retrospect. Nevertheless, the idea of output financing is sometimes seen shimmering through in global environmental policy. The following quote of the World Bank (1992) is exemplary: "*The international community should transfer additional funds to developing countries to achieve a level of spending that reflects the desire to protect species and habitats there.*" The global climate and other conventions could be added to this biodiversity-oriented 'protection of species and habitats'. The same is visible in Tobey (1993) and many other authors discussing the global efficiency of forest protection. At the same time, however, these authors as well as institutions such as World Bank and GEF appear to be somehow stuck in the 'banking paradigm' of input financing.

It seems to be worthwhile to explore the modalities of adding an output-financing component, which in this case is a rather direct link between the global forest benefit consumers (mostly countries in the North) on the one hand and the global forest benefit producers (largely countries in the South) on the other. The focus will be on global benefits, since it is assumed that international, national and sub-national economic benefits (logging, medicine, watershed regulation, etc.) are taken care of through existing markets already (wood market, pharmaceutical market, eco-tourism market, etc.).

7.3 Key modalities

Under normal market conditions, a buyer pays a supplier a certain amount of money, which is at least equal to the discounted future benefits that are expected to be derived from the purchase. The buyer pays the supplier at the moment of the delivery of the good or service, not at all future moments that actual benefits arise. To put this buyer-supplier relationship in practical terms, taking the purchase of a car can serve as an example. Someone buys and pays a car as soon as the car dealer has delivered it. He does not pay the car dealer later, at every moment or in accordance to the degrees that actual benefits are realized. The analogue for the global forest facility would be:

- not to pay for the separate efforts of the forest producing and protecting (i.e. supplying) countries,
- not to pay for all separate global forest benefits at the moment they actually arise,
- but to pay for the physical present forest, i.e. for standing forest on a per-hectare-per-year basis.

Using this mechanism, the global forest facility may function as a global clearing house that structures disbursements. The facility receives financing from the net benefit receiving countries and disburses to the net benefit producing countries, on the basis of simple rules, yet to be proposed and agreed upon. Disbursements per hectare per year are congruent with the actual way benefits of forests accrue. Moreover, by structuring disbursements in this way, the proper incentive for forest protection is set; if protection fails or if the forest is willingly given up to ranching or intensive logging or is converted otherwise, disbursements simply stop.

Disbursements take place on the basis of actual and measurable hectares of standing forest. In order to distinguish between high and low quality forests, some quality criteria (e.g. in terms of biodiversity and climate risk) have to be formulated and implemented. The criteria may be assessed through remote sensing and automated data processing. Crown cover and road density are likely to be sufficient to largely fulfill this role, connected to the geographic location of the forest. This way, maintaining a very low logging rate and other non-destructive types of forest use remain possible. Disbursements will follow the automated remote sensing assessment, hence overhead (transaction) costs of the facility will be low.

This method of assessment does not include the conservation of cultural diversity and the rights of indigenous peoples in forests. Forests could get an 'indigenous peoples bonus' if a government can prove, for instance, that the forest is used by indigenous people.

Disbursements may take place from governments of net benefit receiving countries to governments of net benefit producing countries through the facility. After all, it is governments who have committed themselves to the aim of forest protection through the forest-related conventions, which have been summarized earlier in this Chapter 2. Severe human rights violations and suchlike could be justified as ground for exclusion from the facility, as is customary in international affairs. Naturally in order to maintain their level of benefits from the global facility, countries will be inclined to use the benefits for forest protection. The precise distribution of the disbursements from the national to the sectoral and local levels should be left to domestic political processes in the receiving countries, however. Involvement in domestic distribution mechanisms is not a practical necessity (nor a primary moral obligation) of the facility.

Output funding will largely resolve the sovereignty problems that are associated with input funding. This is in line with the desire of many developing countries, that global solutions to lower the emissions of GHGs will not undermine their sovereignty. In structures of input funding of forest protection, one example of which are debt-fortune swaps, a country promises to protect a certain area of forest for ever. In a general sense, the country gives up its sovereignty over this forest and this piece of land. In the long run, nations "do not accept being transformed into a doorman of a zoo of the Americans", as a Brazilian once put it (Buttel, 1990). This problem is one of the reasons why debt-for nature swaps never gained much ground. In a structure of output funding, *i.e.* disbursements on the basis of actual standing forest, a country is not obliged to promise anything, let alone for ever.

A final general point to note with respect to disbursements on a per hectare per year basis, is that countries with much forest will receive much, merely as a matter of luck. This seems to contradict to principles of common meritocratic morality. At the same time, however, meritocratic morality is not the morality of all domains of daily life or of international relations. The diamonds of Botswana, the oil of the USA, natural gas of the Netherlands or the geographic position of Singapore - all of these are just a matter of luck, which is accepted at the same time. There is no need to make an exception for the natural resources of forested countries.

