Forest and climate change

Instruments related to the United Nations Framework Convention on Climate Change and their potential for sustainable forest management in Africa

CIRAD

FAO

Forest and climate change

Instruments related to the United Nations Framework Convention on Climate Change and their potential for sustainable forest management in Africa

Alain Karsenty, Cécile Blanco, Thomas Dufour

CIRAD-Forêt, Paris, France

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2003

Preface

Forests play major roles in climate change. They contribute carbon emissions when destroyed or degraded and they suffer from changing climate, drought and extreme weather. Managed sustainably, they can provide a unique environmental service by removing excess carbon from the atmosphere, storing it in biomass, soils and products. In addition, sustainably produced wood fuels offer an environmentally benign alternative to fossil fuels.

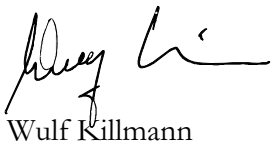
During the 7th Session of the Conference of the Parties to the UN Framework Convention on Climate Change in Marrakech, Morocco, in 2001, governments agreed on the final framework for implementing the Kyoto Protocol, which obligates industrialized countries to reduce their net greenhouse gas contribution by country-specific, fixed amounts.

Developing nations have no specific reduction targets, but seek to minimize their greenhouse gases emissions on the path of sustainable development. The Clean Development Mechanism is meant to facilitate achieving this goal. It can also help to finance certain development-related activities involving forest carbon sinks. Moreover, those forestry measures which are not eligible for the Clean Development Mechanism may receive financial support through other climate change-related sources also described in this working paper.

Given the important role of forests in global change, forestry professionals in general may have been underrepresented in negotiations. Africa, though contributing relatively little to Climate Change, could be one of its major victims; yet its voice seemed underrepresented on the negotiating floor. With this publication, FAO seeks to inform African sink experts and the African forestry sector about climate change, the agreements reached, the current state of the Clean Development Mechanism, other opportunities for forest conservation, adaptation and mitigation, and about prerequisites for implementation.

Producing an acceptable translation in an emerging, highly technical field can be a time-consuming and expensive task. As there was neither time nor money to carry this to perfection, readers will undoubtedly discover flaws. However, we believe that the deep knowledge about forestry and development of African countries, about funding possibilities outside of the CDM proper, and about the larger context for the CDM in Africa, which the authors provide, may compensate for editorial shortcomings of this translation of the French original. FAO Working Papers are preliminary documents, meant as focused technical contributions to emerging issues.

The negotiations on forestry in the Clean Development Mechanism are currently far from completed and continue to evolve rapidly. Therefore, this working paper also "shoots at a moving target." Nevertheless, FAO believes that technical detail and a holistic perspective of climate change-related forestry measures in Africa may support negotiations towards and implementation of a regime which is important for forests in Africa, their conservation, adaptation and sustainable management.



Wulf Killmann
Director
Forest Products Division
FAO, Rome

Contents

TABLES AND ILLUSTRATIONS

Acknowledgements

This report was commissioned by Olman Serrano and supervised and edited by Suzuko Tanaka and Dieter Schoene of the Forestry Products Division, FAO, Rome. It was written in French under contract with CIRAD-Forêt. The authors, Alain Karsenty, socioeconomist and researcher, Cecile Blanco, agroeconomist, and Thomas Dufour, biologist, wish to thank Cheryl Andre de la Porte, Bruno Locatelli, and Cyril Loisel for relevant special information.
This translation of the original document was edited by Suzuko Tanaka and Dieter Schoene.

Introduction

The African continent is potentially the one most vulnerable to climate change. The risk of desertification, from which the continent is known to suffer, the poverty of a large proportion of the population, which depends upon natural resources and agriculture, the insufficient means possessed by governments which are barely able to maintain even the existing infrastructures, e.g. health care, all seem to be setting the stage for a potentially worrisome situation at the beginning of the 21st century.

Africa's contribution to the global anthropogenic emissions of greenhouse gases is relatively small; they amounted to approximately seven percent in 1990, land-use changes included. The emissions caused by the burning of fossil fuels, including transportation, are even smaller and represent only 3.9 percent of the worlds total (IEA, 1999). With approximately 70 percent, the principal emission source on the African continent is land-use change, which essentially means deforestation. The remaining 30 percent can be attributed to industrial emissions and transportation. These data indicate the importance that the climate change negotiations represent for Africa, particularly the way forestry and agricultural activities will be treated in the different mechanisms which are emerging from the international negotiations. The majority of African countries, except several North African countries and South Africa, which have a significant industrial base, scarcely benefit from the financial incentives linked to reducing emissions in the electricity, cement, manufacturing or transportation sectors, especially in comparison with China, India or Brazil.

Africa will only be able to overcome the negative consequences of climate change by safeguarding the continent's ecological balance, since conserving its forest areas and soil production capabilities, and maintaining its animal and plant biodiversity are vital to the continent's ability to adapt. Africa cannot develop without assistance from the rest of the world, particularly from developed countries. Development assistance has begun to diminish, and private investments now exceed official development aid, but they tend to concentrate in other world areas, excluding Africa from this investment flow.

The United Nations Framework Convention on climate change (UNFCCC) has created several instruments for reducing greenhouse gas concentrations in the atmosphere. They aim at encouraging investments in "clean" development activities which limit greenhouse gas emissions or fix carbon in the earth's ecosystems. Some of these instruments are still under development and not yet operational. One of them, the "Clean Development Mechanism" (CDM), is both a development instrument and a method allowing industrialized countries to reduce emissions at the lowest possible cost. Further negotiations must clarify the definitions, rules and modalities for the CDM, and many African countries hope for an investment instrument which corresponds to their needs.

This document aims to present the potential of the instruments of the United Nations Framework Convention on Climate Change (UNFCCC) and of the Kyoto Protocol for sustainable forestry in Africa.

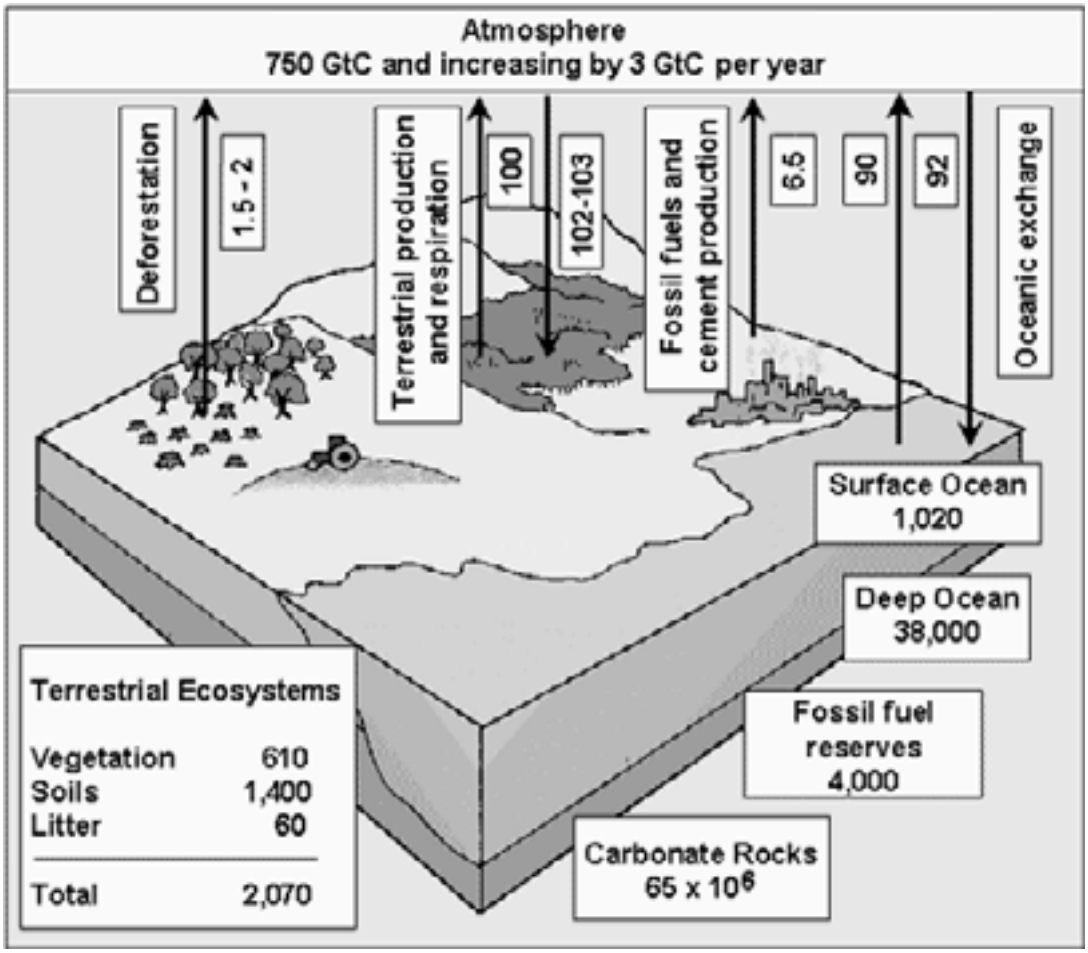
Forests and climate change

Carbon and the greenhouse effect

The scientific community essentially agrees on the phenomenon of global change (IPCC, 2001). The main cause of climate change is the anthropogenic increase in greenhouse gas concentrations in the earth's atmosphere.

Carbon dioxide (CO_2) is the principal greenhouse gas. Its concentration in the atmosphere is the result of a cycle between different carbon pools: CO_2 is the product of the oxidation of carbon from these pools. The carbon cycle at the earth level is presented in the following diagram.

Diagram 1: A simplified diagram indicating carbon pools and CO_2 fluxes between the earth and the atmosphere



Source: *Edinburgh Centre for Carbon Management* (http://www.eccm.uk.com/climate.htm)

CO_2 concentration in the atmosphere has increased by 31% since the beginning of the industrial era, from 280 to 360 ppm (IPCC, 2001). Anthropogenic emissions of CO_2 originate primarily from the burning of fossil fuels and deforestation in tropical regions. Some of these emissions (on the order of 6 GtC/year) are reabsorbed by the terrestrial and oceanic ecosystems. The net atmospheric increase (on the order of 3 GtC/year) is small compared to the size of the carbon pools. However, this flow, that began more than a century ago with the Industrial Revolution, continues to grow, and is sufficient to explain global warming and the resulting imbalance in the climate system.

Definitions:
Carbon pool: A reservoir of carbon. A system which has the capacity to accumulate or release carbon.
Carbon stock: The absolute quantity of carbon held within a pool at a specified time. The units of measurement are mass.
Carbon flux: Transfer of carbon from one carbon pool to another in units of measurement of mass per unit area and time (e.g., t C ha^{-1} yr^{-1})
Carbon sink: Any process or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. A given pool (reservoir) can be a sink for atmospheric carbon if, during a given time interval, more carbon is flowing into it than is flowing out.
Sequestration (uptake): The process of increasing the carbon content of a carbon pool other than the atmosphere.
(IPCC, 2000).

The role of forests in climate change

Forests are important carbon pools which continuously exchange CO_2 with the atmosphere, due to both natural processes and human action. Understanding forests' participation in the greenhouse effect requires a better understanding of the carbon cycle at the forest level.

Organic matter contains carbon susceptible to be oxidized and returned to the atmosphere in the form of CO_2. Carbon is found in several pools in the forest:

- the vegetation: living plant biomass consisting of wood and non-wood materials. Although the exposed part of the plant is the most visible, the below-ground biomass (the root system) must also be considered. The amount of carbon in the biomass varies from between 35 to 65 percent of the dry weight (50 percent is often taken as a default value).
- dead wood and litter: dead plant biomass, made up of plant debris. Litter in particular is an important source of nutrients for plant growth.
- soil[1] organic matter, the humus. Humus originates from litter decomposition. Organic soil carbon represents an extremely important pool.

At the global level, 19 percent of the carbon in the earth's biosphere is stored in plants, and 81 percent in the soil. In all forests, tropical, temperate and boreal together, approximately 31 percent of the carbon is stored in the biomass and 69 percent in the soil. In tropical forests, approximately 50 percent of the carbon is stored in the biomass and 50 percent in the soil (IPCC, 2000).

- Wood products derived from harvested timber are also significant carbon pools. Their longevity depends upon their use: lifetimes may range from less than one year for fuelwood, to several decades or centuries for lumber.

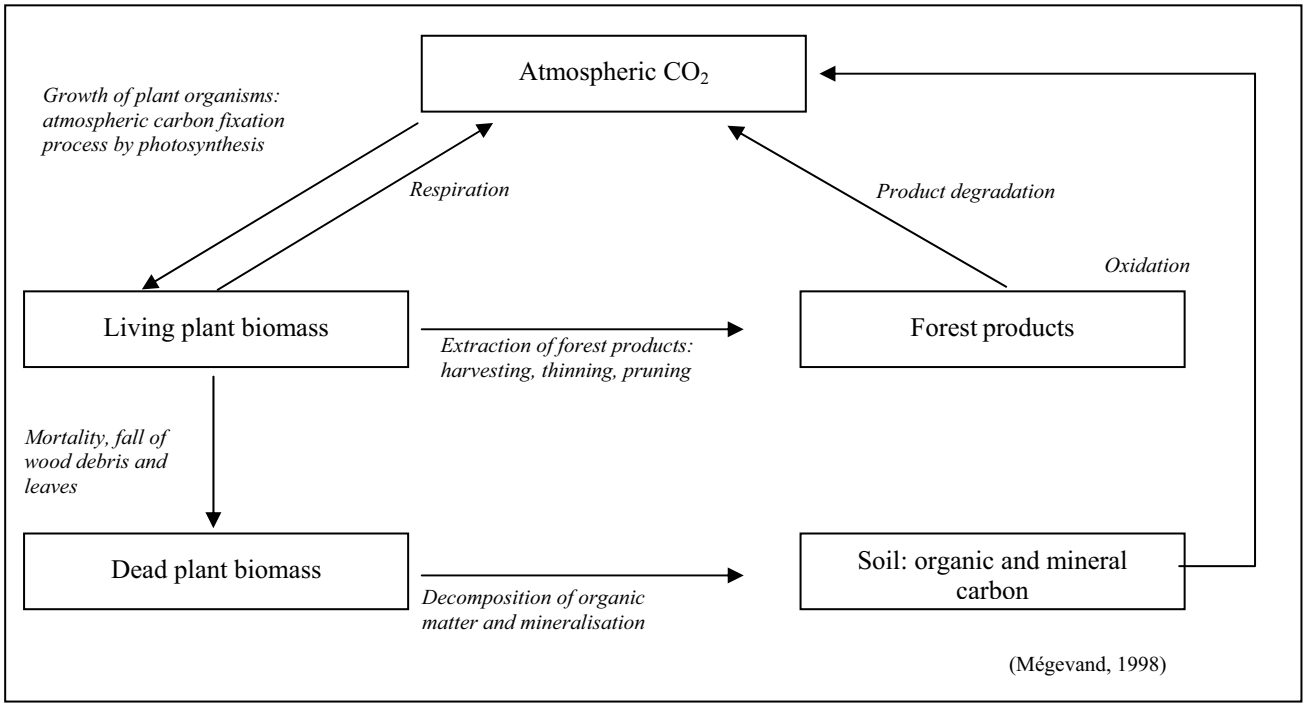
The oxidation of carbon found in organic matter and the subsequent emissions of CO_2 result from the following processes:

- respiration of living biomass,
- decomposition of organic matter by other living organisms (also called heterotrophic respiration),
- combustion (fires).

[1] The soil also contains mineral carbon from geological processes.

The process of photosynthesis[2] explains why forests function as CO_2 sinks, removing CO_2 from the atmosphere. Atmospheric CO_2 is fixed in the plant's chlorophyll parts and the carbon is integrated to complex organic molecules which are then used by the whole plant.

Diagram 2: The carbon cycle in the forest



The participation of forests in climate change is thus three-fold:
- they are carbon pools
- they become sources of CO_2 when they burn, or, in general, when they are disturbed by natural or human action
- they are CO_2 sinks when they grow biomass or extend their area.

The earth's biosphere constitutes a carbon sink that absorbs approximately 2.3 GtC annually. This represents nearly 30 percent of all fossil fuel emissions (totaling from 6.3 to 6.5 GtC/year) and is comparable to the CO_2 emissions resulting from deforestation (1.6 and 2 GtC/year).

"Current scientific evidence suggests that managed and even old growth forests (of the temperate and boreal zone) sequester carbon at rates of up to 6 ton ha. These results question the paradigm that old growth forests are in equilibrium with a net carbon balance. On the other hand infrequent disturbances (fires, pest outbreaks, storms.) are triggering a sporadic, but massive return of carbon to the atmosphere" (Valentini *et al.,* 2000). A soil specialist has emphasized that "*there is a potential for reversing some of these processes and sequestering carbon in soils in terrestrial ecosystems. The magnitude of the potential is estimated to be up to 50 to 75 percent of the historic carbon loss. Theoretically, the annual increase in atmospheric CO_2 can be nullified by restoration of 2 billion ha of degraded lands, which would increase their average carbon content by 1.5 ton / ha in soil and vegetation."* (Lal, 2000).

The carbon cycle (photosynthesis, plant respiration and the degradation of organic matter)in a given forest is influenced by climatic conditions and atmospheric concentrations of CO_2. The distinction between natural and human factors influencing plant growth is thus sometimes very difficult to make.

[2] Sugar synthesis from atmospheric CO_2 and water in the plants' chlorophyll parts.

The increase of CO_2 in the atmosphere has a "fertilizing effect" on photosynthesis and thus, plant growth. There are varying estimates of this effect: + 33 percent, + 25 percent, and + 60 percent for trees, + 14% for pastures and crops (IPCC, 2001). This explains present regional tendencies of enhanced forest growth and causes an increase in carbon absorption by plants. This also influences the potential size of the forests carbon pool.

There are still questions regarding the long-term future of the biospheric carbon pool. Several bio-climatic models indicate that the ecosystems' absorption capacity is approaching its upper limit and should diminish in the future, possibly even reversing direction within 50 to 150 years, with forests becoming a net source of CO_2. Indeed, global warming could cause an increase in heterotrophic respiration and the decomposition of organic matter, and a simultaneous decrease of the sink effectiveness, thereby transforming the forestry ecosystems into a net source of CO_2 (Scholes, 1999).

The *Hadley Center* Simulation

In 2000, *Nature* published the results of a simulation made by the *Hadley Center*. It analyzed the possible effects of global warming and of the increase of atmospheric CO_2 concentration on plant life and the oceans, and the subsequent emissions by these pools during the course of the 21st century. They tested three hypotheses:

- A 5.5 percent (4° globally) increase of the average ground temperature. The model predicted the decline of a large part of the Amazonian forest, due to the increase in drought. The decomposition of the soil's organic matter would accelerate and the result would be an emission of 60 GtC by the earth's ecosystem.
- An increase in CO_2 concentration to 700 PPM, with no rise of the global temperature: the earth biosphere would globally absorb 750 GtC.
- A combination of the increase of CO_2 emissions and the temperature rise, with dramatic results: the CO_2 concentration in the atmosphere reaches 980 PPM, the average increase in ground temperature reaches 8° (5.5° globally), and the earth's biosphere emits 170 GtC (Cox *et al.,* 2000).

References:

Cox *et al.,* 2000. Acceleration of global warming due to carbon-cycles feedback in a coupled climate model. *Nature*, 408.

The Hadley Center's simulation result is somewhat questionable, since it depends upon an uncertain direct link between an increase in earth temperature and respiration. The capacity of the vegetation to adapt to an increase in temperature is also largely unknown. An article written by 18 climate specialists published in *Science* (2000), gives a different opinion: "*recent results from long-term soil warming in a boreal forest contradict the idea that the projected rise in temperature is likely to lead to forests that are now carbon sinks becoming carbon sources in a foreseeable future"*. This article postulates that the strength of the sink should increase in the future (by 10 to 20 percent) due to CO_2 fertilization, and then decline, followed by long-term saturation, due to the respiration increase caused by the rise in average temperatures (Falkowski P., Scholes R.J. *et al.,* 2000). These forecasts refer to ecosystems that are not used for production, and are not managed or reforested.

Forestry activities to mitigate climate change

Carbon sinks and measures for reducing industrial emissions: complementary or opposing actions?
Opposing the inclusion of carbon sinks in the Climate Convention negotiation process is often seen as an attempt to avoid more stringent emission reduction measures in the energy sector. However, it would be mistaken not to use the forestry potential simulateneously, since climate change is not a linear phenomenon, and there undoubtedly exist critical threshold levels beyond which the climate system would change unpredictably and timing of reduction measures counts (Pederson, 2000).

The *Edinburgh Centre for Carbon Management* (ECCM) created two simulations involving CO_2 concentrations in the atmosphere.
The first compared a pessimistic forestry situation (constant deforestation, an inversion of the Amazon sink" to a source, and no large-scale reforestation), with an improved forestry situation (reduced deforestation and significant reforestation programs). In both cases, the atmospheric concentration exceeded 500 ppm, which the ECCM considers a critical threshold level for climate change, with a difference of ten years: about 2050 in the first variation, and 2060 in the second. This proved that forestry measures alone will not solve the problem of climate change.
The other scenario involved a large reduction of greenhouse gas emissions in the energy sector, with the same variations in the forestry sector. With a pessimistic forestry situation, the critical threshold level was reached in 2070. With the improved forestry situation however, the threshold was never reached. Instead, the curve of CO_2 concentration in the atmosphere started to decrease in 2050 slowly until 2100.
The ECCM concluded that the only way to fight climate change was to combine vigorous fossil fuel emission reductions with a voluntary program for improving forestry management, forest conservation and reforestation.
References
Tipper R., Forestry and the Clean Development Mechanism, *Edinburgh Centre for Carbon Management,* 12th May 2000.
Pederson T. 2000. Climate Change Fore and Aft: Where on Earth are We Going. IGBP Newsletter 44.

Several actions can be taken in the forestry sector in order to mitigate climate change.

Plant trees to create carbon sinks

Planting new forests, rehabilitating degraded forests and enriching existing forests contribute to mitigating climate change as these actions increase the rate and quantity of carbon sequestration in biomass. This potential has certain physical limitations such as plant growth and available area. Agro-forestry and the planting of multiple- use trees (fruit trees, rubber wood, etc.) also contribute to this objective.

Tree planting projects are doubly interesting from the point of view of CO_2 sequestration, inasmuch as carbon storage in durable products such as boards, plywood, or furniture complements the permanent stock in standing trees. Even if the life span of products is limited, an average life span of several dozen years is still significant, since it allows to "gain time" while waiting for cleaner technologies in the energy and transportation sector to develop, and it can also help avoid concentration peaks of CO_2 in the planet's atmosphere. If a part of the annual harvest replenishes and increases the pool of wood products, the forestry sector's storage capacity can increase considerably without occupying more space in the landscape.