7.4 Financing the global forest facility

In this section the inflow requirements of the global forest facility will be briefly explored, based on De Groot and Kamminga (1995). Several principles of financing are presented here:

- The first is the logic of *benefits*. Countries finance the facility to the degree they have benefits from the halting of deforestation. This is common economic logic, visible in the quotation from the World Bank (1992), Tobey (1993) and many others. Roughly, this principle might be operationalized by GNP. Countries with a large economy then contribute more than countries with a relatively small economy.

- A second principle is *causation*. Countries contribute to the facility to the degree they have contributed to the forest problem, i.e. the degree to which they have deforested their formerly forested area. In general, the principle of causation is common in international politics
- A third principle is *taxbearing capacity*, or global equity. Roughly, this principle might be operationalized by GNP per capita.

Practical ethics and international negotiations will have to decide upon the final form that facility financing will get. In order to arrive at a first estimate of what countries would have to contribute under various financing regimes, De Groot & Kamminga (1995) elaborate a 'mixed compromise' formula.

The rules mentioned above are distributive, hence do not touch upon the total amount that would be needed for the facility to work. The key figure in this respect is the level of disbursements per hectare per year that would be needed to make a real difference for the global forest. Explorations by De Groot & Kamminga (1995) indicate that an average disbursement of US$ 15 per hectare per year, although not offsetting alternative revenues of deforestation in some cases (e.g. mining), will make this difference. Taking into account the area of existing tropical forest, the yearly throughput of the facility would then be approximately US$ 15 billion a year. This figure may be compared with the estimates of Tobey (1993), of US$ 150 billion a year for global CO_2 emission stabilization, or with the US$ 40 billion per year for Official Development Aid, the US$ 100 billion per year of debt servicing by developing countries, the throughput of the world timber market of US$ 5 billion a year, or the World Bank lending to the LDCs of US$ 10 billion per year (all figures from around 1990, found in De Groot & Kamminga, 1995). In sum, mounting a facility of a US$ 15 billion magnitude does not seem impossible. Countries or groups of countries could start the facility on a bilateral and modest scale, e.g. by twinning countries in the North and South. Such a schedule is in discussion already with respect to the climate adaptation fund.

8

CONCLUSIONS AND RECOMMENDATIONS

This report aims to clarify the following questions:

1. May the inclusion of tropical (non-Annex I countries') forests in CDM, conceptualised as carbon sinks, comply with the CDM criteria (Article 12 of the Kyoto Protocol)?
2. What are the positive and negative external effects of plantations as carbon sinks?
3. Which alternative ways of implementing forestry in the climate policy can be found with regards to the forest of non-Annex I countries (*i.e.* in CDM)?

These questions will be answered briefly in this chapter. Subsequently, some recommendations for future research will be presented.

8.1 Conclusions

May the inclusion of tropical (non-Annex I countries') forests in CDM, conceptualised as carbon sinks, comply with the CDM criteria (Article 12 of the Kyoto Protocol)?

Article 12 of the Protocol sets the criteria that any CDM project should meet. These criteria comprise the following: emission reductions should be real, measurable and yield long-term benefits related to the mitigation of climate change, additional to any that would occur in the absence of certified project activity and characterized by transparency of reporting, accountability, efficiency and verifiability of results.

Plantations as carbon storage facilities can not live up to all of the above criteria.

- Leakage of achieved emission reductions undermines the criteria that reductions should be real.

- The issue of permanence, which is unique to sinks, refers to the fact that there is no guarantee that carbon is stored on the long term. This carbon can be released as a result of natural or anthropogenic influences.
- The baseline issue is of a different origin in the case of sinks, than in that of CDM projects directed to the prevention of emissions. For the latter group, the baseline is the GHG emission under a business-as-usual scenario using fossil fuels. The former requires a baseline, whereby calculations have to be made in order to determine the amount of sequestered carbon if the sink project would not have taken place. This requires an extensive set of assumptions on future developments. This reflects negatively on the measurability of the achieved reductions.
- The problem of additionality is connected to the issue of baseline. Measuring this criterion requires a broad set of assumptions as well.

It is concluded that the sink concept should not be the key to implement forestry in CDM. As said in Chapter 6, some exceptions may be considered on a site-specific basis, to be proposed by non-Annex I parties, especially with respect to large sinks that are beneficial also for other purposes (such as the combat of desertification).

What are the positive and negative external effects of plantations as carbon storage facilities?

When reviewing the costs and benefits of plantations as carbon storage facilities for non-Annex I countries, opportunity costs are often disregarded, resulting in a positive assessment of these facilities. This report pays some more attention to this fact and comes to the overall conclusion that including sinks may not be desirable under most circumstances.