Protect existing forests to reduce emissions from deforestation

The carbon reservoir in the forest biomass and soils is very large, highlighting the importance of conserving natural forest, and eliminating agricultural practices which contribute to the deterioration of these reservoirs.

One aspect of the debate about carbon sinks is whether conservation activities should be accounted or not. These activities aim to protect a forest area threatened by human-induced

deforestation, particularly from farming. Climate specialists consider this conservation option to be the "best strategy for sink maintenance" (Valentini *et al.,* 2000) to the extent that it contributes more effectively to carbon storage and preserves the biodiversity associated with old-growth forests.

Improve forestry techniques to reduce emissions

Numerous forestry activities emit greenhouse gases; these emissions can be curtailed by applying appropriate techniques.

- Forest harvesting can cause serious damage to the soil and the forest stand when carried out inappropriately. Reduced impact logging in the context of forest management and harvest plans involves using a set of techniques, such as pre-planning skidding trails; optimizing landings; directional felling; employing appropriate skidders, which reduce damage to soils, harvested trees and the remaining stand; these damages would heighten mortality and release carbon unnecessarily.

- Timber processing also generates a considerable quantity of waste wood, which could either be reduced, or used as a raw material for production or as fuel. Improving the forest industry's efficiency helps limiting the amount of wood waste created by the production process. This could be achieved by increasing product yield, reducing residues, or adding production lines which utilize them as parquet, moulding, etc. Using wood wastes in combined heat and power generation, thereby simultaneously generating heat for kiln-drying of wood, energy for running the machines, and electric power for the outside would reduce emissions and valorize these residues, which can substitute for fossil fuels[3]. Moreover, charcoal production also is a process of widely varying efficiency, depending on the method and techniques used, which could be improved.

Wood acting as a substitute for fossil fuels and energy-intensive materials

- **Replacing high-energy materials with climate-friendly substitutes**

Using lumber instead of materials requiring large amounts of energy during production helps fight the greenhouse effect, e.g. in replacing concrete or steel constructions by wood as frames, beams, etc. Using $1m^3$ of lumber in buildings sequesters 1 ton of CO_2 for an average period of 20 years, and reduces net emissions by 0.3 t of CO_2 if concrete is replaced, and 1.2 t of CO_2 if steel is substituted.

- **Fossil fuel substitution through renewable wood energy**

Producing wood for energy purposes mitigates climate change by combining sink action with emissions reduction. Substituting fossil fuels, such as coal, natural gas, or oil by fuelwood for domestic use, electricity production, or industrial use, e.g. in iron smelters, reduces CO_2 emissions because wood is renewable. The expected sequestration of carbon through the growth of trees after sustainable harvest compensates for the CO_2 emitted by combustion.

However, this assumes that fuelwood production does not cause irreversible deforestation, i.e. that wood stocks are managed in a sustainable manner. Good management may even increase the productivity of forests and hence their sequestration capacity both in above-ground and below-ground biomass.

[3] Waste-wood is the ultimate by-product of timber conversion. Using it for energy results in a net saving of fossil fuels and, therefore, a reduction of CO_2 emissions.

Different actions related to fuelwood can be taken:

- Increasing fuelwood supply by creating new plantations or enhancing productivity of existing forests through forest management. The contribution to climate change mitigation depends on the size and permanence of the carbon pool, and on the fuelwood increment.
- Increasing the energy efficiency of fuelwood use and derived products. Charcoal will often replace fuelwood in households. Improving and adapting stoves is necessary in order to raise energy efficiency and avoid the over-exploitation of certain species which have low wood density and burn rapidly. Charcoal contains two to five times more energy than wood by weight. Its use may also improve the distribution of fuelwood resources by reducing transportation costs from distant forest areas[4].
- Increasing the efficiency of charcoal production. In Africa, productivity ratios can be as low as 10 to 15 percent, which corresponds to energy ratios of 20 to 40 percent. There are techniques which can obtain conversion ratios of 25 to 30 percent, or energy ratios of 65 to 80 percent (Girard and Bertrand, 2000). These techniques are particularly important for Africa, where urbanization has caused households to rapidly shift from wood to charcoal[5].

The following table summarizes forestry activities that mitigate the greenhouse effect.

Table 1: Forestry activities that mitigate the greenhouse effect

Creation and management of carbon sinks and pools	**Reduction of greenhouse gas emissions by sources**
Biomass and soil organic matter in forests	**Emissions resulting from forestry activities or products**
Introduction of trees on non-forest or degraded forest lands: industrial plantations, *village plantations, restoration of natural forest, watershed protection,, orchards and perennial cultures, agro-forestry*…	Reduced impact logging
Conservation of threatened forests	Reduction of harvest and production residues by improving conversion efficiency
Combat against pests and fires	Improving energy efficiency in transformation and use of biomass energy (wood, charcoal)
Improving the management of natural forests*:* Forest enrichment, improved forestry techniques, rotations, cutting cycles…	

Wood products	**Substitution: avoided emissions**
products with long lifetimes	Fossil-fuel substitution by biomass
Increasing product lifetime by recycling or maintenance	Substitution of energy-intensive materials (cement, steel) by lumber

[4] The degradation of forest resources in Sahelian countries is primarily linked to improper selection of harvesting sites: forest stands close to cities are over-exploited, while more remote sites are underused. Alarming predictions of the 1970s concerning a fuelwood crisis have been partially refuted and the resource turned out to be more abundant and resilient than predicted, with possible exceptions, e.g. Mauritania.

[5] The transition to gas or oil is still impeded by low incomes, but the changeover is nonetheless inevitable.

Multiple dividends of carbon forestry projects

In addition to helping protect the environment, forestry activities that mitigate climate change can provide global, regional and local benefits, as long as they are adapted to the local context.

Economic activities

- They can offer potential income to rural populations in forest areas. Industrial plantations can generate employment in nursery operations, harvesting, tending operations. Community plantation projects may involve direct payments to villagers by an investment fund.
- Timber plantation projects, particularly if undertaken in combination with efforts to increase forest industry efficiency, raise competitiveness by adding value to production and processing. They also help supply construction materials adapted to both urban and rural populations. In countries with large wood industries, such as Nigeria, Ivory Coast, Ghana, Cameroon, this could reduce the pressure on their natural forests.
- Reduced-impact logging techniques contribute to maintaining sustainable timber production by curbing forest degradation through destructive harvesting.

Adaptation to climate change, combat against desertification

- Multiple-use plantations can contribute to the combat against desertification and erosion in vulnerable areas. Tunisia and several Sahelian countries believe that they can also produce carbon sequestration, provide income and supply fuelwood to rural populations.
- Conserving forests is a means of adapting to climate change. It helps provide protection against surface erosion, regulates water flows and limits landslides and rock falls. Forests at the coastline provide protection against wind and water erosion as well as water and sand intrusion.

Energy independence

- Improving the management of natural forest ecosystems as a source of fuelwood or charcoal contributes to energy supply at a moderate cost, reducing the country's dependence on fossil fuel imports. Biomass energy development permits decentralized electricity production in areas inadequately served by the national electricity grids. This can be of particular interest to dry areas, especially in the Sahel.

The international negotiations on climate change

The United Nations Framework Convention on Climate Change

In June 1992, the United Nations Conference on the Environment and Development (UNCED), held in Rio de Janeiro, took the first steps in the international combat against climate change. The United Nations Framework Convention on Climate Change (UNFCCC) was adopted by most developed and developing countries. It sets forth the framework for this international effort, whose objective is "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The UNFCCC suggests two methods: limiting emissions of anthropogenic greenhouse gases at their source, and increasing removals by sinks.

Guiding principles of action include:

- The protection of the climate system on the basis of equity and in accordance with the common but differentiated responsibilities and respective capabilities of the countries concerned. The developed countries must take the lead in reducing emissions.
- The need to give full consideration to the specific needs of particularly vulnerable developing countries, particularly small island states.
- The need to take precautionary measures in the absence of scientific certitude.

The Convention entered into force in 1994. It has been signed by 186 countries.

The Convention's uppermost body is the Conference of the Parties (COP), responsible for specifying the methods to be used in achieving its objectives. Since 1995, the COP has held annual meetings. The most significant progress was made during the Kyoto Conference (COP3) in December 1997. The COP works with two bodies of experts, the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI), who help to settle the technical questions involved.

The Convention on climate change is supported by the Intergovernmental Panel on Climate Change (IPCC), made up of 2,500 experts appointed by the United Nations. The IPCC was created in 1988 jointly by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP). Its mission is to collect pertinent scientific data, to promote production and dissemination of such data, and to provide a critical summary of this data. It is also responsible for evaluating the ecological and socio-economic effects of potential climate change and evaluating possible mitigation and adaptation strategies. The IPCC published its first report in 1990, which was updated in 1992, and served as a negotiation basis for the adoption of the climate change convention. It published a second report in 1995, and a third, rather alarming one in February 2001.

The Kyoto Protocol

On December 10, 1997, the Conference of the Parties adopted the Kyoto Protocol, providing for a first concrete step in the reduction of greenhouse gas emissions. The Kyoto Protocol proposes quantified emission reductions targets for the principal developed nations (parties listed in Annex I of the Convention, namely the Organization for Economic Co-operation and Development (OECD) and the Eastern European countries): for the period 2008-2012 (first commitment period), annual emissions should correspond to an average total reduction of 5.2 percent of 1990 emissions. Each Party has an individual reduction target. This corresponds to an actual reduction

necessity of nearly 10 percent from current emissions, and nearly 30 percent from estimated emissions in 2010.

Carbon fluxes resulting from land-use, land-use change and forestry (LULUCF) are to be accounted for in the greenhouse gas emissions inventory of developed countries. Where these fluxes result in net carbon sequestration, as in almost all forests in developed countries, which currently are in a phase of accumulating growing stock, this lightens the burden of commitments: CO_2 removals by forestry and other sinks in land use can be subtracted from emissions in other sectors.

Weighing the national priorities in the current decision-making process: the African difficulties in the negotiation

The objective of the African Ministerial Conference on the Environment, held in Dakar in October 2000, was to harmonize the positions of the African countries in view of COP6. The points discussed included the CDM, vulnerability, adaptation, the preparation of national communications, carbon sinks and technology transfers. The Conference emphasized that " *carbon sinks, inasmuch as they contribute to soil fertility and improvement of food security, which are among Africa's priority objectives, can be excellent goals for future development projects* ".

Despite this, African voices were often difficult to hear in the negotiation process. Two reasons might explain this :

- Participation in international meetings is hampered by the limited amount of funds available to the African countries' national delegations. These funds are generally provided for only one person, the "national focal point", whom the Convention Secretariat finances in each country, whereas for example the United States finances a team of about a hundred persons. A choice must therefore be made concerning the subjects the delegate should follow, due to the complexity of the discussions. Negotiation on climate change is a constantly-evolving process on the scientific, political and diplomatic levels. Participating in this process implies being informed about all linked special topics at all times. This often poses an unsurmountable problem for African countries, as the logistics are not always sufficient.

- Access to information and participation requires a good level of English, as translations cover only some texts and debates. This represents a severe handicap for most of French-speaking African countries. To solve these problems, the reinforcement of links between French-speaking countries has been encouraged under the impulse of Canada and the Intergovernmental Agency for the French-Speaking World (www.agence.francophonie.org): the French-speaking negotiators have created a working group which meets during negotiations or in workshops. A French version (although incomplete) of the Climate Convention Secretariat's web-site (http://www.unfcc.int/portfranc/) has been created. Other web-sites such as that of the French Inter-Ministerial Mission for the greenhouse effect (http://www.effet-de-serre.gouv.fr/) or the Senegalese NGO ENDA's web-site (http://www.enda.sn) also provide information in French. The information access problem is also a very serious one for project promoters and decision-makers from African countries, since they find it difficult to understand and take advantage of the opportunities offered by the climate change convention's instruments.

The Kyoto Protocol also offers developed countries alternatives to domestic action. Three "flexible mechanisms" aim to reduce the cost of meeting emission targets:

- Emissions Trading: trading of emission rights between countries which have emission targets;
- Joint Implementation: emission rights gained through individual projects in developed countries;
- The Clean Development Mechanism: emission rights gained through projects in developing countries.

The developing countries rejected any obligation to take on quantified objectives for future emission levels, claiming that the developed countries were responsible for the present situation, and that future goals must be achieved equitably by taking into account population levels and development needs. The entry into force of the Kyoto Protocol requires ratification by no less

than 55 Parties to the Convention, including Annex I Parties whose carbon dioxide emissions in 1990 accounted for at least 55 per cent of the total for Annex I countries.

Negotiations have continued since 1997 to specify the rules and modalities for applying the Kyoto Protocol, which will affect the decision to ratify of the signatory countries. The website http://unfccc.int/resource/kpstats.pdf shows the current status of Kyoto Protocol ratification: as of 1 March 2003, 105 Parties had ratified or accessed the Kyoto Protocol, representing 44% of respective emissions. Among those Parties are the European Union and Japan. USA and Australia have so far rejected ratification. The future of the Kyoto Protocol now depends upon the ratification by Russia. Forests and tropical forests in particular, have been important elements in these negotiations.

The Marrakech Accords

COP7 held in Marrakech in November 2001 adopted a set of decisions (the "Marrakech Accords", UNFCCC 2001) that clarify concrete modalities which apply to the climate change convention and the Kyoto Protocol. They correspond to a more detailed version of the agreements taken in Bonn in the second part of COP6.

In particular, the Marrakech Accords clarify the use of different economic instruments towards developing countries. These instruments are intended to have developing countries participate in the international process through other means than national emission commitments, help them in the pursuit of sustainable development and help them to adapt to climate change. Some of these instruments could be used by forestry; others focus more on the energy, industry and transport sectors.

The Marrakech Accords also propose a framework for capacity building ("learning by doing"), technology transfer and development ("increase the transfer of and access to environmentally sound technologies and know-how"), for which the COP mandates additional financial and technical resources. This does not constitute a new funding mechanism, but it gives guidelines for the use of existing funds and investment mechanisms of interest for developing countries.

Economic instruments for developing countries and a potential for African forestry

The climate change negotiations, have produced different economic instruments for developing countries. Some of them are already operational, some are still being developed, and others depend on the ratification of the Kyoto Protocol. Their potential for forestry is summarized in table 2 and presented in detail in the next page.

Table 2: Economic instruments towards developing countries and their potential for forestry

Type	*Instrument*	*Potential for forestry*
Funds provided by the Convention or the Protocol	GEF climate change focal area	Biomass production and use Carbon sequestration
	GEF Multifocal area OP 12 Integrated ecosystems management	Projects addressing climate, biodiversity and land degradation issues E.g. Rehabilitation and improved management of forested watersheds (sustainable forest management)
	Special climate change fund of the Convention	Adaptation, technology transfer, forestry. Details to be determined
	Least developed countries fund of the Convention	Capacity building and adaptation priorities identification
	Adaptation Fund of the Kyoto Protocol	Conservation projects in vulnerable zones where forests constitute an adaptation measure
	French fund for the global environment	Carbon sequestration in forests and soils
Mechanisms to foster North/ South private and public investment flows	CDM for GHG sinks	Afforestation and reforestation projects, to be defined more specifically by COP9
	CDM for GHG sources	Substitution projects of fossil fuels by biomass
	AIJ pilot phase	All forestry activities, as a learning experience for the CDM

Funds managed by the Global Environment Facility (GEF)

The GEF: financial mechanism of the Convention

The convention on climate change established a financial mechanism to provide funds to help developing countries implement the Convention (See Annex). The Convention assigned the role of operating the financial mechanism to the Global Environment Facility (GEF) on an interim basis and, in 1996, the Conference of the Parties, at its second session (COP2), adopted a memorandum of understanding with the GEF on their respective roles and responsibilities. In 1998, COP4 entrusted the GEF with this role on an on-going basis, subject to review every four years.

The GEF is a multilateral financial institution, with 173 member countries, bringing together development institutions, the scientific community, private sector and non-governmental organizations in behalf of a common global environment agenda. Its secretariat is based in Washington D.C. and managed by the World Bank under the supervision of the GEF Council, which is the GEF's decision-making and control authority. The Council has 32 members, representing 14 OECD countries, 16 developing countries and 2 countries from Central and Eastern Europe. The GEF was established by the World Bank, the UN Development Program (UNDP) and the UN Environment Program (UNEP) in 1991 with a pilot phase up to 1994 to fund certain developing country projects that have global environmental benefits, not only in the area of climate change, but also biodiversity, protection of the ozone layer and international waters. The issue of land degradation is also included in funding as a cross-cutting issue.

The financial mechanism is accountable to the Conference of the Parties, which decides on its climate change policies, program priorities and the eligibility criteria for funding. The COP therefore provides regular policy guidance to the financial mechanism on its climate change work, based on advice from the Subsidiary Body for Implementation (SBI). The Kyoto Protocol will use the same financial mechanism.

The GEF will also manage newly created funds related to climate change and developing countries: the Special Climate Change Fund, the Least Developed Countries Fund and the Adaptation Fund, provided for in the Marrakech Accords.

In 1994, the GEF was granted US$ 2 billion by 34 nations. In 1998, it was granted US$ 2.74 billion by 36 nations. A third replenishment of approximately US$ 3 billion occurred in 2002. The USA announced its participation in the third replenishment. The grants to the GEF, mostly from OECD countries, are additional to official development assistance.

Since 1991, the GEF has allocated a total of US$ 7.1 billion to climate change activities, including US$ 1.2 billion in grants and US$ 5.9 billion leveraged through co-financing from bilateral agencies, recipient countries and the private sector. Between July 1999 and June 2000, total project financing for climate change activities exceeded US$ 1,424 million, of which the GEF provided US$ 199 million in grant financing. The total grants provided by the GEF between 1991 and 2002 for all focal areas amounts to US$ 4.2 billion , divided among 1000 projects in 160 developing countries.

COP 6 had requested that a sufficient amount of resources be placed at the disposal of the Parties not included in Annex I, the developing countries. No agreement was reached on eventual financial penalties for the Annex I countries that exceeded their emission quotas during the course of a commitment period.

These penalties could have been earmarked for financing the funds managed by the GEF. The total amount of these funds will therefore largely depend on the good will of the industrialized countries, and, in the case of the Kyoto Protocol Adaptation Fund, on the carbon credits to be generated by the CDM project. In 2001, an annual sum of US$ 410 million by 2005 was announced collectively by the European Community, New Zealand, Japan, Switzerland, Iceland and Canada as extra-funding for developing countries, to be revised in 2008. This comprises subsidies to the GEF, to the new climate change funds as well as bilateral assistance.

The climate change focal area and the multi-focal area of GEF

The GEF Operational Strategy

4 focal areas:
Biodiversity
Climate change
International waters
Ozone depletion
and land degradation as a cross-cutting issue

3 types of projects:
⇒ Enabling activities
⇒ Short-term activities
⇒ 13 Operational programs

Biodiversity
1. Arid and Semi-Arid Zone Ecosystems
2. Coastal Marine, and Freshwater Ecosystems
3. Forest Ecosystems
4. Mountain Ecosystems
13. Conservation and Sustainable Use of Biological Diversity Important to Agriculture

Climate Change
5. Removal of Barriers to Energy Efficiency and Energy Conservation
6. Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs
7. Reducing the Long-Term Costs of Low Greenhouse Gas Emitting Energy Technologies
11. Promoting Environmentally Sustainable Transport

International Waters
8. Water body-based Operational Program
9. Integrated Land and Water Multiple Focal Area Operational Program
10. Contaminant-Based Operational Program

Multi-focal Area
12. Integrated Ecosystem Management

Source: www.gefweb.org

The different focal areas of the GEF allow for the financing of forestry projects. The GEF has provided more than US$ 500 million through its forestry program, and US$ 350 million to projects addressing deforestation and desertification. Fifty-five percent of GEF forestry sector funds are intended for use in Africa.

The projects selected for GEF funding are implemented by multilateral agencies such as:

- the World Bank for investment projects,
- the UNDP for technical assistance projects and institutional support,
- the UNEP for projects involving capacity building, research and public awareness,

as well as regional development banks.

Project proposals must come from beneficiary countries, from their national offices, non-governmental organizations or the private sector, and must be consistent with national priorities in sustainable development. Projects can deal with economic and social development, as well as environmental protection. A project can be presented as investment and technical assistance, capacity reinforcement, research or as a micro-project.

To be eligible to GEF funds, projects must:

- have a significant positive impact on global environment
- justify incremental costs
- be located in developing countries that ratified the Convention.

Funding Options

- ***Full-size projects***. GEF's three implementing agencies (and soon regional development banks) work with the operational focal point in each recipient country to develop project ideas that are consistent both with the country's national programs and priorities and with GEF's operational strategy and programs. Regional or global programs and projects may be developed in all countries that endorse the proposed activity.
- ***Medium-Sized Projects (MSPs)***. Grants of less than US$ 1 million are available through expedited procedures that speed processing and implementation. These medium-sized grants increase GEF's flexibility in programming resources and encourage a wider range of interested parties to propose and develop project concepts.
- ***Enabling Activities.*** Grants for enabling activities help countries to prepare national inventories, strategies, and action plans in cooperation with the Convention on Biological Diversity and the UN Framework Convention on Climate Change. This assistance enables countries to assess biodiversity and climate change challenges from a national perspective, determine the most promising opportunities for project development, and subsequently pursue full-scale projects.
- ***Project Preparation and Development Facility (PDF).*** Funding for project preparation is available in three categories or "blocks". Block A grants (up to $ 25,000) fund the very early stages of project or program identification, and are approved through GEF's implementing agencies. Block B grants (up to $ 350,000) information gathering necessary to complete project proposals and provide necessary supporting documentation. These grants are approved by the GEF CEO, with attention to the GEF operations committee's recommendations. Block C grants (up to $ 1 million) provide additional financing, where required, for larger projects to complete technical design and feasibility work. Block C grants are normally made available after a project proposal is approved by the GEF Council.
- ***Small Grants Program.*** UNDP administers this project, which offers grants of up to $ 50,000 to eligible projects.
- ***Small and Medium Enterprise (SME) Program.*** A partnership with the International Finance Corporation (IFC), a World Bank affiliate, the SME program finances projects that demonstrate a positive environmental impact and have basic financial viability, thus promoting private sector investment opportunities in developing countries.

Source: www.gefweb.org

The climate change Focal Area

The budget of the climate change focal area represents a little less than 40% of GEF's endowment. It covers enabling activities, climate change mitigation activities and adaptation activities. Three types of actions are developed:

i) Long term measures in the context of ***operational programs***

Operational programs concern activities in the energy and the transport sector. Biomass energy use and efficiency is eligible to OP6 (renewable energy) and OP7 (low-emitting technologies).

ii) ***Enabling activities*** help countries to establish national communications for the Convention and to define national priorities.

Capacity reinforcement in sub-Saharan Africa (Ghana, Kenya, Mali and Zimbabwe) in conformity with the United Nations Framework Convention on Climate Change

Project components:

- Systematic inventories of greenhouse gas sources
- Capacity development for the implementation of studies and projects
- Identification of projects in the energy and forestry sectors
- Creating private sector awareness to finance these activities

GEF–UNDP Allocation: US$ 2 million (covering the total cost of the project)
Project control by UNDP

iii) ***Short- term mitigation projects*** involve low-cost actions in high priority fields. Two examples are found in Africa:

BENIN – Village-Based Management of Woody Savannah and the Establishment of Woodlots for Carbon Sequestration.
Financing: GEF
Implementation: UNDP
Execution: Ministry for Rural Development
Coordination: Director of Forests and Natural Resources
Project duration: December 1992 – October 1997 (still under way)
GEF commitment: US$ 2.5 million

The project's objective is to reduce CO_2 emissions at different sites in the semiarid zone through the improved management of the forests and lands near the villages, on a total area of 126,700 ha. The project will make it possible for local communities to develop their own regulations, techniques and forest resources management plans. This involves activities such as inventories and the gathering of data linked to tree growth and protection.

Benefits: 5,338,167 tons of carbon due to the 609,098 trees planted.

SUDAN – Community-Based Rangeland Rehabilitation for Carbon Sequestration
Financing: GEF
Implementation: UNDP
Project duration: August 1992 – February 2000
GEF commitment: US$ 1.5 million

This project's objective is to test a natural resources management model involving the participation of local communities in the Bara province north of the State of Kordofan. It will permit the rehabilitation of land that is presently degraded and in danger of desertification, through the planting of herbaceous plants and local tree species. This will stabilize dunes by the creation of 195 km of windbreaks composed of two rows of trees and to rebuild the initial carbon stores of the above-ground and below-ground biomass.

These projects, in accordance with GEF policy, concentrate on the environment. Their objective was to allow local communities to acquire know-how regarding the sustainable management of their lifestyle. They therefore relate more to the transfer of skills in forestry techniques than to development as such.

Operational Program 12 of the Multi-focal Area

Operational Program 12 «Integrated ecosystem management»[6] is more appropriate for activities relevant to both forestry and climate change combining the climate change aspect with other global services offered by forests.

[6] This program was originally to have been called "carbon sequestration", but a number of parties involved feared that certain sequestration activities, such as large mono-specific plantations, would run counter to the biodiversity conservation goals.

OP12 falls under the multi-focal area of the GEF, covering the GEF's four fields of action as well as land degradation. The undermining principle is that natural resources management must address social and economic issues because humans play a major role in the disturbance of ecosystems. Projects aim to involve and empower a wide range of local residents and to create sustainable livelihood opportunities so as to strengthen local economy and reduce poverty. OP12 covers interventions to create an enabling environment through policies, regulations, and incentive structures, institutional strengthening activities, such as training and logistical support, and investments. Investments under OP12 include the «rehabilitation and/or improved management of a forested watershed or floodplain wetlands through sustainable forest management to achieve multiple benefits, including improvement in soil and water conservation, aquatic biodiversity conservation, flood control, minimization of damage to globally important water bodies, and reduction of net emissions or improved sequestration of greenhouse gases».

In its first year (2000), OP12 was granted US$ 100 million to cover GEF country workshops, small and medium-scale enterprises programs and small grants programs. It is expected to function with US$ 200 million per year.

The GEF announced the supporting of three integrated ecosystem management projects in Africa for a total of US$ 16,8 million, one of them explicitly mentioning carbon sequestration in natural ecosystems.

> The Niger Community-Based integrated ecosystem management program offers means to improve ecosystem management, to address desertification and land degradation and to increase the capacity of dry land ecosystems for carbon sequestration. It is implemented by the World Bank. The GEF commitment amounts to US$ 4,35 million for a total cost of US$ 34 million, of which US$ 2 million originate from local communities.
> Two other projects in Namibia and Egypt deal more specifically with biodiversity and land degradation.

Financing the cost of protecting the global environment: the incremental cost

Intervention of the GEF in the context of the focal areas is based upon the concept of "incremental cost". The subsidies are allocated in relation to the expenditures for the global environment in a classical development project: they are supposed to fund the transformation of a project with national benefits into one with global environment benefits. In other words, the GEF grants cover the difference or "increment" between a narrower, cheaper, possibly more polluting option and a wider, more expensive, more environment-friendly option. The incremental cost is thus equal to: {the total cost of the project favorable to the environment} minus {the total cost of the reference project} minus {the local financial impact}.

The GEF is thus one of the rare examples of a financial mechanism that is specifically focused on the difference between global benefits and local costs involved in protecting the world environment. The process of determining incremental costs can be complicated. Furthermore, it has sometimes led the GEF to favor projects in which the local impacts, and thus local development, are small, in favor of projects centered upon global problems, making it more difficult to find appropriations for such locally beneficial projects.

Comments on the GEF additionality criteria

In the climate change context, the GEF additionality criterion poses numerous problems, and may lead to unforeseen consequences. GEF additionality refers to the supplementary costs resulting from additional project components, whose specific objective is reducing emissions or sequestering greenhouse gases. This is the origin of the notion of incremental cost and its operational meaning. Arranging for GEF resources involves comparing the candidate project to a reference scenario including its economic and environmental impacts in order to determine what additional expenditures arise from the goal of reducing emissions or sequestering carbon.

From an economic standpoint, the fact that the GEF resources are thus constrained leads to efforts to maximize the marginal emission reductions achieved. The paradox however is that the evaluation criteria will ensure that:

- On one hand, projects with the lowest marginal reduction costs/ unit will be chosen;
- on the other hand, as soon as projects become actually profitable, that is have negative marginal costs, they become ineligible;

Given the uncertainties associated with the reference case scenario and the evaluation tools, the most efficient projects for accomplishing the GEF's goal, are also those which are the closest to being ineligible (Cornut, 1998).

The GEF plans to finance technical assistance and information in order to reveal the benefits of technologies that are eliminated by barriers to adoption, and to formulate and back up the necessary reforms. As for the reduction of the long-term costs of low-emission technologies, the GEF plans to finance "the incremental cost of projects that further the application of specific technologies" (GEF, 1996).

References:

Cornut, P., 1998. Analyse et complémentarités entre le MDP et le FEM: une première mise en perspective. Rapport pour le FFEM.
GEF, 1996. Operational Strategy of the Global Environment Facility.
de Gouvello, Ch., 2001. Le MDP: essai d'intégration de la référence positive au développement. CIRED, document de travail.

Three new funds for developing countries: the Special Climate Change Fund, the Least Developed Countries Fund, and the Adaptation Fund

The Marrakech Accords confirmed the creation of three new funds, i.e. the Special Climate Change Fund and the Least-developed Countries Fund under the Convention, and the Adaptation Fund under the Kyoto Protocol.

The Special Climate Change Fund should finance activities, programs and measures in the following fields:

(a) adaptation,
(b) technology transfer,
(c) energy, transports, industry, agriculture, forestry and waste management,
(d) the diversification of economies that are heavily dependent upon fossil fuels.

The fund will be replenished through voluntary contributions by Parties. Carbon sequestration in forestry and land-use activities should be eligible. It is probable that this fund, together with the Adaptation Fund, shall function as a complement to the CDM in what regards forestry and land-use activities. As technology transfer is one of the fund's priorities, forest industry or reduced-impact logging could possibly benefit from it.

The Least-Developed Countries Fund covers work on least-developed country national action programs for adaptation (NAPA), which have already been financed by the GEF. It aims at helping LDCs to formulate funding demands to the GEF. Land-use and forestry are concerned, among other fields. A LDC executive committee has also been established. The fund will be replenished by GEF.

The Kyoto Protocol Adaptation Fund should finance adaptation of developing-country Parties to the Kyoto Protocol. Possible projects include capacity building for adaptation, conservation of tropical forest in vulnerable zones where forests contribute to adaptation, the rehabilitation of degraded lands and the combat against desertification, particularly in Africa. This fund will be financed by a two percent levy, a share of the proceeds, on all CDM project activities, except those in least-developed countries. Industrialized countries are expected to provide complementary funding. The implementation of this fund depends on the ratification of the Protocol. Like the Special Climate Change Fund, the Adaptation Fund should complement the CDM.

These three funds should be operated by the GEF, once they come into function. They should supplement the financial resources of the GEF's climate change focal area and those provided at the bilateral and multilateral levels. Details need to be further developed under the negotiating process at the SBI level. The GEF is charged with proposing modalities for the functioning of these funds at COP9 (2003). Like all other GEF funding, demands must originate from a host country and fulfill criteria which need to be developed.

The French Global Environment Facility (FFEM)

The French Global Environment Facility (FFEM) has complemented the GEF's activities since 1994. Its goal is to finance the additional costs incurred in protecting the global environment in development strategies. It is a bilateral fund financed by the French Government, over and above the latter's development assistance and its contributions to the GEF. The French Development Agency (AFD) in Paris manages the FFEM Secretariat.

The eligibility criteria for the FFEM are the same as for the focal areas of the GEF. The FFEM concentrates on activities in which it has a comparative advantage over the GEF. It supports projects which must be:

- related to economic and social development,
- in their field operation phase,
- innovative and replicable,
- allow co-financing: the FFEM contribution is limited to a maximum of 50 percent of the project's total funding.

The priority directions of FFEM eligible activities are:

- Combat against climate change:
  - Energy efficiency (in energy production and distribution, industry, transports and households)
  - Promotion of renewable energy sources and of energy sources which emit less greenhouse gases
  - Carbon sequestration in forests and soils
  - Elimination of organic wastes
- Mixed biodiversity/climate change projects which aim to facilitate the application of global environmental concepts to African countries, in particular:
  - Developing the appropriate tools, methodologies and criteria for dealing with biodiversity and climate change mitigation in forestry development projects,
  - Creating tools and methodologies for facilitating FFEM projects that focus on the combat against desertification, and improving their integration into development projects.

- Preservation of biodiversity
- Protection of international waters

The FFEM is also participating in mechanisms such as the CDM.

FFEM subsidies amount on average to € 1 million for individual projects, which represent between 5 to 50 percent (15 percent in average) of projects' total cost. Unlike GEF financing, FFEM support is not directly proportional to the incremental cost. A project's economic and social impact, the risks involved, the direct and indirect costs, etc. are taken into account.

The FFEM's financial resources rose to € 73 million for the period 1994-1999, and were renewed for the same amount for 1999-2002. 116 projects totaling approximately € 114 million have been implemented between 1994 and 2000. Activities involving the combat against climate change represented nearly 34 percent of this amount, and nearly 20 percent concerned mixed activities that involved climate change. Africa benefits from a little less than 50 percent of FFEM means.

Example of a FFEM project combining Biodiversity/Climate change
"Support of sustainable forestry development in Gabon"
Project components:

- Support forestry developers in integrating biodiversity in their development plans through training in inventory techniques, data processing, planning of wood harvesting, zoning.
- Development of low-impact logging: and of improved techniques to minimize harvest losses
- Support for local development activities, such as animal breeding as an alternative to hunting, improving agricultural output

Total cost of the project: € 11.2 million
Financing: French Development Agency (€ 7 million), forest concessions (€ 3 million) and the FFEM (€ 1.2 million)
Work controlled by the Gabon General Directorate for Forestry
Project approved in 1999. Three agreements were signed (June-November 2000) between the forest concessions and the local AFD Agency at Libreville.

Examples of FFEM climate change projects in Africa

Support program for the Clean Development Mechanism
Multi-countries
Started 27/11/2000
Institution: World Bank (via GEF's Secretariat)
FFEM's contribution: € 375,000

Fuelwood project: spreading efficient equipments in the crafts sector
Morocco
Started 26/3/2001
Institution: AFD
FFEM's contribution: € 1,590,000

Agro-ecology action plan
Cameroon
Started 26/3/2001
Institution: AFD
FFEM's contribution: € 610,000

Agro-ecology development and carbon sequestration in pan-tropical and Mediterranean agriculture
Multi-countries
Started 9/11/1999
Institution: AFD and French ministry of foreign affairs
FFEM's contribution: € 762,245

Charcoal production from plant residues in Rosso
Mauritania
Started 30/11/2001
Institution: French ministry of foreign affairs
FFEM's contribution: € 600,000

Sustainable village-based management of forests in Southern Mali and urban fuelwood distribution
Mali
Started 20/12/1996
Institution: AFD and French ministry of foreign affairs
FFEM´s contribution: € 762,245

The Clean Development Mechanism: promoting investment flows from developed to developing countries

The possibility for developing countries to participate in the global carbon market

Principle: Combine sustainable development and economic efficiency

The Kyoto Protocol created the Clean Development Mechanism (CDM-Article 12). If the Protocol comes into force, the CDM should allow developing countries to participate in the market for emission reductions and to attract Annex I country investors.

The CDM has a dual objective:

- To help developing countries achieve sustainable development, and contribute to the ultimate objective of the Convention. Emissions in developing countries, which are presently low, might soon exceed those of developed countries, if measures are not taken to introduce reduced-emission technologies. The principle is to encourage investment flow and the transfer of technologies from the developed countries to the developing countries, to help them in their development trajectory while minimizing their greenhouse gas emissions.
- To help the developed countries fulfill their commitments to limit or reduce emissions.

The CDM grants "Certified Emission Reductions" (CERs) to projects located in developing countries that contribute to reducing greenhouse gas concentrations in the atmosphere. CERs will be allocated proportionally to this contribution. CERs are emission permits that can be purchased and used by entities in Annex I countries for reaching the assigned amounts set by the Protocol for the first commitment period in 2008-2012. They can be remunerated, and are therefore an addedrevenue for a project. The CDM could therefore be a windfall for developing countries, and could promote transfers of funds and technologies from private or public entities in the developed world. Thus, the CDM is designed to function as a lever for clean development.

The CDM's innovation resides in its quasi infinite potential - as long as a demand for emission permits exist - to attract investment flows from developed countries to developing countries. The value of CERs will be the result of transactions on the carbon market, and, at the project level, of an contractual agreement between the investor, the project developer, and the land-owner.

However, there is concern that the demand for carbon credits from projects in developing countries would be rather modest. The Annex I countries could fulfill fixed parts of their total commitment by resorting to the increment of their forests, which may be business-as-usual or result from specified additional management activities, and carbon sequestration though agricultural activities. These activities combined could deliver up to 90 percent of their commitments. The concessions obtained by the Russian Federation suggest that there might be a large number of Russian carbon credits offered during the first commitment period. The withdrawal of the United States of America from the Kyoto Protocol, if maintained until 2008, lowers expected demand for official carbon credits under the Protocol. A combination of these trends could result in a low potential price per ton of carbon, which would tend to limit the activities that could be implemented within the CDM framework, particularly in the forestry sector, where uncertainties still remain.

A cap applies to the use of CDM forestry sink projects by Annex I Parties to fulfill their emission reduction commitments: 1% of the 1990 emission level multiplied by five, or a total of 247 Mt of carbon including the USA, and 164 Mt. C without. For France alone, this maximum allowance of 1.5*5 Mt C represents planting of approximately 120 000 ha or 25 000 ha per year little-by-little over ten years (Loisel, 2001). The binding constraint on afforestation and reforestation projects under the CDM is less this cap but rather the ability of projects to meet the requirements of the certification process. Developing countries' capacity to create conditions to attract investors will also be important and this is particularly true in the forestry sector where times of return on investment are long, risks high, and land tenure rights uncertain. If those barriers are eliminated, the CDM could be a motor for development, making climate-friendly development projects possible.

Early projects

The prospects of a market for emission permits were foreseen well before the Kyoto Protocol. They lead to early private and public investments into carbon projects, involving different organizations, companies and foundations with a variety of goals: organizational culture or public relations, learning-by-doing, sponsorship and activism. Here are some examples in the forestry sector.

A precursor to the CDM: Activities Implemented Jointly under the Pilot Phase

In 1995 COP5 in Berlin established a pilot phase for Activities Implemented Jointly (AIJ). The aim of the pilot phase was to gain experience (learning-by-doing) and to build capacity in the field of projects for greenhouse gases emission reductions or CO_2 sequestration in developing and transition countries, involving developed country investments. Projects under the pilot phase did not acquire tradable emission permits, however they could hope to eventually be registered as full-fledged JI or CDM projects later on. The Marrakech Accords acknowledged in decision 8 the unbalanced geographical distribution of AIJ projects, particularly in Africa, and decided to continue the pilot phase noting that it constitutes an opportunity for learning- by-doing and should, as such, attract private flows.

Apart from the possibility of learning-by-doing and a "greener" image, the pilot phase does not offer any benefit that might attract Annex I investments in non-Annex I countries. This explains the low level of private investments of approximately 200 projects. The pilot phase nevertheless constituted an interesting experience in terms of capacity building for a future CDM. It is a way to identify difficulties, test methodologies and possibly identify eligible projects. This is particularly true in the forestry sector, where approximately thirty projects helped identify methodological difficulties, such as baseline construction, leakage assessment and technical difficulties in measuring removals and emission reductions[7].

[7] See a synthesis of experiences learnt for forestry projects in Annex III.

The Peugeot project.

The Peugeot initiative in Brazil (Mato Grosso) was carried out in association with Pro-Natura International, a French-Brazilian NGO and the Office National des Forêts, the French National Forest Service. The project plans to reforest 5,000 ha of grassland using principally native forest species, in order to create a carbon sink capable of removing 50,000 tons of carbon per year during the growth phase. The project should last 40 years. This project falls within the framework of Peugeot's public relations policy as it contributes to "greening" its image. (http://www.peugeotavenue.com).

The Noel Kempff Climate Action Project

Mention should also be made of the initiatives being carried out by The Nature Conservancy, a foundation dedicated to preserve natural resources. It finances large conservation projects in Latin America and the Asia-Pacific area. Their best-known project is the "Noel Kempff Climate Action Project" in Bolivia. Activities in favor of riverside populations and low carbon-emitting agricultural techniques have been proposed. Contracts were signed with forest concessions to prevent them from exploiting other areas in the region and thus causing leakage. Monitoring sites have been installed in order to evaluate and compare carbon fluxes and thus establish additionality and baselines. At a higher level, studies are being conducted with regard to land use, markets and forest exploitation in order to identify possible influence on forest conservation that the project might have in the country and thus assess leakage and/or spillover.

The Costa Rican experience

In 1994 Costa Rica created its Joint Implementation office (OCIC – *Costa Rica Bureau for Joint Implementation*), in which the Government (Ministry for the Environment), ecologists (NGOs), energy producers and private investment companies are represented.

The OCIC approved two types of cooperation within climate-friendly forestry projects, both essentially forest conservation projects:

- Bilateral projects: Investors were directly involved in the proposal, planning and implementation of projects. These projects generally had significant transaction costs and a high level of risk for the entrepreneur in terms of the return on his investment, as well as an important effect on greenhouse gas emissions. Nine projects of this type were approved by the OCIC, in collaboration with the American Initiative on Joint Implementation – USIJI.
- Multilateral projects, known as *Umbrella Projects*: An investor could participate in the financing of a project by purchasing *Creditable Tradable Offset* vouchers that were hoped to be convertible into emissions permits, once the international accreditation system would be set up. Three projects of this type were approved and financed by the OCIC, with complementary funding by the Norwegian Government, the USIJI and a private company. This second approach was particularly audacious. The investors were reimbursed in the form of CTOs having an equivalent value to their investment. The CTOs corresponded to a quantity of greenhouse gas emission reductions or removals, expressed in carbon equivalents. The verification of CTO projects was carried out by SGS-Forestry, an independent company that certified the CTOs with World Bank financing. These were delivered one year after the reduction has been carried out, and guaranteed for a period of twenty years by the Government: "*through the emission of this certificate, the Government of the Republic of Costa Rica commits itself to maintain the validity of the amount of GHG offsets specified in this certificate during the next 20 years, and guarantees replacement offsets if it is demonstrated that the offsets here certified have not been produced in the amount indicated on the certificate*". This guarantee was covered by converting only a part of the total emissions reductions into CTO. In this manner, Costa Rica committed itself for a period corresponding to the longest project, increased by 20 years of guarantee or a total of 60 years. The CTOs were sold for US$ 10 per metric ton of carbon, in blocks of 1 000 CTOs, and the price increased in 1998 to US$ 20 due to the high verification costs (Rada, 1998, *in* Michaelowa, 1999). Norway obtained 200 000 CTOs in two projects, the USIJI purchased 16 million CTOs in 1997, and a private American company bought 1 000 CTOs that it offered on the Chicago Stock Market.

Reference:

Michaelowa and Dutschke, 1998, *Joint Implementation as Development Policy –The Case of Costa Rica*

Potential of the CDM for forestry

For the first commitment period concerning developed countries emissions between 2008 and 2012, the following actions are eligible for certification as CDM projects:

- **Projects inducing a reduction of greenhouse gases emissions by sources, excluding emissions from biomass combustion.**
- **Projects inducing an increase in removals of CO_2 by sinks through afforestation and reforestation.**

Annex I Parties will be allowed to use certified emission reductions to achieve their commitments under the period 2008-2012.

The CDM can benefit developing countries forestry in several ways:

- Directly: a forestry project which corresponds to the definitions of "afforestation" and "reforestation" can be certified as a CDM project. It could thus benefit from additional revenue from certified emission reductions, which will be tradable to developed parties entities. Both an industrial plantation project or a project re-establishing a semi-natural forest could be eligible to the CDM if projects meet the definitions,rules and modalities described below.
- Indirectly: The use of biomass as a substitute for fossil energy in the form of oil, coal, or natural gas could be eligible for CDM certification. Indeed, GHG accounting methodology (IPCC, 1997) considers biomass as a renewable energy and emissions caused by its combustion are not taken into account. Thus, substituting fuelwood for fossil fuel achieves an emission reduction. However, the environmental integrity of the CDM could be threatened if fuelwood harvest causes irreversible forests degradation : fuelwood must come from sustainably managed forest. In this way, the CDM could encourage sustainable forest management of plantations.

It should be noted that a project combing biomass production through afforestation or reforestation and its subsequent use as a substitute for fossil fuel benefits twice from the CDM, as it combines CO_2 removals with CO_2 emission reductions.

Emission reduction projects could also be set up in the wood industries, for example regarding transport or energy efficiency. We will however concentrate in this report on the "sink" part of the CDM.

In future commitment periods, the range of eligible forestry activities might increase. Negotiations concerning the second commitment period (2013-2017), due to begin in 2005, should study this possibility, in particular regarding agroforestry, low-impact logging, forest rehabilitation or restoration, and sustainable forest management.

At this time, the definitions of "afforestation" and "reforestation" under the CDM, which will determine eligibility of projects, as well as the rules and modalities for such projects, have not yet been accepted unanimously and will not be finalized before COP9. The definitions contained in the Marrakech Accord and applying undoubtedly to developed country Parties for the purpose of land use, land-use change and forestry activities under Article 3.3 and 3.4, may serve as a reference point:

(a)"Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storey and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.
(b) "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.
(c) "Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

At this time it is unclear if these definitions will be adapted to developing countries' particular circumstances in the course of a SBSTA work programme currently underway. Of particular significance is the threshold date finally chosen for the non-forest / forest transition.