Sinks may have the following positive external effects:

- On a local scale plantations can provide new sources of income.
- Local knowledge concerning forestry and land management may increase.
- The establishment of plantations can strengthen the local service base, improve local infrastructure, etc.

Sinks may have negative external effects as well:

- Indigenous people and rural dwellers may be displaced from their land.
- The poor may be affected if their source of livelihood is changed into a plantation.

- Large investment may induce social, racial or cultural disruption.

On a different scale, the negative effects are:

- Crediting plantations might be an incentive to replace existing forests for plantations.
- The crowding out effect vis-a-vis clean technology transfer.
- Non-Annex I countries may sell cheap solutions of GHG mitigation to Annex I countries, and consequently have to buy expensive clean technology in the future.
- Countries may be caught in an institutional, technological and economic lock-in effect.

8.2 Solutions

Which alternative ways of implementing forestry in the climate policy can be found with regards to non-Annex I countries (i.e. in CDM)?

The overall assessment of including plantations as carbon storage facilities is negative. Nevertheless, tropical forestry remains crucial in mitigating climate change. This is acknowledged by this report by formulating two alternative principles for including the tropical forest in climate policy. These options alleviate most of the problems surrounding plantations as carbon storage.

First, plantations may be included as producers of (energy) resources that prevent the use of fossil fuels. On the basis of Article 12 (CDM) and the above considerations, a set of guidelines has been formulated that these plantations have to comply with, such as no-harm criteria that may be used in the certification of plantations-to-be. In the operational framework, disbursements take place if and when trees from certified areas actually prevent the use of fossil fuel, *i.e.* the time of combustion in any type of energy-producing technology.

Second, existing forests in non-Annex I countries may be conserved through a 'multi-convention' global facility. This recognizes the multi-functionality of forests. The facility is based on the straightforward principle that net forest benefit consuming countries disburse to net forest benefit producing countries on the basis of standing forest per hectare per year. Only global functions which are not economically valued in existing markets, such as the biodiversity and carbon storage functions, should be accounted for under this regime.

8.3 Recommendations for further research

This report explored problems and solutions surrounding forestry in CDM. Although an extensive body of literature is currently evolving around this issue, certain aspects remain underrepresented.

The body of research around the economic feasibility of tropical bio-energy in all its forms is something that has gained attention only recently. Most research in this respect is carried out on a national level, while the two main determinants of feasibility are the timber and energy markets. These markets operate on a global level to a great extent, however. Besides this economic feasibility, there is a lack of scientific literature on the social acceptability and the multi-functional design of large scale (biomass) plantations.[3]

Depending on the reception of the ideas developed in the present report, further research is needed on the design, consequences, start-up and acceptability of plantations as sources of energy under CDM and global forest financing. One issue with respect to the latter may be, for instance, how such financing might be 'flexibilized'.

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[3] In 2000, a research project has been started under co-ordination of the Center Technology for Sustainable Development, with the title: "Social acceptance of biomass as a sustainable source of energy: consequences for development and implementation".
(http://www.tm.tue.nl/jfschouten/research/design%20and%20evaluation/biomass.htm)

ANNEX I: ACRONYMS

AIJ	Activities implemented Jointly
Annex I Countries	Countries that have committed themselves to a quantitative CO2 target (OECD, Central and Eastern European Countries, listed in Annex I to the UNFCCC)
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CML	Centre for Environmental Science
CO2	Carbon Dioxide
CoP	Conference of the Parties to te UNFCCC
ERU	Emission Reduction Unit
GEF	Global Environment Facility
GHG	Greenhouse Gas(es)
IET	International Emissions Trading
IPCC	International Panel on Climate Change
JI	Joint Implementation
NGOs	Non-Governmental Organisations
Non-Annex I Countries	Countries without a quantified CO2 target
Nox	Natrium Oxide
NRP	National Research Programme on Global Air Pollution and Climate Change
ODA	Official Development Assistance
QELRCs	Quantified Emission Limitation and Reduction Commitments
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

ANNEX II

<u>Participants in the workshop "Forests & CDM", held on the June 13th 2001 in Leiden:</u>

Dr. B.J. Heij (NRP)

Dr. H.J.F.Savenije (EC-LNV)

Prof. J. Slanina (ECN/ Wageningen University)

A. Stevens (Stichting Natuur & Milieu)

Dr. P.A. Verweij (Utrecht University)

<u>The following persons have contributed to this report as a result of our conversations:</u>

Mr. Adriaan Korthuis (Senter-ERUPT)

Mr. Jeroen Vis (Ministry of Agriculture, Nature Management and Fisheries)

Dr. Gjalt Huppes, CML

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