Discussion

The restrictions for forestry activities under the CDM are the result of a compromise between opponents and supporters of including sinks in the flexible mechanisms of the Kyoto Protocol.

The debate on forestry activities' eligibility to CDM

Opponents and supporters of including sinks in the under the CDM have taken strong, opposing positions:.

Opponents have emphasized the lack of equivalence between a ton of CO_2 not emitted and a ton of sequestered CO_2. While CO_2 emissions can be considered irreversible, as the lifetime of a carbon molecule in the atmosphere is of the order of 100 years or more, sequestration activities are potentially reversible: carbon remains sequestered in terrestrial ecosystems from a mean of one year in savannahs to an average of 30-80 years in tropical forests, and perhaps for centuries in temperate or boreal forests (Valentini *et al.*, 2000). Furthermore, terrestrial carbon pools, e.g. forests can be quickly destroyed by forest fires, storms, land-use changes, harvests, etc.

Those in favor of including forest sinks highlight the important contribution they make in mitigating climate change, despite a risk of a possibly temporary and reversible role. Additional activities of creating sinks can clearly modify the net emission trajectories (emissions minus absorption), with a difference of 5 to 6 Gt by year 2040 (Ciais, 2000). Furthermore, in the opinion of many climatologists, one of the most important risks is the peak in the CO_2 concentration in the atmosphere, which is due to carbon cycle inertia and the inevitable increase in emissions by the developing countries in the short and medium term. Even temporary carbon storage in terrestrial sinks can help prevent such peak carbon concentrations in the atmosphere below potentially dangerous levels, while mankind awaits large-scale application of innovative, low-emission technologies.

Finally, an effective instrument must be made available to reverse the decline and degradation of natural forest ecosystems in developing countries, to re-introduce trees into degraded agro-pastoral systems, and to modify techniques currently prevalent in agriculture in favor of more sustainable methods. Challenges in terms of technical change and modification of widely-used practices exist in the forestry and agriculture sectors, just as in the energy and transport sectors.

The CDM will now definitely include certain carbon sinks. However, in comparison with Annex I countries that can implement a full range of activities under Article 3.4 of the Kyoto Protocol, that is forest management, management of croplands, grazing lands, revegetation, the range of sink activities under the CDM is very restricted.

Most Parties would like to accept for the CDM the definitions of forest, afforestation and reforestation which have been agreed upon for developed country Parties. Others argue that these definitions would fail to fit the situation in developing countries. Here, a 50-year non-forest condition might not be demonstrable for afforestation; reforestation would not be acceptable if it

occurred on lands which had been cleared after 1989. Conceivably, plantings on non-forest land might compete with and replace agricultural activities, thus promoting leakage.

The above-mentioned definition of reforestation excludes, for example, any reforestation according to the FAO definition, such as enrichment planting, which is carried out within degraded natural forests and might enhance restoration or rehabilitation of the natural forest cover. This type of activity is particularly suitable, in terms of both ecology and economics, in a number of African countries, such as Ivory Coast, Ghana, where development and agricultural practices have degraded large forest areas. Where remnants of the old forests exist alongside these degraded areas, reforestation activities using commercial species that have either become rare or have completely disappeared may be particularly useful. The example of gazetted forests in Ivory Coast is significant: many of these "forests" consist now of deforested or sparsely wooded lands. But the definition for "forest" in Annex-I Parties excludes any rehabilitation activities under the CDM during the first commitment period, unless the areas in question do not attain or are not expected to attain the minimum crown-cover selected in the definition of "forest".

The exclusion of forest conservation as eligible activity reflects the desire to reduce the role of land-use and forestry activities in the Kyoto Protocol, and the difficulties concerning an applicable baseline and evaluation of net emission reductions for such projects, given the complexity of the socioeconomic dynamics that lead to deforestation.

Restrictions of CDM activities could make the GEF assume responsibility for activities which are not currently eligible under the CDM, but which nevertheless provide multiple benefits, support innovation and learning-by-doing, such as certain types of agroforestry, sustainable forest management, reduced impact logging. The GEF might also support pilot projects involving forestry activities that have been excluded from the CDM during the first commitment period. Developing biometric methods or technical and economic reference cases in the form of forestry and agroforestry pilot projects might help future negotiations on agricultural and forestry activities under the CDM during the second commitment period.

Setting up a CDM project

The CDM is still an evolving instrument, which depends above all upon the entry into force of the Kyoto Protocol. Definitions, rules and modalities for its use are currently being developed. Here are some elements from the Marrakech Accords.

CDM-Project Cycle

A CDM project should involve the three following entities:

Project Participants: *Investors and implementers from developing and industrialized countries*

- Design and implement the project
- Present the monitoring plan including measurement, baseline construction and leakage evaluation.

Operational Entities: *legal entities accredited by the CDM Executive Board.*

- Validate the proposed CDM activities
- Verify and certify the emission reductions/removals in accordance with the monitoring plan.

CDM Executive Board: C*omposed of ten members designated by and under authority of the COP, six of them coming from developing countries.*

- Approves methodologies and definition of project limits
- Determines accreditation of operational entities
- Registers the certified project

- Issues CERs with a unique serial number to the project participants

The CERs issued to a CDM project will be calculated by subtracting the actual anthropogenic removals/emissions by sinks/sources from baseline removals/emissions and adjusting for leakage. This should be possible by the elements given in the monitoring plan presented by the project developers for certification.

The methodologies to construct a monitoring plan for CDM sink projects are under development by the SBSTA and the Executive Board of the CDM, and should be decided at COP9 in December 2003.

Measurement of emissions and removals

The evaluation of greenhouse gas removals resulting from forestry project activities can be carried out in two ways[8]:

- by directly measuring CO_2 fluxes between a forest stand and the atmosphere. This method is in the experimental stage, still imprecise, unreliable and expensive.
- by monitoring the evolution of carbon stocks over a given period. Possibly in agreement with stipulations for forestry activities in Annex I Parties inventories, applicable carbon pools to be accounted for and include above-ground biomass, below-ground biomass, litter, dead wood, and soil organic carbon, unless transparent and verifiable information is provided that one of these pools is not a source. The treatment of wood products is still pending, but it seems unlikely that they will be considered in the first commitment period. Current accounting rules assume that carbon is emitted as soon as timber leaves the forest, an obvious oversimplification. Different methods have been applied to measure carbon stock changes in harvested wood products, but no agreed methodology has yet been specified. The measurement cost depends highly on the required precision level and the measurement interval, which needs to be determined.

The COP requested the IPCC to pursue work on Good Practice Guidance for measuring carbon sequestration in the land use and forestry sector , with adoption expected at COP9.

Setting a baseline

The baseline or reference scenario is a model which reasonably represents the anthropogenic emissions/removals by sources/sinks of greenhouse gases that would occur in the absence of the proposed project activity. The methodologies to be used for establishing baselines for sink projects have not yet been decided, but general ideas can be deduced from what was proposed for emission reduction CDM projects in the Marrakech Accords.

The baseline should be established:

- by project participants, who can choose to use an approved methodology or a new one,
- in a transparent and conservative manner,
- on a project-specific basis,
- with simplified procedures for small-scale CDM projects, possibly also for small scale sink projects, although the latter is highly controversial
- taking into account relevant national and/or sectoral policies and circumstances.

Baseline may include a scenario of increasing future anthropogenic emissions due to specific circumstances of a host party. CERs should not be earned for decreases in activity levels outside the project activity or due to force majeure.

[8] For further details on carbon measures, see Loisel 2001, and Locatelli 1996.

Different baseline options are proposed in the Marrakech Accords:

- existing actual or historical emissions,
- emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment,
- average emissions of similar project activities undertaken in the previous five years in similar social, economic and technological circumstances, and whose performance is among the top 20% of their category.

In the case of the CDM sink projects, the issue of general technologic performance is not as relevant as in emission reduction projects and the criteria for baseline establishment might well be different.

Allowing for leakage

The assessment of leakage is necessary to make certain that emission reductions resulting from a project do not increase emissions in another geographic area or another activity sector. Leakage is defined as "the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary and which is measurable and attributable to the CDM project activity" (IPCC, 2000). It should be evaluated by the project participants through monitoring. This implies the need to define an appropriate project boundary.

The leakage issue is particularly vital in the case of forest conservation activities. It was one of the causes for excluding such project activities from the CDM, at least for the first commitment period. In conservation projects, the possibility exists that the actors will transfer their exploitation efforts to another geographical area, now or even later.

The question of market leakage involves the modification of market prices as a result of the implementation of a CDM project. An increase in the wood supply due to the development of plantations could cause a decline in local wood prices and affect the profitability of other plantation projects, obviously discouraging their implementation. It could also lead to conversion of forest to agricultural use. Forecasts in this domain are extremely uncertain, and the effects of projects can be the counterintuitive. Wood grown on plantations can also lead to reducing the pressure on natural forests, which supply most of the wood used in the majority of tropical African countries.

Non-permanence of CO_2 removals by forest sinks: towards a system of temporary credits

Forest carbon pools are susceptible to anthropogenic and natural disturbances. They may thus provide only temporary or short term storage - in contrast to geologic or underwater carbon pools which are far more stable. A forest can burn or be cut down, and become a GHG source. A project which reduces emissions cannot be reversed: emission reductions are permanent.

This constitutes one of the most difficult technical questions involving inclusion of "sinks" in the CDM. The CDM is based on the permanent reduction of developed countries' emissions during a given commitment period. The possible non-permanence of CO_2 removals by forests should be taken into account in order to guarantee the environmental integrity of the CDM. The SBSTA experts have proposed different options.
The option most seriously discussed is that of temporary credits, based on a proposal by Colombia during COP6 at The Hague. It involves the creation of a specific credit system for forest sink projects, with allocation of temporary credits having a fixed validity period. These temporary certified emission reductions are called TCER's. A temporary credit would be recorded in the registry of the entity receiving them, and could be used to fulfill commitments, be

placed in reserve or sold. Once applied to attain the assigned amount of a Party, a temporary credit would expire after the validity period has passed; the entity that had used them would be obliged to replace them with other reduction units, that is e.g. by domestic emission reductions, permanent credits from emission reduction projects or even with new temporary credits. This system achieves the same effects as that of the "permanent" CERs from emission reduction projects. The two credit forms are only exactly equal, if an infinite sequence of temporary credits would replace a permanent CER. Of course, market values will differ.

The length of the validity period of these temporary credits is still under discussion. It is probable that a common value shall be decided for all forestry projects, so as to simplify procedures. A value of five years is currently favored, corresponding to the duration of one commitment period. However, this value could also be longer and based upon the time during which the project could guarantee stock maintenance by providing adequate insurance or a buffer of unused credits. The question of the responsibility for the stock's reversibility during this validity period is also under discussion. Detailed modalities will be decided at COP9.

The creation of a temporary credit system specific to forestry projects is an innovation and definite improvement in comparison to previous proposals which involved permanent credits:

- The "average stock" proposal involves allocating CERs in the exact amount of sequestration and ex post at the time that removals are certified. Garantees are provided, e.g. in the form of insurance or buffer stocks, that removals are virtually permanent. This method will create problems if deliberate intermediary or final harvest cuts are undertaken or land-use changes.
- The "ton-year" proposal is more elaborate. A quantity and a time dimension would apply to credits. The method is based on the "equivalency time" at the end of which sequestered CO_2 would just compensate for the climate effect of the same quantity of CO_2 when emitted. It has been difficult to reach a consensus on the applicable decay time of greenhouse gases in the atmosphere. Values proposed for CO_2 range from 46 to 100 years. As the scientific bases are apparently uncertain, the approach would therefore require a political decision. The ton-year method is no longer favored in negotiations.

The crediting method chosen for sink projects determines the quantity of carbon credits issued, the point in time when they are issued, and their value on the carbon market. The latter will be important for the magnitude of investment flows to forestry projects, that is, the CDM's potential to function as a lever for sustainable forestry in developing countries. A CER market value from sink projects that is too low would relegate sink projects to a marginal activity compared to energy projects. The African continent would be the loser, since the size of the energy sector in Africa cannot be compared to the size of that sector in emerging countries like China, India or Brazil.

As temporary credits need to be replaced after their period of validity, they will have a lower value than permanent CERs. However, for the buyer, temporary credits buy time which may be essential for innovation, restructuring or adapting. It also allows him to fulfill his obligation cheaper than by purchasing more expensive permanent reductions . Despite the lower market value of temporary credits, TCERs might constitute an interesting potential for forestry in developing countries, as tropical forestry, offers low-cost opportunities to remove CO_2 from the atmosphere. Moreover, revenues for the host over the entire lifetime of a project will not be reduced, as new temporary credits will be issued, provided that growing stocks and carbon stocks are maintained. Should a project hostess decide e.g. on a growing stock reduction, a final harvest of a plantation or a change in land use, temporary CERs do not restrict her. She will simply not re-obtain some or all of the original new TCERs.

Additionality: a filter for eligibility

Emission permits will be issued based on "additional" sequestration or emission reductions achieved by a project, i.e. sequestration that would not have occurred in the absence of the proposed project. Environmental additionality is the fundamental eligibility requirement for a CDM project: this means that a CDM project, be it a sink or an energy project must induce an additional reduction of greenhouse gases in the atmosphere. The additionality of sequestration or emission reductions can be ascertained by asking the three following questions:

- Would the project have been undertaken without the existence of the CDM? The aim is to certify only projects that would not have been undertaken without the CDM, so that CDM ensures the environmental integrity of the Kyoto Protocol and "free-riding" is eliminated.
- What would have happened in the absence of the project? This refers to a probable future situation without the project, called reference scenario. It is important to keep in mind that the reference scenario is not equivalent to a before-project situation.
- What level of sequestration / emissions would there be in the reference scenario? (quantification of the baseline)

The last step is to be carried out in the monitoring plan of a CDM project, presented by the project developer (see paragraph on baselines).

The first and eventually the second step however require that a choice be made by the COP as to what projects in a given region and for a given technological should be considered additional and thus possibly eligible for CDM accreditation. Discussions on this complex issue of additionality continue and should be settled at COP9. Here are some elements.

A first possibility to determine additionality would be to use the GEF's additionality criteria, with all the imperfections described above. This would mean that only an activity that is unprofitable at the outset can benefit. The implicit hypothesis in this approach is that profitable projects which remunerate the invested capital at or above the alternate rate of return on investments, will be undertaken anyhow, provided that the information is accessible to investors, and that there are no regulatory or other barriers. The a priori financial profitability indicator used in this approach is however of little use: the lack of objective information about true project costs and potential profits facilitates data manipulation which could make non-additional projects eligible.

Another method to determine additionality could be based upon the examination of barriers impeding clean development in the project's or a broader, national or regional context . This approach is in the tradition of political economics that maintain that an economic activity need not necessarily be merely profitable for it to be undertaken, due to the existence of barriers. This is especially true in developing countries, where lack of investment may be due to many barriers, e.g. property rights, institutional impediments, psychological obstacles, lack of capital and human resources. Breaking away from the financial criteria alone in determining additionality would make it possible for profitable activities to be eligible to the CDM, provided that valid reasons why the activity would not have been undertaken without CDM are provided. The CDM would act as a lever for removing barriers to development. Using this method would consist in analyzing a project area that is well-defined geographically on the scale of a region, a country, or an ecological/economic area within a country, analyzing the development trends of the area, making an inventory of obstacles - economic, institutional or organizational-, and finally determining the activities that could be considered additional and therefore eligible to the CDM. However, the range of possible reference scenarios must clearly have been determined by sector and geography and the exercise carried out beforehand. To be clear, the projects will still have to undergo a specific analysis in order to quantify on site the additional emission reductions or

sequestration compared to a scenario "without project". By setting norms for reference scenarios for a given sector in a given territory, this approach has two advantages:

- it limits the risks that individual operators "downplay" the reference scenarios in order to raise additionality and payoff to the CDM, probably inevitable in a project-by -project approach, where the operator defines the reference scenario based on the project's specific conditions;
- it allows reduction of the cost of creating reference scenarios, as no specific reference scenario needs to be financed.

Another advantage of this method is that it offers host country governments an analytical framework enabling them to recognize the nature of investment barriers, as well as the innovations that are vital to their removal. Finally, the link between CDM policies and concrete activities and projects is facilitated by this approach.

Additionality could be the most restrictive criteria to CDM eligibility. Phillips (2002) considers that "high-impact" forestry projects using exotic species with short rotation cycles grown for wood fiber products for national and international markets could face difficulties in terms of additionality, while "low-impact" forestry projects using native species should obtain certification more easily.

How could the CDM help achieve sustainable development?

How to define sustainable development criteria?

By definition, the objective of the CDM is to "assist developing countries in achieving sustainable development, and contribute to the ultimate objectives of the Convention". To be registered, a CDM project must receive approval of the host country government.

The question of how to guarantee that any developments induced will be "sustainable" was the center of long discussions. It has now been decided that the host country decides if ancillary benefits, such as employment, revenues, regional development, infrastructure and environmental impacts contribute to sustainable development.

In the case of forestry projects, environmental criteria are particularly important. Thus, the project monitoring plan should address local environmental impacts. Compatibility with other international environmental agreements, particularly the Convention on Biological Diversity (CBD), should be a condition for eligibility. In its note of 27 October 2000 to the COP6 meeting at The Hague, the CBD Executive Secretariat emphasized the need to consider possible conflicts and to create common criteria for evaluating CDM projects that could affect biodiversity. This note echoed the fears of many non-governmental organizations that CDM forestry projects favor establishing fast-growing exotic species instead of native forests. This could reduce biodiversity and threaten the ecological balance. Environmental impact assessments could therefore be a prerequisite for registered CDM forestry projects, including local and global impacts. Using globally or regionally recognized forest certification schemes instead of environmental impact assessments to assess socio-environmental impacts could also be a way forward.

Development versus flexibility

The OECD countries will be unable to achieve their emission reduction commitments by domestic actions alone, since it appears now that their actual emissions will exceed these goals considerably. There will therefore be a strong demand for emissions rights.

However, the CDM competes with two other flexible mechanisms established by the Kyoto Protocol for Annex-I Parties to obtain emission rights:

- Joint Implementation: a mechanism for funding projects between Annex-I Parties by granting Emission Reduction Units (ERU) or Removal Units (RMU);
- the market for trading emission rights between countries that have taken on emission reduction commitments.

The objective of these flexible mechanisms is to equalize and reduce the marginal cost of emission reductions, by relocating efforts to areas where they are less costly. It is estimated that the cost of emission reductions by domestic action in developed countries will be between US$ 67 and US$ 584/ton of carbon. The flexibility mechanisms would offer emission rights with a price between US$ 20 and US$ 50/ton of carbon. Before the US withdrawal from the Kyoto Protocol and the capping of CDM credits, the global carbon market was estimated at US$ 14-65 billion/year, although a more realistic estimate would be between US$ 10 and 20 billion/year. The anticipated supply of emission rights including all mechanisms has been evaluated between 621 million and 1.32 billion tons of carbon, with potentially 265-723 million tons of carbon/year arising from the CDM. The key problem is the developing countries' capacity to produce the CERs (Lecoq, 2000).

The CDM's unusual nature is due to the fact that it must accomplish two objectives simultaneously: flexibility and sustainable development. The clear concern for sustainable development was what motivated its creation in 1997, due to the fear of the developing countries that an instrument aimed at flexibility alone might imperil their development priorities. The CDM will hopefully be able to combine optimal climate mitigation with optimal sustainable development, that is, create a feasible compromise between simple maximization of each goal. The reference to sustainable development in dealing with the forestry sector places the CDM within the sphere of two other conventions on global environment that had been signed in Rio: the Convention on Biological Diversity and the Convention to Combat Desertification in the countries that had been seriously affected by drought and/or desertification, particularly in Africa. The consequences are significant: while pure flexibility mechanisms are required to offer maximum carbon fixation at the lowest possible cost, the CDM should encourage actions that optimize benefits for biodiversity and prevention of desertification as well.

As a mere flexibility instrument, the CDM will certainly be unable to promote sustainable and diversified forest management. In its dual dimension as a sustainable development and flexibility instrument however, it might serve in redirecting forestry investments. Although payment for the carbon sequestration function is needed for this redirection, it does not suffice, since optimum climate mitigation does not necessarily coincide with optimum biodiversity, or with optimum development. The CDM must be combined with other instruments and carried out in an institutional frameworks that remains yet to be created, so that its potential as an instrument for sustainable development materializes.

Investment structure

The CDM was conceived as a "bilateral" structure, referring to an investor from one of the Annex I countries seeking carbon credits, and a public or private partner from a developing country seeking to develop certain activities. These partners might have different solutions for sharing the carbon income, the CERs or TCER's generated by the activity, and the commercial income, that is any profits of the activity itself, independent of carbon sequestration.

The problem of equity for CDM project beneficiaries has led to the concept of a multilateral structure based upon investment funds or clearing houses that would be intermediaries between investors seeking CERs and project hosts and developers in developing countries. The clearing

house idea is of definite interest, given the nature of CDM objectives. Without a coordination mechanism, bilateral investments would inevitably concentrate on projects removing a maximum of CO_2 and generating a maximum of CERs (mere dividend projects) according to the objectives of actors in industrialized countries and to the detriment of less profitable projects that could however provide numerous ancillary benefits for the host country, such as diverse land use, more equitable income distribution, or maintaining biodiversity. Investment funds could create a coordination mechanism with groups of projects that correspond to the national objectives of the developing countries. The Southern countries would then be able to promote their own environmental and development objectives, which would not necessarily be the case if a bilateral solution were to be used alone.

The Marrakech Accords seem to also allow for unilateral projects, with investors in the developing country undertaking an activity that would earn CERs, to be sold on the carbon market. This type of investor might exist in those Southern countries where significant investment capacities and a dynamic entrepreneurial class has emerged. Some wood manufacturers operating in West and Central Africa might use this model to undertake afforestation and reforestation activities with native, slow-growing species, and thus guarantee a sustained supply for their processing plants. Maintaining supplies of certain valuable species has become increasingly difficult due to the degradation of natural forests.

Each of the three possible options for the CDM market structure has strong as well as weak points. The bilateral and unilateral models both take full advantage of private investment dynamics, that is project identification and initiation is carried out by the entrepreneur, and flexibility is high, but both models benefit certain project categories and beneficiaries. In the case of investment funds, there is less flexibility, a risk of high transaction costs and the bureaucracy of the fund, possibly resulting in low efficiency. An open market could be created in which the three models would coexist, as proposed by the World Resources Institute (WRI) (Baumert et al., 2000).

Choosing only one or all of these options for the CDM would probably not resolve all the problems related to the preferred activities and the segment of beneficiaries involved. Other structures might yet be devised which would establish, *a priori,* an equilibrium between activities that cannot offer the same cost-effectiveness in terms of the carbon alone.

The Prototype Carbon Fund: a multilateral fund

The World Bank launched the Prototype Carbon Fund (PCF), in operation since the year 2000 (www.prototypecarbonfund.org). This program, with US$ 180 million at its disposal, is an investment fund that seeks to energize a carbon market with the developing and transition countries. Its objective is to bring about "high quality" emission reductions, in the sense that all the relevant stages (calculation of baselines, evaluation of the resulting effects in terms of sustainable development, verification, validation, etc.) will be carried out with the utmost care. Moreover, the fund is explicitly meant to be an operation that "learns by doing", for the benefit of the entire international community. The PCF is funded from the private sector as well as from governments (The Netherlands, Finland, Sweden, Norway, Canada and Japan).

The fund is involved in CDM and JI projects, with particular emphasis at the outset on the CDM and on renewable energies. Due to the uncertainties regarding carbon sinks, no more than ten percent of the fund will be invested in forestry projects of this type, and then mainly in the "transition" countries in Eastern Europe. The African countries participating in this program (as host countries for fund projects) are Senegal, Togo, Morocco, Burkina Faso, Uganda, Ghana and Swaziland.

For private sector investors in this program, the World Bank has proposed a certain number of advantages, by offering them:

- a means of satisfying their Kyoto Protocol obligations with a good cost/efficiency ratio
- rapid learning in this new market
- a better environmental responsibility image
- a profit potential on the second stock market
- the possibility of discovering new growth opportunities.

With regard to the host countries that are World Bank clients, the expected advantages are:

- the possibility of benefiting from profits in the carbon market, for which they have a comparative advantage
- finding opportunities for stimulating private sector investments
- demonstrating how the development of the emission permits market should result in the transfer of cleaner technologies
- emphasizing the benefits in the area of public health that result from the reduction of pollution
- improving the capacity of countries in competing in the emerging market of emission rights.

The PCF serves as an intermediary between investors from Annex I countries and the host countries. It does not however present itself as a structure that coordinates funds between projects having a mixed environmental and social profile and with a different cost-efficiency ratio. Furthermore, the fund will only finance "additional" sums in relation to the base investment of the reference scenario, i.e. it uses the GEF incremental cost notion.

CDM and official development assistance (ODA)

CDM funds should not divert ODA

The risk of competition between funds meant for official development assistance (ODA) and the CDM is very real. The G-77 countries and China have therefore requested guarantees to make certain that the funds invested in the CDM are additional to ODA funds and other international financing. The European Union proposed in 1999 that participants in CDM projects financed in parts by ODA guarantee that these public funds would not be subtracted from the aid contributed to the GEF. The agreement concluded in Bonn in July 2001 emphasized that "public financing of projects carried out by the Annex I Parties under the Clean Development Mechanism must not divert ODA and must be separated from the financial obligations of these Parties and separately accounted for" (FCCC/CP/2001/2/Add.3/Rev.1, pp. 13-14). However, it appears difficult to demonstrate that this requirement has been met. For instance, the donor countries are not always aware of the precise amount of funds given to ODA each year. Furthermore, only a few Northern European countries actually devote 0.7 percent of their GDP to ODA, as the 1992 Earth Summit had recommended.

The most delicate situation involves "tied" aid, under which a country receiving ODA funds commits itself to purchasing goods and services from the country providing these funds. Developed countries might be tempted to support their companies' search for emission

reduction certificates by subsidizing CDM projects. The tied aid would thus pressure the host country to accept the companies' projects rather than projects that correspond to their real development needs.

Complementarities between ODA and CDM

The Marrakech Accords allow economic activities benefiting from ODA to be simultaneously eligible under the CDM, that is, ODA financing of CDM activities appears possible. It is feared that the CDM investment flow might concentrate on certain countries that have the potential for carrying out large-scale projects, leaving aside the poorest countries and a large part of Africa that depend most on ODA and are characterized by a high aid / GNP ratio. It is also foreseen that CDM flows will concentrate on financially viable activities, to the detriment of activities with low-profitability that nevertheless contribute to local development and the combat against rural poverty. These countries and projects are already excluded from the growing North-South investment flows that now exceed ODA in most developing regions. Combining ODA to the CDM could help reverse this tendency and attract CDM investors. ODA could:

- Finance capacity building. Inadequate structural capacity is African countries´ principal handicap for CDM investment. Costa Rica, for instance, managed to attract investments by deliberately pursuing a farsighted policy in environment matters.
- Lower transaction costs and remove barriers to investment, e.g. financing the high costs of contracts involving numerous scattered individual producers, or the costs of monitoring and training project participants..
- Modify cost-benefit ratio of CDM projects to render their implementation possible. Certain activities in the forestry sector suffer from low profitability, but their implementation would nevertheless provide significant environmental and social benefits. This, for example, applies to community agroforestry projects, or reforestation for watershed protection, activities that are unlikely to attract private CDM investments otherwise.

African participation in the CDM

Compared to Latin America, carbon projects are not widespread in Africa. However, some examples exist.

The Burkina Faso initiative – a project focusing on development.

This forestry-related project in Africa was officially registered at the Climate Convention Secretariat under the AIJ pilot phase. Its primary focus is development of the host country, while achieving reduction of greenhouse gases.

Burkina Faso – Sustainable energy management
Financing: DANIDA (Denmark), World Bank, Government of Burkina Faso, Government of Norway
Implementation: Ministry of Energy and Mining
Start of project: 1997
Project cost: US$ 20.4 million, of which US$ 2.4 million from the AIJ fund
US$ 1.66/t CO_2 on average for the entire project (both emission reductions and sequestration)

This project includes four sub-projects of considerable size that deal with:

- forest management activities on 300 000 ha,
- optimization of charcoal production,
- production of photo-voltaic energy for lighting and water pumps,
- introduction of more efficient cooking stoves.

The project thus deals simultaneously with carbon emission reductions (charcoal production, stoves and photo-voltaic systems) and with carbon sequestration (forestry activities).

Total emission reductions and sequestration of the project during the first six years amounted to 410,000 tons of carbon. The forestry activities accounted for 67,000 tons of carbon. One million tons are expected after 30 years at a cost of US$ 970,000. This gives a current cost of US$ 3.6/t of CO_2 , expected to diminish to US$ 0.25/t of CO_2 after 30 years.

Private initiatives: seeking emission permits

A few projects were initiated by private sector groups from industrialized countries that have become aware of the potential for carbon credits.

UGANDA – Rehabilitation of the Mt. Elgon and Kibale National Parks
Implementation and financing: FACE Foundation (The Netherlands)
Execution: Uganda National Parks Agency
Start of project: 1994
Duration of activities: 17 years
Project cost: US$ 2.6 million

The objective of this carbon sequestration project is to implement forestry regeneration in the Mt. Elgon and Kibale National Parks, through the planting of twenty native tree species over a total area of 27 000 ha. The Dutch foundation created 700 jobs for local workers involving planting and protecting against forest fires.

Benefits: 0.9 t C/ha/yr, 26 t C/ha for the duration of the project,
for a total of 700 000 t C.

UGANDA - "*Tree Farms"* and "*Norwegian Afforestation Group*" Plantations
Financing: Tree Farms and NAG
Implementation: Busoga Forestry Company, Ltd.
Start of project: 1996
Duration of activities: Four years
Project cost: US$ 500 000 lease

The Norwegian Tree Farms and Norwegian Afforestation Group rented land in Uganda at a cost of US$ 3 per hectare for a period of 50 years for their plantations covering 7 000 ha. The project's objective is the planting of fast growing species (Eucalyptus, Pinus and several native species). Several hundred employees from local villages were recruited at the start of the project. Only about fifty of them are still working for the project.

Expected benefits: 136 t C/ha for Tree Farms and 27 t C /ha for NAG during 25 years.
810 000 tons of C sequestered

TANZANIA – "*Tree Farms"* plantation
Financing: Tree Farms
Implementation: Escarpment Forestry Company, Ltd. (EFC)
Execution: Kilombero Forests, Ltd. and Mafinga Forests, Ltd.
Start of project: 1996
Project cost: US$ 4.64 million lease

This project's objective is also the planting of fast growing species (Eucalyptus and Pinus) by 500 local employees who are responsible for planting, protection and road construction.
The project is only being carried out on 1,700 ha at present, but will later be extended to 87,568 ha at different sites.

Benefits: 136 tC/ha during 25 years
12 million tC on the total area

These private sector projects have raised numerous problems, the most important concerning land ownership rights and asymmetrical information. The two *TreeFarms* projects have been criticized by a Norwegian NGO (NorWatch www.fivh.no/norwatch) for paying very low land rents, given the profit potential of the carbon trade. This criticism, however, concerns the sharing of potential profits, a problem that can be solved when profits are actually made, rather than issues of competing land uses. The projects were accused of distorting competition between plantations and agricultural use. With regard to implementation, the companies provided financing for planting, but follow-up costs at the end of the project lifetimes have apparently not been fully considered.

The FACE foundation

The FACE (*Forests Absorbing Carbon Dioxide Emission)* foundation was created in 1990, as an initiative of four major Dutch electricity companies of the *Dutch Electricity Generating Board* (SEP).

Ninety percent of the Dutch electricity production comes from the burning of fossil fuels (Cornut, 1999). The initial objective of the FACE foundation was to offset the emissions of a 600 MW coal-fired power station for a period of 25 years, or approximately 75 million tons of CO_2 (20 MtC coal equivalents). In order to achieve this, the project provided financing of reforestation programs involving a total area of 150 000 hectares, for a period of 25 years. The cost of these programs was estimated at approximately US$ 8.5 million. They would be located for the most part in in Central Europe (nearly 15 percent of the planned total) and in tropical countries of Latin America, Asia and Africa (over 80 percent of the total). The first plantings were carried out in 1992, and pilot projects have been undertaken at present in the Netherlands, the Czech Republic, Poland, Ecuador, Uganda and Malaysia.

During 1990-1997, more than US$ 25 million was invested in the project. The sequestration costs have turned out to be lower and the projects' impact greater than expected. The FACE foundation estimates that the 150 000 hectares will make it possible to sequester 115 million tons of CO_2, or approximately 31 Mt of carbon..

Fears and expectations

An instrument - such as the CDM - differs fundamentally from ODA, since it is a medium for mobilizing private investment for implementing projects in developing countries and for achieving the climate change convention's objectives at a reduced cost. Its potential depends upon institutional and economic factors, the dynamics of private partnerships, prospects for new activities, an effective legal system that can help guarantee the contracts between partners, and insurance systems for covering risks. These are obviously characteristics that one rarely finds in developing countries in Africa.

Work by Youba Sokona and Djimingue Nanasta (2000) presents the expectations and concerns of African countries with regard to the CDM:

Expectations:
- encouraging foreign investment, transfer of means and mitigation technologies, and projects involving adaptation to climate change.
- establishing a link between the needs of developing countries and the global environment.

Africa's assets:
- The increasing awareness by African countries of the opportunities offered by climate change for development and business, thanks to past capacity building by the GEF and others.
- Africa is able to offer attractive CDM projects thanks to marginal costs which are competitive with those of the AIJ pilot projects, and because of the great potential for technology transfer and capital flows.

Disadvantages and delays:
- Limited appeal for private investors: only three percent of direct foreign investment in 1995
- high risks compared to other areas
- Low level of emissions (four percent of global emissions), therefore little opportunity to reduce them
- Low participation in GEF programs
- Low participation in the AIJ pilot phase
- Insufficient experience for the CDM
- High project establishment costs due to inadequate infrastructure (transport, telecommunications, energy supply, institutions)
- Opportunities mostly for small-sized projects, which have higher implementation costs

Concerns:
- Diverting official development assistance toward activities for the mitigation of climate change would risk intensifying difficult conditions in Africa
- The African private sector's difficulty in identifying, creating and submitting possible eligible activities for financing

Requests:
- Fairness in the geographic distribution of CDM projects
- Avoiding future emissions rather than reducing emissions; the relevant criterion is not reducing emissions compared to the initial situation, but to compare future emissions at a comparable level of development
- A preparatory program to encourage CDM investments in Africa
- Building local capacities, establishing transparent project criteria and establishing capacities and procedures for measurement and verification
- Building national mechanisms for attracting and managing investments and guaranteeing convergence with national and international objectives

CDM-Assist: a World Bank's initiative

The "CDM-Assist" program of the World Bank is aimed at Southern and Western Africa. Financing is provided by the energy sector management assistance program (ESMAP) of the World Bank and the OECD member governments, particularly through the FFEM. The general objective of CDM-Assist is to enhance Africa's ability to attract CDM projects, and to build capacity in Africa to develop and manage such projects.

Specific objectives include:

- Promotion of the regional balance and diversity in the CDM,
- Building capacity through methodological studies, workshops, training of national experts,
- Following up pilot projects initiated under AIJ or as National Strategic Studies by the World Bank since 1997,
- Negotiating and transfer of CERs,
- Promoting the transfer of technology.

Eligible activities cover renewable energy, alternative energies, avoiding methane emissions, energy efficiency and land use. The CDM-Assist will also collaborate with climate change capacity building efforts undertaken by other multilateral organizations active in the region (UNIDO, UNDP, GEF, UNEP, UN foundation), to facilitate information sharing, optimize networking opportunities, and avoid duplication of activities.

This program successfully meets some of the needs of the African continent with by reinforcing CDM-acquisition capacities. It is interesting to compare the CDM-Assist and the Prototype Carbon Fund principles in order to better understand their respective focus:

Prototype Carbon Fund (PCF)	**CDM-*Assist***
Capacity for the OECD	Capacity for Africa
Market development	Search for equity
Rigid: specific criteria for projects and portfolio	Flexible: experimentation possible
Exclusively for GHG reduction	Also adaptation, forestry projects
Global distribution	Centered on regions
Geared to investors' needs	Geared to the needs expressed by the host
Multilateral funds	bilateral agreements
Indirect investments	Direct involvement in projects
Business relations	Partnerships
Carbon transactions	Transition toward the CDM
Specific projects	Synergies and follow-up
Needs host institutions	Creates institutions in the host countries

Presented by the World Bank, Lyon, September 2000

CDM-Assist finances capacity building efforts in Uganda, in connection with a PCF financed project in Kenya, Mauritius, Senegal, Swaziland, Ghana, as preparation for PCF projects in Tanzania and in Burkina Faso, as support to sustainable biomass energy management projects developed by the World Bank and the Norway AIJ program.

Some projects financed by the World Bank in Africa relate to forestry:

SWAZILAND: Power co-generation from pulp and paper residues.
Development of a 20MW co-generation power plant fed with waste from the pulp and paper industry

GHANA: Power co-generation from wood processing waste
1 MW cogeneration power plant using wood wastes from a lumber mill for self-consumption and possible sale of surplus power to the electricity grid

GHANA: Integrated timber and fuelwood plantation
Creation of a 10,000 ha carbon sink through sustainable management of forests in buffer zones of Ghana.

Other World Bank contributions to the development of markets for greenhouse gases emission reductions include:

PCF-plus: a research, training and information program that supports the PCF's development. Its objective is to help the PCF's participating parties (fund members, participants, and host countries) as well as the international community to understand the complex questions that surround the creation of the emissions reduction market linked to CDM and JI. The objective is to reduce the transaction costs and the risks associated with the implementation of projects.

The program's research component has three parts:

- CDM projects, linked
  - the "tool kit" of to the establishment of reference scenarios, monitoring and verification, the legal framework and the contract system;
  - the potential market for emissions reductions in the framework of the JI and the CDM, based upon different hypotheses regarding the carbon price;
- the CDM and sustainable development. This component concentrates on activities carried out under the CDM and their effect upon sustainable development. One of the questions examined is that of the "low-hanging apples", i.e. the fact that the CDM might reap disproportionate benefits from the least costly emissions reduction opportunities, while the opportunities remaining for eventual implementation by the host nations will be the most costly ones.

- National Strategic Studies for AIJ, JI and the CDM, ongoing since 1997.

Opportunities for combating climate change in Africa's forests

Two instruments have been or should soon be established so that developing countries can participate in climate change mitigation:

- Funds managed by the GEF
- The Clean Development Mechanism.

Africa offers a wide range of opportunities for climate change mitigation in its forestry sector. Table 3 evaluates the potential of forestry mitigation activities under two aspects:

- their potential eligibility to the economic instruments of the Convention: As those instruments are currently still being developed, it is important to remember that this is just a preliminary assessment which is conditional on the results of COP9, in December 2003. The Least Developed Country Fund (focused on capacity building in a first phase), the AIJ pilot phase (no restriction on eligible activities) and the FFEM have been excluded from this analysis.
- their development potential for African countries, using various criteria (such as climate, population, population density, deforestation rate and socioeconomic conditions) indicated in the table[9].

Table 3: Forestry mitigation activities in Africa, their potential and eligibility for financing

Activity	Instruments of potential interest	Concerned African countries	Criteria used for selection of concerned countries
Multiple-use forestry and agroforestry	CDM? ("A&R") GEF CC Focal area Special Climate-Change Fund (adaptation, forestry) Adaptation Fund	South Africa, Benin, Burkina Faso, Burundi, Cameroon, Comoro Islands, Ivory Coast, Ethiopia, Gambia, Ghana, Kenya, Madagascar, Malawi, Morocco, Nigeria, Uganda, Rwanda, Senegal, Togo, Tunisia	population density agro-climatic zone agricultural dynamics
Reforestation on degraded areas	CDM? ("reforestation") GEF OP12 Special climate-change fund (adaptation, forestry) Adaptation Fund	Ivory Coast, Ghana, South Africa, Algeria, Benin, Burkina Faso, Burundi, Cameroon, Guinea, Kenya, Madagascar, Malawi, Morocco, Nigeria, Uganda, Rwanda, Tanzania, Tunisia	deforested areas degraded areas agro-climatic zone
large scale afforestation	CDM, if socio-environmental, additionality and other criteria met	South Africa, Congo, Algeria, Cameroon, Madagascar, Nigeria, D. R. of Congo, C.A.R., Tanzania, Zambia	land availability population density private sector agro-climatic zone
wood energy	CDM, if substitution eligible; GEF CC Focal area	South Africa, Benin, Burkina Faso, Burundi, Cameroon, Ivory Coast, Eritrea, Ghana, Guinea, Guinea-Bissau, Kenya, Madagascar, Mali, Malawi, Morocco, Niger, Uganda, D. R. of Congo, Rwanda, Sao-Tome and P., Senegal, Tanzania, Togo, Tunisia, Zambia, Zimbabwe	population existing wood resources gas or oil alternative

[9] Several sources have been used: World Development Report 2000 (World Bank), State of the World's Forests 1999 (FAO), World Development Indicators 2000 (World Bank), World Resources 2000-2001 (UNDP, UNEP, World bank, WRI).

Activity	Instruments of potential interest	Concerned African countries	Criteria used for selection of concerned countries
Efficiency of wood-processing industry	CDM (cogeneration, if substitution eligible) GEF CC Focal area Special climate-change fund (technology transfer)	Angola, Cameroon, Congo, Ivory Coast, Gabon, Ghana, D. R. of Congo, C.A.R.	size of existing industry development perspectives forestry resources Remark: Angola has strong potential but industrial development depends on long-term stability
Forest Conservation	GEF OP12 Special climate-change fund (adaptation, forestry) Adaptation Fund	D. R. of Congo, Congo, Cameroon, Ivory Coast, Liberia, Madagascar, Mozambique, Gabon, Equatorial Guinea, C.A.R., Angola	forest type and extent extent of short and medium-term land tenure pressure for deforestation rate agro-climatic zone Remark: The country with the greatest potential currently too unstable
Reduced-impact logging	Special climate-change fund (technology transfer)	Gabon, Cameroon, Congo, Equatorial Guinea, D. R. of Congo, Liberia, Angola	large-scale harvest in dense forests established operators Remark: Some countries with large potential are unstable, or political will to develop these activities is doubtful

Multiple use plantations and agroforestry

Multiple use plantations and certain agroforestry activities could be eligible under the CDM in the first commitment period, depending on definitions and modalities for afforestation and reforestation eventually accepted for the CDM. If they can be considered as adaptation, they could be eligible under the Adaptation Fund of the Kyoto Protocol or under the Special Climate Change Fund of the Convention, in the latter case also as mere forestry activities.

This activity would be of interest to predominantly rural African countries with a sufficiently active farm economy and a sufficiently dense rural population. Existing cooperatives in rural communities are undoubtedly an advantage for the development of initiatives. In North Africa, olive and fodder tree plantations could constitute suitable options, since they could have a significant impact on the development and local industries of these areas. In other regions, such as the Sahel, options for open, park-like woodlands exist.

Reforestation of degraded areas

Reforestation of some degraded areas as rehabilitation or restoration could be eligible under the CDM in the first commitment period depending upon the definition of "forest" and "reforestation" ultimately chosen by Parties. The definition accepted for developed countries applies to land not occupied by forest before 1990. This definition, if applied to the CDM, would exclude forest rehabilitation in most instances. Possibly, this reforestation definition will be adapted to special circumstances of developing countries. If not, rehabilitation could still be eligible for funding through the GEF (mixed biodiversity-climate-degraded land projects, OP12). If rehabilitation can be billed as an adaptation measure to climate change, it could be eligible under the Adaptation Fund of the Kyoto Protocol or, as an adaptation and forestry activity, under the Special Climate Change Fund of the Convention.

This activity concerns countries that have suffered from erosion (Burundi, Madagascar, Ethiopia, North Burkina, Benin and Togo) and deforestation (Ivory Coast, Ghana and Guinea). Rehabilitation can be carried out by farmers in a watershed or a small region, or by agricultural or

industrial enterprises. In the wood-producing West African countries (Ghana, Ivory Coast and Guinea), in Central Africa (Cameroon, Southern Congo) and in South Africa and Zimbabwe, the wood industries, often exporters, face the problem of renewing their wood resource base. Several of these countries have excess processing capacities, accentuated by degradation of natural forests. CDM activities could be integrated into existing local efforts, e.g. in Ivory Coast and Cameroon. "Unilateral" CDM, that is projects conceived and implemented by a local operator in a developing country to acquire and market CERs are also conceivable. Under overly restrictive definitions of afforestation and reforestation under the CDM, restoration or enrichment planting in degraded stands must use other instruments than the CDM to fund parts of operations. Land rights are undoubtedly the most serious institutional barrier. Ivory Coast provides one of the most striking examples, where instead of the land owner, concessionaires undertake reforestation on concession lands but face ambiguity regarding their rights to timber resource ownership.

Plantation forestry

Plantation forestry generally involves fast growing, short-rotation species for pulp or fuelwood. An example of industrial afforestation not under the CDM is the 43,000 hectares eucalyptus plantation in Southern Congo aimed at the export of pulpwood logs. It has also given rise to a fuelwood industry in the Pointe Noire region.

Industrial afforestation falls under the eligible activities of the CDM, on the condition that definitions and modalities, such as additionality and environmental criteria are met. The CDM would allow industries to benefit from CERs. The industry could eventually share this added carbon income with wood producers.

Industrial afforestation can thrive even in regions with a low population density, but unless land rights are clearly established, transaction costs may reduce competitiveness. In South Africa, many plantations earmarked for supplying pulpwood have been established on the basis of contracts between the paper industry and local communities.

Large fuelwood plantations occasionally compete with small local growers: increasing supply might lower the price for fuelwood in the local markets. This was the case in Burundi. The South African contracting system has resolved this problem to a certain degree.

Fuelwood use

The importance of biomass energy in Africa

The African continent derives the highest fraction, almost two-thirds of its total energy, from biomass (fuelwood, agricultural waste, animal excrement, charcoal). By comparison, biomass energy represents three percent for OECD countries.

- Africa consumes approximately 205 Mt oil equivalents of biomass and 136 Mt oil equivalents of conventional energy.
- Most of the biomass energy is used in sub-Saharan Africa: five percent in North Africa, 15 percent in South Africa and 86 percent in sub-Saharan Africa, excluding South Africa.
- Wood, including charcoal, is the most common source of biomass energy. Fuelwood represents 65 percent of the use, charcoal approximately three percent.

Reference:
Energy Information Administration (USA). www.eia.doe.gov/emeu/cabs/chapter7.html

Activities that substitute biomass for fossil fuel energy are eligible under the CDM, as well as for the GEF climate change focus. This is based on the idea that biomass is a renewable resource.

In a number of African arid or semiarid countries, consumption of fuelwood has seriously degrades forest or tree resources, and has decreased the store of carbon in the growing stock; the usual assumption of automatic renewal of the standing biomass is clearly not applicable. Attempts are made to reduce fuelwood consumption to diminish pressure on natural forests. Programs which encourage use of natural gas instead of wood or charcoal were developed in Niger and Mali, and have been extended to other countries including Madagascar (where most of the fuelwood comes from plantations), in an attempt to balance the supply and demand for domestic fuelwood. This demonstrates that promoting wood fuels is only an option if sustainability is assured through plantations or the improved management of existing forests and woodlands.

Promoting sustainably produced wood fuel may involve more plantations and improved management of fallow lands, woodlands and agroforestry. If they match the definitions and modalities for afforestation, fuelwood plantations may also act as carbon sinks under CDM. In this case, energy producers could benefit from substitution credits and growers from sequestration credits. This activity offers the greatest potential for the majority of predominantly rural African countries.

Increasing efficiency in the wood processing industry

Two options exist in the sector:

- Using harvest slash, saw mill and veneer residue or scrap wood as fuel. This material is presently often used either as low yield boiler fuel or simply burnt. Producing heat and energy by co-generation necessitates costly investments which could be partially financed under the CDM if they achieve fossil fuel substitution. As technology transfer, the activity could also be eligible for the climate change focal area of the GEF and the Special Climate Change fund.
  Potentially concerned are countries with well-developed wood industries, such as South Africa, Nigeria, the Democratic Republic of Congo, Ghana, Ivory Coast, Ethiopia, Kenya, Uganda, Tanzania and Zimbabwe. Potentials also exist in countries that have a large but still unused potential for forest management, e.g. Gabon, Congo-Brazzaville, the Central African Republic and Angola.

An example in the Central African Republic

The Central African Republic has a small domestic energy market. There is a considerable amount of wood waste, all of which is burnt. When comparing wood waste in sawmills and wood use in drying plants, with capacities from 700 to 2,000 kW, it appears feasible to at least match supply and demand in these sectors. The maximum capacity for generation is theoretically even twice as large as existing demand. In this way it appears possible to save 6,000 t of oil equivalents, with an associated emission to reduction of 4,800 tons of carbon/year.

Reference

Girard, Ph., 1997. Utilisation des déchets des industries du bois pour le séchage et la cogénération d'électricité. AFD - CIRAD-Forêt.

- Reducing waste in milling, veneer production, furniture and moulding by increasing the process efficiency and increasing total products recovery, and enhancing the pool in long-lived forest products. In principle, this activity should be considered in carbon accounting under the CDM, but it is currently still ineligible under the CDM. On the other hand, this activity might qualify for the Special Climate Change Fund as technology transfer. It could also significantly impact the wood industry's competitiveness, and allow adaptation of older plants and equipments to the new developments, such as increased use of small diameter timber and lesser species. This issue is particularly pressing in countries like Ghana and Ivory Coast.

Forest Conservation

This activity is not eligible under the CDM during the first commitment period. However, a double dividend related to climate change mitigation and biodiversity conservation makes it eligible for the multi-focal area of the GEF (OP12). If it can be considered an adaptation measure to climate change, it could be eligible to the Adaptation Fund of the Kyoto Protocol. It could also be eligible to the Special Climate Change Fund of the Convention under adaptation and/or forestry.

The countries concerned possess vast areas of primary forest, subject to strong land-use change pressures. They include countries like Ivory Coast (in its eastern part), Cameroon (the Centre-Eastern and Southern Coastal regions) and several regions of the Democratic Republic of Congo and Uganda. On the other hand, countries like Gabon, the Central African Republic, Equatorial Guinea, Angola, Mozambique or Congo do not have a sufficiently high overall land–use change pressure to justify the activity as climate change mitigation, even though it would enhance biodiversity conservation. While this assessment is valid at the national level it might be very different locally, e.g. specific forests, threatened in an area of agricultural expansion.

Reduced- impact logging

Reduced-impact logging mitigates usual impacts of conventional harvest, that is, the rapid release of greenhouse gases from decomposing biomass in damaged, decaying trees, roots and logging slash in the forests. Reduced-impact logging and sustainable forest management are currently not eligible for any financing instrument. Possibly, it might qualify as technology transfer under the Special Climate Change Fund of the Convention.

All the major forestry countries in the humid tropical region with exploitation of dense forest stands are concerned *a priori*, but only the countries that possess a relatively stable institutional framework would be able to benefit from projects of this sort. The countries in the best position to benefit from this type of activity are Gabon, Cameroon, Congo-Brazzaville and the Central African Republic. Equatorial Guinea and Liberia follow, but inasmuch as the two latter countries are not known for guaranteeing the application of even the minimum regulations regarding good exploitation, they would appear to be less suitable for benefiting from this opportunity. Finally, countries like the Democratic Republic of Congo, Angola and Mozambique appear lacking in political stability at the present time.

Can the instruments linked to the Convention on climate change foster a sustainable forest management in Africa?

African forestry sector difficulties

From the standpoint of sustainable development, the instruments of the Convention and the Kyoto Protocol related to developing countries must deal with the concrete problems these countries face, in particular problems regarding the management of their forest resources. The correct analysis of these problems is essential to determine how the proposed instruments can help, and how flanking measures and regulations will enable them to function effectively.

Many studies have investigated the causes of deforestation and the degradation of the of forest resource. The norm has been to distinguish between the people causing deforestation (farmers, concessionaires, herders) and the underlying structural causes. One of the most recent documents dealing with this question [10] indicates that socio-economic factors, such as population and economic growth that have increased the demand for products and land have been acerbated by "market failures". One of these failures is the lack of market prices for goods and services linked to forestry, since only certain wood species and a small number of non-wood forestry products are considered to be "commercial" and sold at market prices. All other forestry resources and functions such as soil and water conservation, animal and plant biodiversity, regulation of micro-climate, carbon storage that contribute to the well-being of local, regional and global population are not included in the market economy. The conservation and management of these goods and services are of no economic interest to private entities, demonstrating the sharp divergence between individual economic rationale and the collective well-being.

The long-term conservation and management of forestry resources is particularly difficult in the context of marketing and capital mobility. Wood as a natural resource renews itself over a long period of time, generally several dozens or even hundreds of years, which is too long in terms of the modern economy's investment cycles and usual interest rates. Concurrent agricultural land use and artificially simplified ecosystems offer far shorter cycles of return on investment and reduce the attractiveness of natural resources management which better protects forest diversity and enhances socio-environmental functions. In many tropical countries, companies reap the easy income from exploitation of primary forests, and then convert forest lands into grazing lands or industrial plantations involving planting of single tree species such as oil palms, acacia mangium, eucalyptus, that return a higher rate of return on invested capital, rather than managing secondary forests with felling cycles from 20 to 40 years.

Agricultural production and land ownership patterns in Africa have played an ambivalent role in the evolution of the forestry sector. On one hand, traditional slash-and-burn agriculture in forests has long permitted renewal of woodlands and soil fertility. On the other hand, demographics, changes in land ownership laws that allowed governments to appropriate forest lands without possessing a management capacity, development of new crops and the decline of traditional authorities in land allocation have contributed to a crisis state in forest management. Very few countries have succeeded in halting unsustainable exploitation practices for timber and fuelwood, thus worsening the situation.

Combining instruments: Prerequisite for achieving sustainable forestry

How can the instruments related to the United Nations Framework Convention on Climate Change contribute to change ? Since the causes underlying degradation of forests are closely connected to the continuing global increase in demands, a major characteristic of contemporary

[10] Contreras-Hermosilla, A. 2000. *The Underlying Causes of Forest Decline*, Occasional Paper n. 30, CIFOR.

society, expecting simple, ready-made solution is not realistic. The gap between the social cost of forest degradation and the private cost of exploiting the resource must be narrowed. Governments must create policies and taxation, requiring operators to assume an increasing part of the cost of environmental degradation they cause. This implies a pricing system that reflects the social value of forestry goods and services and allows for the remuneration of non-market functions for those agents who opt for truly sustainable management of natural ecosystems. Remunerating forestry's carbon function helps to reduce the economic handicap of long-term sustainable management via considerable profits that can accrue under this land management regime.

Remuneration of the carbon function, which must be developed into a practicable mechanism, resolves only one of the many causes of deforestation and forest decline. Past experience has clearly demonstrated the limits of forest management which is exclusively based upon regulatory constraints. The economic incentive system entices actors to circumvent regulations that forest administrations have attempted to enforce with varying degrees of conviction. Economic instruments cannot always substitute for regulations. However, they can contribute to reducing tension between the short-term perspective that dominates practical choices by operators and farmers, and that of long-term forest management, by modifying the incentive structure for economic practices.

Investments made in the forestry sector, if they concentrate on short-cycle activities, lead to biological impoverishment of woodlands and to the degradation of forests. Exploitation of primary forests and planting of fast growing species profoundly change the composition and structure of forests to the detriment of biological diversity. Forest management carried out to preserve or restore this diversity, e.g. via reduced-impact logging, enrichment planting, planting of native species, is handicapped by low returns compared to alternatives that radically simplify the ecosystem or cause its degradation, often leading to its conversion to non-forestry uses. Massive planting of short-rotation species in tropical areas, feared by ecologists for their perverse effects, has already begun and may have become the reference scenario in many regions of Southeast Asia and Latin America. The reason for these choices is simple: they result from the high alternative rates of return of private investors, discouraging them from investing in activities where the return on investment is low and/or deferred too far into the future.

The creation of a CDM carbon income would not eliminate the profitability gap between short-rotation and long-rotation forestry, but it could potentially make long-rotation forestry profitable. Creating related capacities, such as investment funds in carbon sink projects, organizations that monitor CDM implementation, combining financing instruments, e.g. GEF funds and private green investments and / or incentives, such as forest certification and other performance bonuses can all help reduce the profitability gap.

Combination of instruments favoring sustainable forest management: plantations

Let us take the example of a plantation project in the tropics that is eligible for the CDM. The leat cost-CO_2 sequestration option will in all likelihood be planting fast growing species, such as eucalyptus or acacia mangium for pulpwood production.

Many tropical hardwood species used for furniture or lumber have become rare in the natural forest, and their very slow growth rate and late maturity make them less suitable for plantations established by a private investor in search of high return rates of return. On the other hand, a permanent, diverse, sustainably managed forest is often a determinant for the biological diversity of animal and plant species, which require a long-term, dynamic mix of native species and for specific human activities, ranging for example from gathering moabi oil in Central Africa to specialized forest-based industries that use these species.

The cost differential of removing a ton of CO_2 between a project involving plantations of fast growing species and one involving the plantation of mixed native hardwood species could be compensated by GEF funds, thereby decreasing the economic gap between these sequestration projects.

The potential of different instruments to address forest degradation

A variety of causes, involving different actors, lead to forest ecosystems degradation and destruction. Consequently, the instruments for dealing with them cannot be identical. Forest exploitation, for example, opens up roads into remote forests and provides inroads for influx of new dwellers, thereby triggering land clearing and permanent or subsistence agriculture, which in turn can supply distant markets, thanks to the road system created and maintained by forest concessionaires.

The risks posed by forest degradation for global environmental degradation, in particular climate change, will obviously depend upon the intensity of the phenomena involved: small-scale slash-and-burn agriculture, for example, has generally had only a moderate impact on greenhouse gas emissions, except in cases when it caused large forest fires. These risks also depend on the nature of ecosystems. The collection of fuelwood has only a minor impact in humid tropical areas with large forest areas, but is more destructive in arid or semiarid regions. Converting natural forest into industrial plantations could constitute a risk, if the plantations proved to be vulnerable to fires; in Indonesia, many of the large fires have involved oil palm or acacia mangium plantations, or have at least started here.

Table 4 presents different cases of forest degradation observed in Africa, the stakeholders involved and the underlying causes. Possible actions to control these degradations and most suitable instruments are presented. The instruments considered are:

- Policies and Measures at the national level: different economic (taxation, subsidies), regulatory or institutional instruments, planning tools and sectoral policies, e.g regarding land ownership.
- The instruments related to the Framework Convention on Climate Change: Funds operated by the GEF and the Clean Development Mechanism (CDM).

We see that in all cases Government policies and measures would be indispensable for resolving the problems causing forest degradation. The climate-change related instruments could be supplementary means of action, but they cannot substitute for suitable policies.

Table 4: Combination of national policies and measures
and climate-change economic instruments to address forest degradation in Africa

Nature of forest degradation	Stakeholders involved	Principal causes	Potentially adequate policies and measures	Potentially adequate climate change related instruments
Small-scale pioneer agriculture (food-crops)	Local farmers or migrants	Population growth associated with extensive farming Illegal access to land and land-tenure insecurity	Land-tenure reforms, agricultural policy, rural taxes, rural development projects in general	
Small-scale slash-and-burn agriculture on fallows	Local farmers	Population growth without adaptation of agricultural systems	Rural development projects in general	
Small-scale agroforestry, such as cocoa planting	Local farmers or migrants, small-scale entrepreneurs	Low profitability of forestry Encouraging state policies Land-tenure insecurity	Land-tenure reforms, modification of incentive structure	Forest conservation: funds Agro-forestry: funds
Conversion of forest to pasture	Small-scale farmer entrepreneurs	Low profitability of forestry Encouraging state policies	Modification of incentive structure	Forest conservation: funds Agro-forestry: funds
Conversion of natural forest into industrial plantations	Large-scale entrepreneurs	Low profitability of forestry Growing needs for raw material for industrial production (palm oil, pulp)	Land-use policy	Sustainable forest management: funds
Fuelwood collection	Local populations, informal businesses	Rural poverty Free access to forest resources Insufficient supply of fuelwood from renewable stocks	Fuelwood distribution scheme, adjusting land-tenure, rural markets, taxes, control	Sustainable forest management: funds Afforestation/reforestation: CDM Rural markets financing and development: funds
Herds	Local herders	Degradation of traditional pastures Lack of alternative economic activities to cattle raising Concurrence with agriculture for land, leading to pressures on forest areas	Land-tenure reform	Fodder plantations: CDM
small scale forest exploitation	Small-scale local or urban entrepreneurs	Unregulated access to resources	Forest regulation, rules for forest management, incentive structure to stakeholders and local populations	
Industrial forest exploitation	Large- or medium-scale businesses	Low profitability of long-term natural forest management Unregulated access to resources Inadequate State forest protection policies	Forest policy in general	Financing specific aspects of sustainable forestry, (RIL, waste management): funds

Adapting institutional frameworks to these instruments

In a large majority of African countries, governments play an important role in the management of economic and social affairs, which frequently inhibits development of institutions that could serve as a relay mechanism and interface to the rural world. It also limits the expansion of a private sector that is sufficiently independent from the state. In many of these countries, government services are highly inefficient, which, as in the case of official development assistance, inevitably leads to lagging implementation of new programs, and to accentuated administrative difficulties caused by an ever-present and poorly equipped bureaucracy. This inevitably increases transaction costs, that is those costs not directly linked to implementation of activities.

The African countries are on the whole ill-prepared to fully utilize the potential that the new economic instruments of the Convention on Climate Change offer, in spite of the fact that a great deal of global environmental stakes reside on this continent. Africa presently has the smallest number of projects for combating climate change, and lags behind South America in the forestry sector. This clearly implies that efforts should increase to help the African countries develop their capacity for good governance, adapt their institutions to make full use of these instruments, and eliminate situations in which the legal framework is found to be inadequate in dealing with questions of land ownership and forestry rights. These are some of the traditional objectives of official development assistance, which many developing countries fear will be increasingly diminished in favor of new instruments based upon private bilateral investment mechanisms, such as the CDM.

The African countries must integrate the potential offered by these global environment instruments in conceiving and implementing public policies. Unlike classical tools such as taxation systems that reside largely within the competence of the state, these new instruments are under the joint supervision of the international community through its specialized bodies, of the international companies that invest, and of the governments of the countries that benefit from the flow of investments. The expanding field of prerequisites, e.g. reforms, legal provisions, demanded by the IMF or the World Bank as prerequisite for loans related to structural adjustment programs now includes the evaluation of the environmental policies of the beneficiary countries. Environmental policies interact with other sectoral policies in the area of biodiversity and global climate change. This could provide an opportunity for countries to make their public policies far more coherent and to make use of the enlarged range of instruments that have been made available to improve not only the management of their environment, but also the effectiveness of their institutions. These countries would then be able to fully utilize these instruments in order to further their development.

Conclusions: combining and integrating instruments into public policies for forest management

The investment potential of instruments related to the United Nations Framework Convention on Climate Change can help the African continent, but in a more limited way than might have been hoped for, at least during the first commitment period from 2008-2012. The choice of restricting the range of activities eligible for the CDM to afforestation and reforestation, and the probable exclusion of rehabilitation and restoration in degraded forests place essential forest management activities outside of the Kyoto Protocol's principal investment instrument for the Southern countries. Small community forestation projects might benefit from CDM investments, depending on the mechanism's final structure, definitions and modalities, to be decided at COP9 in December 2003. The prospect of using biomass energy as a substitute for fossil fuels offers attractive perspectives, particularly considering the need for decentralized electricity production. Present CDM regulations allow credit for energy substitution and fuelwood plantations.

The state of international negotiations on the Kyoto Protocol makes it fairly unlikely that significant investments will be made in carbon sinks in the developing countries. The withdrawal of the United States from the Protocol reduces the potential demand for certified carbon credits under the Kyoto Protocol, and the possibility of industrial countries to earn credit for the normal growth of their forests has the same effect. Combined with the ceiling of 1% of base-year emission for credits from the CDM, this should result in a low price for a ton of carbon on the international market. The CDM in forestry will therefore be constrained to projects that have a favorable cost-benefit ratio, to the detriment of smaller projects or activities that have high transaction costs. The uncertainties regarding land ownership statutes and the frequent institutional crises in African countries risk penalizing the continent in the competition for CDM investments.

Although recent attention has been focused on the CDM, the growing role of the GEF should be emphasized, following the decision to create three funds linked to climate change and intended for developing countries. These funds will be administered by the GEF, whose resources will also be increased. The GEF presently has operational programs that are geared to the mitigation of climate change and its activities would be complementary to those of the CDM. Numerous public and private initiatives came to the fore after the Rio Conference regarding methods for using forests and trees in the combat against climate change. This dynamic is likely to continue, and could be utilized in synergy with UNFCCC's specific instruments in order to implement activities having multiple environmental and social benefits.

Although the CDM deals with only a few activities, the combination of instruments, support by public policies and backing by international aid could help implement more sustainable forest management in Africa which would contribute importantly to achieving the Climate Convention's objectives. The capacity of the governments concerned to encourage initiatives and organize this type of synergies will be a critical factor in the success of these policies.

References

Forests and climate change

Besnéhard, J., 1998. La forêt, puits de carbone ? Exemple de l'internalisation d'un bien ou service non marchand. Mémoire de DEA. ENGREF, Nancy, France.

Cox, P.M., Betts, R.A., Jones, C., Spall, A., Totterdell, I., 2000. Acceleration of global warming due to carbon-cycles feedbacks in a coupled climate model. Nature, 408.

Falkowski, P., Scholes, R.J. *et al.* (lead authors) 2000. The Global Carbon Cycle: A Test of Our Knowledge of Earth as a System, Science, 290.

Edinburgh Centre for Carbon Management (http://www.eccm.uk.com/climate.htm)

EUROFOR, 1996. L'Europe et la Forêt. Parlement Européen. Tomes I et II.

Girard, P., Bertrand, A., 2000. Rôle et place de la biomasse énergie en PED pour lutter contre la pauvreté et améliorer l'environnement. Note pour le G8. CIRAD-Forêt.

International Energy Administration, 1999. World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels. http://www.eia.doe.gov/emeu/iea/carbon.html

Intergovernmental Panel on climate change, 1997. Guidelines for National GHG Inventories. [J.T. Houghton, L.G. Meira Filho, B. Lim, K. Treanton, I. Mamaty, Y. Bonduki, D.J. Griggs and B.A. Callender (eds)] IPCC, Meteorological Office, Bracknell, Great Britain.

Intergovernmental Panel on climate change, 2000. Land Use, Land-Use Change and Forestry – Special report. [R.T. Watson, I. R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo, D.J. Dokken (eds)]. Intergovernmental Panel on climate change, Meteorological Office, Bracknell, United Kingdom. 377 pp.

Intergovernmental Panel on climate change, 2001. Third Assessment Report - climate change 2001. climate change **2001: The Scientific Basis** Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on climate change (IPCC) J. T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P. J. van der Linden and D. Xiaosu (Eds.). Cambridge University Press, UK. pp 944

IPCC web site: www.ipcc.ch

Lal, R., 1999. World soils and the greenhouse effect, IGBP Global Change NewsLetter, March, 37.

Locatelli, B., 1996. Forêts tropicales et Cycle du Carbone. CIRAD. 91 p.

Mégevand, C., 1998. Les programs forestiers. Un moyen de lutte efficace contre le réchauffement global. Mémoire INA – PG, Paris.

Pedersen, T., 2000. climate change Fore and Aft : Where on Earth are We Going. IGBP Newsletter 44.

Scholes, B., 1999. Will the terrestrial carbon sink saturate soon ? IGBP Global Change NewsLetter, March, 37.

Tipper, R., Forestry and the Clean Development Mechanism, Edinburgh Centre for Carbon Management, 12th May 2000

Valentini, R., Dolman, H., Ciais, P., Schulze, D., Freibauer, A., Schimel, D., Heimann, M., 2000. Accounting for Carbon Sinks in the Biosphere – European Perspective. CARBOEUROPE Cluster. EU DG Research, Bruxelles.

The international negotiations on climate change

Loisel, C., 2001. Forêt et changement climatique. L'essentiel en 15 pages. Office National des Forêts.

French Interministerial Task-Force on climate change (Mission interministérielle pour l'effet de serre) web site: http://www.effet-de-serre.gouv.fr/

United Nations Framework Convention on climate change, 1992.

UNFCCC, 1997. Kyoto Protocol.

UNFCCC, 2001. Report of the Conference of the Parties on its seventh session, held at Marrakech from 29 October to 10 November 2001. FCCC/CP/2001/13. Part 2 : actions taken by the Conference of the Parties.

Decisions 5 (Adaptation Fund), 6 (financial mechanism), 7 (funding under the Convention), 8 (AIJ under the pilot phase), 10 (funding under the Kyoto Protocol), 11 (land-use, land-use change and forestry), 17 (Clean Development Mechanism).

UNFCCC, 2002. A guide to the climate change convention process. Preliminary 2nd edition. Issued for informational purposes only. climate change Secretariat. Bonn.

UNFCCC web site: http://unfccc.int

Funds operated by the GEF

Cornut, P., 1998. Analyse et complémentarités entre le MDP et le FEM : une première mise en perspective. Rapport pour le FFEM.

de Gouvello, Ch., 2001. Le MDP : essai d'intégration de la référence positive au développement. CIRED, work document.

FFEM web site: www.ffem.net

GEF, 1996. Operational Strategy of the Global Environment Facility.

GEF web site: http://www.gefweb.org/

Report of the GEF sponsored roundtable on forests. 11th March 2002, New York. Chairman's summary (Jeff Sayer NY).

Mechanism to develop North South investments

Baumert, K.A., Kete, N., (with) Figueres C., 2000. Designing the Clean Development Mechanism to Meet the Needs of a Broad range of Interests. Climate Notes, World Resources Institute, Washington D.C.

Baumert, K.A., 1999. The Clean Development Mechanism: understanding additionality. In: Promoting Development while Limiting Greenhouse Gas Emissions: Trends and Baselines. United Nations Development Program (UNDP) and World Resources Institute, United Nations Publications

Blanco, J.T., Forner, C., 2000. Expiring CERs. A proposal to addressing the permanence issue for LUCF projects in the CDM. Informal paper.

Cisse, M. K., 2000. climate change in West Africa: main concerns and priorities relating to the implementation of UNFCCC and the Kyoto Protocol. CAN Summit, 23-24 March 2000. Washington. http://www.enda.sn/energie/cc/priorities.htm

Chomitz, K., 1998. Baselines for Greenhouse Gas Reductions – Problems, Precedents, Solutions, Carbon Offsets Team, World Bank Research Group, Washington D.C.

Chomitz, K., Brenes, E., and Constantino, L., 1999. Financing environmental services: The Costa Rican Experience and its implications. The Science of the Total Environment, 240, 157–169

Ciais, Ph., 2000. Compliance and Supplementarity in the Kyoto Protocol. RFF/CIRAD Workshop, June 2000.

CIFOR website: http://www.cifor.org

Cornut, P., 1999 et 2000. Mécanisme de développement propre. Une série de 30 fiches réalisées pour le Ministère de l'aménagement du territoire et de l'environnement. http://atlas.conseil.free.fr/cadres.html.

Cornut, P., 1998. Analyse et complémentarités entre le MDP et le FEM : une première mise en perspective. Rapport pour le FFEM.

Dixon, R. K. (ed.), 1999. The U.N. Framework Convention on climate change. Activities Implemented Jointly (AIJ) Pilot : Experiences and Lessons learned. Kluwer Academic Publishers. Netherlands. 422p.

Eraker, H., 2000. "CO_2lonialism-Norwegian Tree Plantations, Carbon Credits and Land Conflicts in Uganda". NorWatch.

de Gouvello, Ch., 2001. Le MDP : essai d'intégration de la référence positive au développement. CIRED, work document.

Heister, J., 1999. World Bank Research on Methodology for AIJ/JI/CDM Projects – Status Report. Carbon Offsets Team, World Bank, Washington, DC, USA.

International emissions trading association (IETA) Discussion Paper 02-02 "LULUCF Projects in the CDM"Discussion Paper No. 02-02. Accounting regimes and proposals for simplified rules and modalities

Kerr, S., Leining, C., 2000. Permanence of LULUCF CERS in the Clean Development Mechanism. Center for Clean Air Policy (CCAP).

Kete, N., Bhandari, R., Baumert, K., 2001. Should Development Aid Be Used to Finance the Clean Development Mechanism? Climate Notes. World Resources Institute, Washington DC

Lecocq, F., Chomitz, K., 2001. Optimal use of carbon sequestration in a global mitigation strategy: is there a wooden bridge to a clean future ? World Bank, Development Economic Research Group.

Marland, G., Schlamadinger, B., 1997. Forests for carbon sequestration or fossil fuel substitution? A sensitivity analysis. Biomass and bioenergy Vol 13, No. 6: 389-397.

Matsuo, N., 1999. Baseline as the Critical Issue of CDM – Possible Pathway to Standardization. GISPRI – IGES.

Michaelowa, A., 1998. Joint Implementation – the baseline issue. Global Environmental Change, vol.8, n°1, Pergamon. http://perso.easynet.fr/~michaelo/ji.htm

Michaelowa, A. et Dutschke, M., 1998. Joint Implementation as Development Policy- The Case of Costa Rica.

Moura Costa, P., Wilson, C., 1999. An equivalence factor between CO_2 avoided emissions and sequestration - description and applications in forestry. Mitigation and Adaptation Strategies for Global Change.

The Nature Conservancy, Technical Operating Protocols for Carbon Monitoring, Leakage Monitoring, Accounting and Reporting, and Verification and Supervision http://nature.org/

Peugeot website: http://www.peugeotavenue.com

Selrod, R., 2000. Evaluation Report of the Norway-World Bank AIJ Program : Lessons Learned from the Pilot Phase under the UNFCCC. Environment Department, The World Bank, Washington, DC, USA.

Sokona, Y., Humphreys, S. et Thomas, J.-P., 1999. The Clean Development Mechanism : what prospects for Africa ? Environnement et développement du Tiers Monde (ENDA-TM), Dakar, Sénégal, 25pp. http://www.enda.sn

Sokona, Y., Nanasta, D., 2000. The Clean Development Mechanism : an African Delusion ? Change, n°54, October-November 2000, p.8-11. http://www.enda.sn/energie/cc/cdm-afric.htm

Stave, J., 2000. Carbon Upsets-Norwegian Carbon Plantations in Tanzania. NorWatch.

UNFCCC web site on AIJ projects: http://maindb.unfccc.int/aij

Valentini, R., Dolman, H., Ciais, P., Schulze, D., Freibauer, A., Schimel, D., Heimann, M., 2000. Accounting for Carbon Sinks in the Biosphere – European Perspective. CARBOEUROPE Cluster. EU DG Research, Bruxelles.

World Bank Prototype Carbon Fund: http://www.prototypecarbonfund.org

World Bank CDM Assist: http://www.worldbank.org/afr/cdm/

African forestry

Barreto P., Amaral P., Vidal E., Uhl C., 1998. Costs and benefits of forest management for timber production in eastern Amazonia. Forest Ecology and Management 108: p 9-26.

Bertault, J.-G., Kadir, K. (eds), 1998. Silvicultural research in a lowland mixed dipterocarp forest of East Kalimantan. The contribution of STREK project. CIRAD-Forêt, Montpellier, France, 250 p.

Contreras-Hermosilla, A., 2000. The Underlying Causes of Forest decline. Occasional Paper n°30, CIFOR.

Energy Information Administration (USA). www.eia.doe.gov/emeu/cabs/chapter7.html

Food and agriculture organization of the United Nations, 1999. World Forests situation. http://www.fao.org, 156 p.

Geller, S., 2000. " Forestry sector Interventions ". United Nations Development Program, Sustainable Energy and Environment Division (SEED), Program on Forests.

Girard, Ph., 1997. Utilisation des déchets des industries du bois pour le séchage et la cogénération d'électricité AFD - CIRAD-Forêt.

Girard, P. et Bertrand, A., 2000. Rôle et place de la biomasse énergie en PED pour lutter contre la pauvreté et améliorer l'environnement. Note pour le G8. CIRAD-Forêt.

Griffon, M. et Mallet, B., 1999. En quoi l'agroforesterie peut-elle contribuer à la révolution doublement verte ? Bois et Forêts des Tropiques 260 : p 41-51.

Kaimowitz, D., Angelsen, A., 1998. Economic Models of Tropical Deforestation : A review. CIFOR, Indonesia.

Karsenty, A., 1999. Economic instruments for tropical forests. The Congo Basin Case. Montpellier, CIRAD. London, Lied. CIFOR, 2000. 12p.

Nginguiri, J.-C., 1999. Les approches participatives dans la gestion des écosystèmes d'Afrique Centrale. CIFOR Occasional Paper, no. 23

Palm, C.A., P.L. Woomer, J. Alegre, L. Aravelo, C. Castilla, D.G. Cordero, B. Feigl, K. Hariah, J. Kotto-Same, A. Mendes, A. Moukam, D. Murdiyarso, R. Njomgamg, W.J. Parton, A . Ricse, V. Rodrigues, S.M. Sitompul, et N. Van Noordwijk, 2000: Carbon Sequestration and Trace Gaz Emissions in Slash and Burn and Alternative Land-Use in the Humid Tropics. ASB climate change Working Group Report. Final Report, Phase II. International Center for Agroforestry, Nairobi, Kenya, 37 pp.

United Nations Convention on biological diversity, 1992.

United Nations Convention on desertification, 1992.

UNDP, UNEP, WB, WRI. World Resources 2000-2001

World Bank, 2000. World development report.

World Bank, 2000. World development indicators

Annex 1: Official texts defining economic instruments related to the UNFCCC

UNFCCC ARTICLE 11. FINANCIAL MECHANISM

1. A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined. It shall function under the guidance of and be accountable to the Conference of the Parties, which shall decide on its policies, program priorities and eligibility criteria related to this Convention. Its operation shall be entrusted to one or more existing international entities.
2. The financial mechanism shall have an equitable and balanced representation of all Parties within a transparent system of governance.
3. The Conference of the Parties and the entity or entities entrusted with the operation of the financial mechanism shall agree upon arrangements to give effect to the above paragraphs, which shall include the following:

(a) Modalities to ensure that the funded projects to address climate change are in conformity with the policies, program priorities and eligibility criteria established by the Conference of the Parties;

(b) Modalities by which a particular funding decision may be reconsidered in light of these policies, program priorities and eligibility criteria;

(c) Provision by the entity or entities of regular reports to the Conference of the Parties on its funding operations, which is consistent with the requirement for accountability set out in paragraph 1 above; and

(d) Determination in a predictable and identifiable manner of the amount of funding necessary and available for the implementation of this Convention and the conditions under which that amount shall be periodically reviewed.

4. The Conference of the Parties shall make arrangements to implement the above-mentioned provisions at its first session, reviewing and taking into account the interim arrangements referred to in Article 21, paragraph 3, and shall decide whether these interim arrangements shall be maintained. Within four years thereafter, the Conference of the Parties shall review the financial mechanism and take appropriate measures.
5. The developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels.

KYOTO PROTOCOL ARTICLE 12. CLEAN DEVELOPMENT MECHANISM

1. A clean development mechanism is hereby defined.
2. The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.
3. Under the clean development mechanism:

(a)Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

(a) Voluntary participation approved by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

6. The clean development mechanism shall assist in arranging funding of certified project activities as necessary.

7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

9. Participation under the clean development mechanism, including in activities mentioned in paragraph 3(a) above and in the acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.

10. Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

Annex 2: Preparatory files for activity identification

In Chapter 4 of the document entitled "Land use, land use change and forestry" (IPCC, 2000), the IPCC identifies the activities that could participate in climate change mitigation. This approach is repeated here in order to present four forestry or agro-forestry activities that are of particular interest for Africa.

Agro-forestry and multiple-use plantations.

Activity definition/description

Systems in which crops and different plants are combined : trees or bushes based upon their different functions (environmental, agro ecological or production), fertilizing plants (wood plants), medical plants or different crops combined with one another.

These agro-forestry areas act as " carbon sinks" due to the trees planted there. This is based less on the amount of carbon stored per area unit than on the area in question. The karite parks in Mali, for example, cover nearly four million hectares (Griffon and Mallet, 1999).

Use and potential in Africa

Africa can reap important advantages from agroforestry. All the countries located in an "agroclimate area" are capable of applying these techniques, particularly on degraded land. Accessibility to water is an important factor, which excludes countries located in the Sahel region. Agro-forestry, based upon crop and activity diversification, can be more easily developed in areas with a large population density that have an important farm dynamic. Agro-forestry is a tool with considerable potential for Africa.

Present knowledge and scientific uncertainties

Agro-forestry strategies are presently available for the different cultivated ecosystems in Africa, whether these be in dry, humid, high altitude or outlying suburb areas. Present knowledge makes it possible to choose among the different strategies for a given area those that will maximize the producers' benefits as well as those of the communities concerned. The multiple roles played by trees and plants when combined with crops are often little known, as is the case with the methods for optimizing these agroforestry systems.

Methods for calculating the effect of emissions reduction

There are methods for estimating the variations in the quantity of soil carbon and epigean biomass resulting from agroforestry techniques Crop diversity can complicate this estimation process, even though tools have been developed for calculating carbon quantities in small trees and bushes (Palm *et al.,* 2000).

Time scale and controls

A period of ten years is needed for evaluating the impact of these activities on soil carbon stores (IPCC, 2000). Verification can be carried out using several different tools. Direct measurements of soil carbon rates can also be made. GIS[11] techniques can be used, given the structuring of the landscape created by agroforestry activities.

Reversibility and permanence

The risks concerning the possible reversibility of the accumulated carbon stores are principally linked to land use change. Replacement with pasture land or slash-and-burn agriculture is

[11] Geographic information system

conceivable. Natural catastrophes (fire, illness, pests) also represent a risk, although it is a small one in a system of this type.
In order to compensate for the reversibility risks linked to land use change, agroforestry activities must provide a profitable economy with benefits that can be distributed as widely as possible.

Combined impacts
The multi-functional nature of trees and bushes can benefit the environment (soil protection against erosion, water regulation [ground water], maintenance of biological diversity) and have certain agroecological effects as well (maintenance of soil fertility, microclimatic effects on the environment).

This diversified activity provides a source of sustainable supplementary revenue for local communities (medicinal plants, timber, resins). By recreating forestry and pasture areas, it permits the growth of breeding areas that can provide income (Griffon and Mallet, 1999). Agro-forestry also makes it possible to structure rural and landscape space (land ownership determination, organization of agricultural, forestry and pasture spaces).

Reduced impact logging

Activity definition/description
Reduced impact logging is primarily concerned with the conservation of developed forest stands, and consequently with carbon sinks as well. This activity, which falls under the heading of development plans implementation, makes it possible, through the development and utilization of structured felling methods, (planning networks of skidding tracks and wood reserves, directional felling, thinning), to minimize the collateral damage inflicted during the course of ground level forestry felling, and to rivers and trees that have not been harvested. Damage avoided in this manner results in efficient and natural forest regeneration and the maintenance of biodiversity, and also helps remedy the excessive degradation of carbon stores caused by conventional development practices.

Use and potential in Africa
This activity can provide the countries of Central and West Africa (Democratic Republic of Congo, Liberia, Equatorial Guinea, Angola, Gabon, Congo and Cameroon) that have large massifs of dense natural forests with a sustainable management tool for their economically profitable forests, but only under certain conditions. These countries must focus their attention on the sustainable aspect of this activity, since their natural forests will be a principal source of timber for several decades to come (FAO, 1999). In order for them to achieve clear and significant carbon gains as well as development profitability, they must have the firm will to carry out long-term forestry policies covering large land areas.

Present knowledge and scientific uncertainties
The techniques used in low impact development are well known today, as they have often been used in the industrialized countries and have been tested in certain tropical regions for the past several years. The felling rate in Africa of approximately 1-2 saplings/ha (Bertault & Kadir, 1998) is compatible with low impact development techniques. These techniques must however be adapted for use in tropical forests, as they are linked to the dendrological and structural characteristics of these forests. Studies on the dynamics of dense and humid forests are presently under way, in order to facilitate this adaptation. The principal obstacle is the lack of qualified personnel to carry out the necessary inventories, which are indispensable for the planning of the different operational stages of this development activity.

Methods for calculating the effect of emissions reduction
The carbon store calculation method in low impact development projects is based on the inventory carried out at the beginning of the projects. The inventory makes it possible to calculate the amount of carbon store to the ton as well as its evolution, through the use of forecasting models. A "reference scenario" can be created using data from the literature concerning the damage caused by conventional forestry development practices. The carbon stores calculated by taking into account low impact development practices can then be compared to those resulting from the first calculation, in order to establish the environmental additionality of the projects. The data required for these calculations are sufficient at present to precisely define the net carbon gains resulting from these projects.

Time scale and controls
The time scale needed for these sustainable management projects can be seriously affected by the lack of established forestry policies in Africa, which can be a veritable brake on this type of initiative and its potential carbon gains. Once under way however, these projects seldom encounter any real difficulties with regard to follow-up and evaluation. The planning of the projects' operations allows for easily carried out controls, including rapid field visits at regular intervals or aerial photographs, since development damage is clearly visible to the naked eye. This makes it possible to achieve a large degree of transparency regarding the results obtained.

Reversibility and permanence
Aside from natural risks (fire, pests) and illegal exploitation, the major risks involved in low impact development are due to the sustainable character of forestry management. In African countries, price fluctuations for wood that are linked to the economic instability of these countries are conducive to short-term forestry policies that are incompatible with low impact development practices aiming to achieve carbon sink conservation. The employees charged with the task of felling trees are paid according to the volume of wood they produce, which does not encourage them to follow the low impact method of tree felling, which requires a longer time.

If these techniques are correctly applied however (by task planning), productivity can be increased and wood losses reduced (Barreto *et al.,*1998), resulting in an increase in average profits. This type of exploitation can then become profitable. If all the personnel involved were allowed to share in this profitability (by a distribution of profits), the permanent nature of the activity and of the carbon stores would be assured.

Combined impacts
The benefits to the environment provided by low impact development techniques are considerable. They include the preservation of the fauna and flora as well as of the soil and rivers, due primarily to the inventories taken, which make it possible to carefully select the areas to be developed as against those that have an ecological value that should be preserved.
These techniques are a fundamental sustainable management tool that is economically profitable, since they increase development benefits, following an initial phase involving investment, training and familiarization with the tools to be used.
This type of activity carried out within the framework of forestry development can make it possible to obtain certification for the wood produced during the project.

Regeneration / planting

Activity definition/description
Planting young trees on recently deforested land as part of regeneration makes it possible to naturally recreate a forest cover or shelter, in order to restore as precisely as possible the ecological and socioeconomic functions of natural forests.

Plantation for purely commercial reasons is generally undertaken with the objective of cultivating economically worthwhile forestry species (Eucalyptus, mangium acacia), frequently for the timber or wood pulp trade.
These two types of activities contribute to the mitigation of climate change by sequestering organic carbon in biosphere stores, through the photosynthesis mechanisms that transform atmospheric carbon (CO_2) into organic carbon, a tree component.
Production orientation also plays a part in mitigating climate change, by concentrating on the useful life of the forestry products (timber, poles) resulting from regeneration or plantation activities.

Use and potential in Africa
All African countries, apart from those situated in the Sahel region, have the potential for implementing these activities. This depends however on whether they are regeneration or plantation activities.
Regeneration involves deforested areas or degraded lands in favorable agroclimatic areas, where water is available on a sustainable basis.
Plantation requires potential land ownership availability for the private sector. Areas with a low population density are preferable, since the large land areas needed to carry out this activity might compete with the areas allocated to agriculture. As in the case of regeneration activities, water access is a key factor in implementing these projects.

Present knowledge and scientific uncertainties
Many forestry species have been studied, and their reproduction cycles and the silviculture methods associated with them are well understood today. Among these forestry species, a varied range of species used for timber, fuelwood and wood pulp are now available for regeneration or plantation.
Present scientific knowledge however does not permit the cultivation of all the forestry species that have been listed and thus to recreate the original natural forests.

Methods for calculating the effect of emissions reduction
Calculating the variations in carbon stores introduces the problem of time, particularly with regard to regeneration projects. Carbon sequestration activity normally calls for long-term action. Carbon variations are therefore very difficult to precisely quantify.
Certain models (CO_2FIX[12] and LUCS[13]) are used for this calculation, whether in regeneration or plantation. They make it possible to estimate the additional carbon stores in function of the different factors linked to planted forestry species (annual growth, rotation frequency) and the soil (enrichment with organic matter). The calculated quantities are then compared to those which could be produced by another activity (agriculture, pasture), i.e. to a reference scenario.

Controls, verifiability and transparency
Visits and regular studies would be sufficient for verifying the continuity of carbon stores, and in particular for certifying the felling activities (whether unauthorized or not) of planted species, such as the okoume plantations in Gabon.

Reversibility
The principal risk lies in the land use changes resulting from the inadequate viability of regeneration or plantation activities. These activities would be replaced by short-term activities (pasture, crops).

[12] This model is available to the public on Internet site www.efi.fi.
[13] This model is available to the public on Internet site www.wri.org.

Illegal felling can contribute to a decline in the profitability of these activities, such as land degradation resulting from pasturing activity.
Natural catastrophes (epidemics, pests, and fire) are also a reversibility risk, in particular in single species plantation.

Permanence
The conservation of accumulated carbon stores calls for the presence of a manager and the viability of the activity in question (regeneration or plantation), with a fair division of income between the different actors participating in this activity.
A pricing system favoring wood plantation is needed (e.g. no felling tax on the plantations) in order to contribute to the profitability of the forestry activities and their continuity.

Combined impacts
Unlike regeneration activities, plantations present the risk of reducing biological diversity. They do however make it possible to retain runoff waters, thus preserving the ground water, particularly in slope areas. Both of these activities help protect the watersheds, due to the planted species root systems.

Conservation of forests threatened by agricultural conversion

Activity definition/description
The conservation of threatened forests consists principally in slowing down or totally preventing deforestation activities by protecting the areas concerned from the causes of such deforestation. The most commonly employed method is acquiring property in the threatened areas and raising their status to that of a natural reserve or national park. Another method consists of seeking out the causes of this deforestation (agricultural pioneer fronts, demand for wood). In such cases, the actors participating in the deforestation must be reconverted and provided with the wood they require. They could then participate in forest protection activities such as the prevention and surveillance of natural catastrophe risks (fires, pests) and the illegal felling of trees.
These activities could help prevent a large discharge of carbon into the atmosphere by conserving it in biosphere stores, thus limiting the evolution of climate change.

Use and potential in Africa
The African countries that are likely to be concerned by forest conservation activities are those that have large forestry massifs, since the size of the land area to be protected is one of the criteria that must be taken into account for this activity. Six countries would thus be able to implement conservation activities within their frontiers: the Democratic Republic of Congo, Cameroon, the Ivory Coast, Liberia, Madagascar and Mozambique. These countries are located in a climate zone that is favorable for forestry conservation. The Democratic Republic of Congo however, the country that has the largest potential in this regard, is too unstable at the present time to be able to carry out a forestry conservation policy.

Present knowledge and scientific uncertainties
The methodologies used for conserving forests are well known and are being widely applied at the present time. The techniques for preventing forest fires and the ravages of pests have been under study for years, but important work must still be done in this area, and in the battle against insects in particular. The large land area involved in conservation projects is an additional problem that must be resolved.
It is difficult to determine and above all to quantify all the causes of deforestation. The models being used at present are recent ones, created to evaluate the dynamics of land use change at the regional but not the local level.

Methods for calculating the effect of emissions reduction

Calculating emissions reductions linked to conservation projects requires an inventory of the forestry massifs to discover the size of the initial carbon store.

The activities that might have caused the deforestation of these massifs must be qualitatively and quantitatively determined in order to estimate the potential carbon losses. Simulation models of land use change based upon the regional socioeconomic context have been created with this goal in mind. Data from the literature on regional agricultural practices can also be used and extrapolated for the future.

Time and control scale

Conservation projects can be considered long-term perspectives. Supervising the maintenance of carbon stores is therefore of the utmost importance. This can be done by carrying out studies and organizing regular field visits, as well as by surveillance using aerial or satellite photographs.

Reversibility and permanence

The conservation of forestry massifs is the forestry activity in which the risks of reversibility are highly important. Local encouragement for this activity is often very weak. Conservation projects generally do not provide large amounts of income. In order to meet their needs, local communities are often more interested in converting forestry areas into areas that can be cultivated or into pasturage. Illegal exploitation and natural catastrophes are other major risks.

An income source for conservation activities must be created, in order to guarantee the permanence of the protected forestry massifs. The development of ecotourism as well as prevention and surveillance activities can also contribute to this goal.

The development of " buffer zones" can be another way of meeting local needs (wood, land area suitable for cultivation and breeding areas). Surveys regarding these needs must also be undertaken.

Combined impacts

The principal effect of the activities for conserving forestry massifs is in the conservation of their original biological diversity and in the maintenance of biological cycles, including the carbon and water cycles.

In the regions concerned by these activities, the gains can often exceed the mere patrimonial stakes. This type of action can help favor "green tourism". Regional development through ecotourism could be a potential source of income that the local communities would have at their disposal.

Annex 3: The lessons learnt from the AIJ pilot phase in the land-use and forestry sector

1. The projects

In 2000, forty land-use and forestry projects had been implemented in order to contribute to climate change mitigation. Eighteen of these were officially recognized as AIJ projects (Table 1) and registered at the UNFCCC Secretariat. The other projects were not accepted. Some had been undertaken before 1995, the official starting date of the AIJ pilot phase. Some are domestic projects limited to a particular country, some are managed by organizations outside the pilot phase structures (such as the projects managed by the GEF), while others have not received the host country's agreement to allow the project to be carried out. Although these projects were not officially recognized during the pilot phase, they are still interesting to analyze, since reference scenarios and the risks of leakage had to be defined and analyzed.

Approximately thirty of these projects are being carried out at the present time, including nine AIJ projects and about twenty non-AIJ projects. The reason for this low number of projects has most frequently been the lack of financing. Project development under the AIJ pilot phase involved the participation of different actors and organizations: governments, public institutions, non-governmental organizations, private companies, local associations, etc.

Different types of projects were proposed:

- Natural forest conservation through land purchase and/or combat against natural catastrophes and pests (80% of projects areas, nearly 7 M ha, if they are carried through to completion);
- Increase of carbon pools through forestation, reforestation, and agroforestry (5%);
- Reduction of emissions through multiactivities: improvements in forest management, reduced impact logging, diminishing of the pressure on forests by meeting fuelwood needs (15%).

The large number of AIJ conservation projects presented is due to the widely-held belief that these projects are relatively easy to set up (simply by purchasing land parcels), that they are not too costly since they do not involve any real technology transfers, and that they yield numerous " emission credits" given the large areas involved. The environmental additionality of these projects would seem to be evident as well. This idea has tended to become increasingly less clear, whether at the level of costs or that of the projects' additionality. The additionality of these projects is less evident at present than it was before, considering the risks of high leakage connected to these projects. If we consider the lifetime of these projects (an average of 44 years, according to the IPCC), it would seem evident that the costs needed for their implementation and their perennial nature are far larger than might have previously appeared. Projects planned for this long a period must limit reversibility risks (maintenance, surveillance). In addition, this long lifetime implies the need for solid reference scenarios, and a very serious approach that could generate supplementary costs.

Table 1. Types of forestry projects encountered during the AIJ pilot phase

Types of project	Objective	Implementation
Conservation of carbon stocks		
Protection by land purchase and/or reconversion of deforestation actors, battle against natural catastrophes (fire, pests)	♦ Limiting deforestation ♦ Reducing GHGE[14] at a lower cost ♦ Preserving biodiversity ♦ Local community participation	• Inventories • Contracts with proprietors, no deforestation elsewhere • Buffer zones (answering local demand for wood • Ecotourism development (reconversion of proprietors and local community participation) • Surveillance (fire, pests, illegal exploitation) by field visits, surveys, aerial photographs
Reduced impact logging	♦ Sustainable forest management ♦ Reduction of GHGE ♦ Preservation of biodiversity, and of soils and rivers ♦ Transfer of competencies	• Inventories • Use of a GIS[15] • Planning of road networks and storage • Planning of felling operations
Increase of carbon stocks		
Forestation Industrial plantations for timber and wood pulp	♦ Storage of atmospheric CO_2 in the terrestrial biomass ♦ Regional economic development (new markets)	• Purchase of lands • Preparation of terrain (irrigation) • Plantation (Eucalyptus, Mangium acacia) • Maintenance • Eventual development • Replanting or return to copse • Choice of lands for reforestation among the 20 to 40% that can be restored at a reasonable cost
Reforestation on degraded terrain or deforested areas, regeneration and enrichment	♦ Storage of atmospheric CO_2 in the terrestrial biomass ♦ Restoration of degraded lands ♦ Protection of watersheds	• Evaluating degradation causes • Reforestation in function of degradation causes and proprietors objectives' ▪ Progressive enrichment
Multi-activities		
Energy efficiency / forest management	♦ Reduction of GHGE (energy efficiency) ♦ Storage of CO_2 in the terrestrial biomasse and response to local demand for wood (forestry management) ♦ Transfer of competencies and technology ♦ Local community participation	• Use of photo-voltaic systems • Use of new technologies in order to reduce demand for wood (oil stoves, improvement of carbonization) • Forestry management (inventories, fire prevention

[14] Greenhouse gas emissions

[15] Geographic information system (remote sensing, computer-assisted cartography)

2. Stages and actors in JI projects

IDENTIFICATION AND FORMULATION

- Governments ***
- NGO's **
- Private Sector **
- Public sector *
- Local communities

DEFINITION OF REFERENCE SCENARIO AND ADDITIONALITY

- Promoter ***
- Independent body *
- JI national office *

VALIDATION

- JI national office or UNFCCC
- Government of host country

FINANCING

- Governments *** (24)
- Private sector ** (18)
- NGOs * (10)

IMPLEMENTATION (AND CERTIFICATION)

- Private sector *
- NGO's **
- Local communities **
- Independent body (project follow-up, certification)

The asterisks indicate the importance of each party's participation.
The figures in parentheses indicate the number of inventoried cases in the 39 forestry projects.

3. Entities involved in the construction of the reference scenarios

The creation of reference scenarios has most frequently been the work of project promoters (Moura-Costa *et al.,* 2000). Two problems were raised in these cases : the credibility of the results obtained and transparency. It is in the interest of promoters to create a reference scenario that is as high as possible in terms of CO_2 emissions, so that the project's additionality is seen as considerable, since their objective is to obtain the highest possible number of emission credits (Tipper and de Jong, 1998). There has been a very limited distribution of information with regard to the methodology adopted by the promoters. It should also be noted that the methodologies created had not been verified (IPCC, 2000).This lack of transparency creates another problem. When information regarding the development of a project is not available, it becomes very difficult to implement similar projects, which runs counter to one of the Convention's objectives.

Where projects have been implemented by governments, such as the *Olafo* project in Guatemala, or the Burkina Faso project, the reference scenarios have been defined by agencies affiliated with these governments, research institutes or universities. This did not prevent a lack of transparency in the methodology applied for the definition of the reference scenarios (Dixon, 1999).

Methodologies have been created by several independent bodies or by third parties in order to compensate for the lack of transparency and the questionable credibility of the reference scenarios. National AIJ offices such as the one in Costa Rica have created reference scenarios,

particularly for the PAP (Protected Area Project) project, regrouping the old *CARFIX* and *BIODIVERSIFIX* projects. Other independent bodies, including auditing consultants (such as SGS Forestry, for example), and supervisory bodies (such as Winrock International, for example), that evaluate the emission credits to be allocated, have created or re-evaluated reference scenarios. The credibility of reference scenarios has thus been reinforced, in spite of the fact that transparency is not always present, except in the case of the AIJ national offices. It is at this level that the private sector has been most active, with evaluation consultancies "growing like mushrooms" (Dixon, 1999).

Since reference scenarios have been developed by bodies as diverse as those noted above, it is hardly surprising to find this diversity reflected in the scenarios and methodologies that were created during the first AIJ pilot phase. Furthermore, the pilot phase was established in order to have different methodologies emerge, so as to compare them with one another and be able to create the most solid reference scenarios in the future, thus achieving the most accurate environmental additionality for the proposed projects.

Different types of reference scenarios were created, either by following the forestry sector's varied activities, or by following projects within the same activity.

Although a variety of reference scenarios were created during the course of the AIJ pilot phase, two fundamental stages were followed in all the projects, in order to establish these scenarios and calculate the environmental additionality of the projects (IPCC, 2000). The first of these involved providing for the probable evolution of the terrestrial ecosystems within the borders of the area that the proposed project was dealing with. The second stage consisted of estimating the carbon stock variations in that area, according to the hypotheses that had been put forward during the first stage.

4. Formulating hypotheses for the reference scenario

Two different lines of conduct were followed in attempting to foresee the future of the ecosystems concerned by the project. The first was based on an hypothesis using simple and qualitative arguments, while the second used simulation models for forecasting this activity.

Simple qualitative reference scenarios

The first line of conduct was adopted in a majority of the projects. The reference scenarios were drawn upon the basis of simple and qualitative arguments (Table 2). Hypotheses were generally similar within a same type of projects. (This helps demonstrate the qualitative aspect of the hypotheses posed by the promoters.) For forestation projects (*RUSAFOR)* and plantation projects (*Green Fleet Initiative)* on degraded lands, the hypotheses proposed led to the assumption that the carbon stocks would remain at the zero level. For most of the conservation projects (conservation or reduced impact logging), the hypotheses were based on past local practices and an extrapolation of the deforestation rates (*Noel Kempff* project in Bolivia, the *A E S Mbaracayu Initiative* in Paraguay, and the *Protected Areas Project* in Costa Rica). Other conservation projects (*Rio Bravo* project in Belize) assumed a conversion of the project area into cultivated land or pasture. Different qualitative hypotheses have also been proposed with regard to local development (projects financed by the GEF). The variation of the soil carbon stock has usually not been taken into account in the reference scenarios, except in three projects (*Scolel Te, RUSAFOR* and *ECOLAND*).

Alongside with past local practices, other variable were used in most of the project reports by the promoters to advance the different hypotheses (Table 2). Certain important variables such as demographic evolution (population growth and movements) or the forestry policy of a region or a country were very rarely evoked in the reference scenarios.

Table 2. Hypotheses and variables in the simple approach to reference scenarios

Hypotheses	No evolution of degraded lands Constant reduction of carbon stocks Land use change (forests to cultivated land) Constant soil carbon (or not) Local development (or not)
Variables	Project lifetime Deforestation factors and rates Illegal harvests Local socio-economic environment Previous local practices Regional and national economic tendencies Evolution of the wood market Forestry policies (legislation) Demography

Hypotheses based on simple arguments do not make the development of a reference scenario any the less rigorous, if all the variables regarding the evolution of a project's implantation area are taken into consideration. In the case of projects in which commercial plantations must be created, using simple arguments to state that some land is going to remain degraded is quite as valid as any other method used.

These arguments are qualitative or they offer approximate figures such as : " the forest will disappear in ...x... years", or " the carbon stores will continue to decrease by ...x%... each year", for example (Pinard and Putz, 1997 : Tipper *et al.,* 1998 ; Brown *et al.,* 2000). This prevents us from obtaining a precise reference scenario with regard to the calculation of greenhouse gas emissions. These hypotheses, taken as they are from simple arguments, demonstrate a linear evolution of the ecosystems concerned (constant deforestation rate, invariability in the rhythm of forest transformation to cultivated lands). It is highly unlikely that this will be the case. It is possible for a deforestation tendency to reverse itself, as was the case in many developed countries during the course of the past century (Chomitz, 1999). Demographic evolution is not linear either, and this factor plays an important role in the fate of ecosystems.

Complex reference scenarios based on models

The second line of conduct adopted by promoters in developing reference scenarios involved the use of models[16]. This approach was not frequent. It was for example used in the *Scolel Te* project in Mexico, the *Guaraquecaba* project in Brazil, as well as in the projects undertaken by the FACE Foundation.

These models, such as the LUCS model developed by the WRI and used in the *Guaraquecaba* project, all take into account the precise and quantitative variables involved, in order to foresee the fate of the ecosystems concerned and what alternative activity would be provided in the event the proposed project was not implemented. The proposed models integrate spatial, social and economic factors (See table3).

[16] The models used are available without cost on Internet or by mail. The LUCS model can be downloaded from the World Resources Institute's Internet site, www.wri.org. The model used by the FACE Foundation can also be downloaded from the European Forestry Institute's Internet site, www.efi.fi.

Table 3. General variables used in baseline elaboration models

Social factors	Population growth Use of wood Technology change Harvesting practices
Economic factors	Energy demand Food demand Local agricultural activity Local economy
Spatial factors	Proximity of towns Proximity of roads

In several cases, the models were more precise than the hypotheses based upon simple arguments. Since these models are quite complicated, they required a large amount of data, which is of course only available at the regional level. This is an indication of their lower limit: models were unable to take into account any changes at the local level. The usefulness of these models is therefore questionable in the case of small-scale projects, since a great deal of data concerning local communities is not available. The *Scolel Te* project in Mexico nevertheless adjusted the model in function of local community needs; the cost of this procedure was estimated US$ 20,000 (UNFCCC).

5. Estimating carbon stocks of the reference scenario

Once the reference scenarios were created, the promoters had to calculate the corresponding carbon stock variations. The IPCC has proposed a calculation method (IPCC, 1997), but the promoters usually made use of others. A number of different methods were created as a result.

One of these methods involved the use of data taken from the available literature. This approach, which is the most widely used, had been chosen in particular for the projects based on hypotheses employing simple arguments (*Bilsa Biological Reserve,* Rio Bravo, CARFIX, for example). The information used had been taken from different sources: FAO and FAO/CEE statistics, as well as regional or national statistics, relative to land use, agricultural production, forestry dynamics and different social factors (the need for wood and food).

Another method involved the creation of models. Only a few projects used this method: four officially registered at the UNFCCC Secretariat (*Forest Rehabilitation of the Krkonose and Sumava National Parks* in the Czech Republic, *Rio Condor* in Chili, *Reforestation and Forest Conservation* in Costa Rica and *Scolel Te* in Mexico), as well as several other projects that are not officially AIJ projects. These models, like the FACE Foundation's CO_2FIX model, made it possible to calculate the amount of biomass supposed to be present in the reference scenarios, while taking into account an important number of parameters concerning plants dynamics as well as forestry and agricultural practices. The limit of these models lies in their assumption that the calculated carbon amount has been either constant or in constant evolution during the entire course of the project (particularly in conservation projects). Forest dynamics are not constant during the course of its evolution, and in particular at the level of its carbon sequestration capacity. This renders the values obtained by the CO_2FIX model relatively artificial, *a priori*. This approach could nevertheless become a usable method, on condition that it be brought up to date during the project's full lifetime.

A third method based on measuring carbon quantities in control land parcels or in areas near the proposed projects has been used by several projects: *RUSAFOR* in the Russian Federation, *Noel Kempff Mercado Climate Action* in Bolivia, *Community Silviculture in Oaxaca* in Mexico and *A E S CARE* in Guatemala. The advantage offered by a method of this sort is that it makes it possible to carry out a follow-up procedure during the course of the project, and to re-evaluate the

reference scenario. This characteristic had only been envisaged in a single project (*Noel Kempff Mercado Climate Action*). It should be noted that these control parcels also served as "buffer zones" for evaluating and attempting to limit leakage.

Some projects like the one involving Burkina Faso, or the *PROFAFOR* project in Ecuador, have combined available literature data with measures in control land parcels. The promoters of two other projects have not included any emission calculations in their reference scenario (*KLINKI* project in Costa Rica and *Commercial Reforestation in the Chiriqui Province* in Panama). Instead, they assumed a zero and constant carbon quantity in the reference scenarios throughout the projects' entire lifetime, these reforestation projects having been planned for degraded lands, presumed to have no possibility of evolution.

6. Different types of reference scenarios

Although the methodologies for evaluating the reference scenarios were different, four types of scenarios were inventoried during the course of the AIJ pilot phase (official AIJ and non-AIJ projects combined): "project-specific" scenarios, "generic" scenarios, static scenarios and dynamic scenarios (Table 4).

Project-specific vs. generic scenarios:

Project-specific" scenarios represent ninety percent of the scenarios created during the course of the pilot phase. This large percentage is due to the fact that the development of these scenarios makes it possible to broaden one's knowledge of the local areas concerned, and therefore to precisely predict, *a priori*, the number of emissions there. Unfortunately, this method also allows promoters to discreetly elaborate "favorable" reference scenarios (heavy deforestation), thereby maximizing the additionality of the projects and consequently the potential emissions credits (Tipper and de Jong, 1998). The specific nature of these scenarios makes it difficult to copy them for use in similar projects. Only the *New England Electric System* project in Malaysia, a low impact exploitation project, proposed a scenario based on another similar existing project, the *ICSB-NEP 1* project in Malaysia (IPCC, 2000). The principal problem posed specific scenarios is their creation costs. These costs totaled US$ 300,000 in the *AES CARE* project in Guatemala[17].

Using generic scenarios make it possible to reduce the costs of baseline establishment. Generic scenarios concern different levels: the regional level (land use, agricultural practices), the technical level (agricultural and forestry techniques), or the sectoral level (conservation, low impact development, plantations). Only regional generic scenarios were used under the course of the first AIJ pilot phase. The different generic scenarios have been more frequently evaluated in the energy sector (Baumert, 1999; Michaelowa, 1999), since generic scenarios using technological references are viable in this sector. The problem is somewhat different in the forestry sector, where one refers more to technical packages and know-how than to actual technology. The transparency of this type of scenario proved to be effective in the case of the Costa Rica projects due to the intervention of an external organization in the development of the projects. The fact that these scenarios lack precision is a disadvantage, since they cannot take local level changes into consideration. The *Scolel Te* project attempted to remedy this problem by including adjustments. Unfortunately, too few examples were available during the course of the AIJ pilot phase: *Solel Te* (Mexico), *PROFAFOR* (Ecuador) and *CARFIX* and *BIODIVERSITY* (Costa Rica). In the last two cases, the reference scenarios were based on the deforestation rates at the regional level and applied to the projects. This system was developed by the AIJ national office in Costa Rica.

[17] Data provided by the www.oecd.org web-site.

Static vs. dynamic scenarios

The other point concerns the adjustment of reference scenarios during the implementation of the projects. In nearly all cases, the reference scenarios were firmly set for the entire project lifetime. A UNFCCC report (1997) had indicated that scenarios should not be revisable, in order to limit the supplementary costs the projects would have to absorb.

"Static" scenarios avoid supplementary costs but have less credibility. Considering the average lifetime of forestry projects, it is almost impossible to estimate precisely long-term carbon emissions associated to such projects. Static scenarios therefore can only provide relatively artificial results. They do nevertheless provide investors with some visibility and minimize the risks attendant upon distributed emission credits.

"Dynamic" scenarios have the advantage of providing regular up-dating and a true calculation of carbon emissions. Apart from the risks to investors (the possibility of a less favorable situation resulting in fewer credits than expected), this method can result in supplementary costs. One must furthermore be able to differentiate between changes that have occurred independently of the project and those changes resulting from the project's implementation.

7. Taking into account leakage risks

Leakage received little attention during the pilot phase. This phenomenon was often only touched upon and no precise calculation of eventual carbon losses was presented by any project. Promoters were tempted to estimate leakage by defining an evaluation area, as for example, the project's boundaries or the neighboring region. In numerous cases, the leakage effects might have been neglected when the promoters stopped at the projects' borders (as in the RUSAFOR project, for example). Consequently, in order to evaluate leakage, the first method used was to widen the Surabaya area. The promoters were thus able to evaluate the possible risks by considering the factors that could cause deforestation effects elsewhere (growth and population movements - Brown, 1998).The disadvantage of this method lies in the fact that it does not make it possible to truly quantify the losses resulting from the implementation of projects. It only allows an evaluation of the origin of possible risks and this in a qualitative manner.

The other method, which is hardly used, is based upon a more quantitative approach. It was employed during the course of the *Noel Kempff* conservation project pilot phase in Bolivia, as well as in several reduced-impact logging projects. This method is based on the use of certain key factors that can signal the eventual risk of leakage. In conservation projects for example, the key factor is wood production. If production decreases as a result of the project, the leakage effect can possibly intervene (an increase in the development effort elsewhere). The method consists then in comparing the level of these indicators with regard to a " with the project" situation and a " without the project" situation. This method is of interest because it can be adapted to different levels: local, regional, national and even international if one takes exportation factors into consideration.

When the risks of leakage were recognized, different methods of dealing with them were tested, principally in conservation projects where the risks are highest. One of the methods used was the acquisition of so-called secure lands by having the proprietors sign "promises" not to develop other forest parcels and then having them participate in conservation activities (surveillance). This does not solve the problem of landless farmers, unfortunately.

Another method that was used in a number of projects (*ECOLAND, Rio Bravo, Noel Kempff, Uganda National Parks)* was the promotion of ecotourism, in order to develop the regions concerned by these projects. Here again, it is far from certain that the beneficiaries of ecotourism activities are the actors most involved in deforestation.

Certain multi-activity projects (*CARFIX, BIODIVERSIFIX,* for example) have been carried out grouping conservation and forestry management or plantation activities. They have the advantage of conserving forest parcels (the conservation part) and answering the wood needs of local communities (the forestry management part). This method involved associating energy sector activities with forestry management activities in the Burkina Faso project.

Periodic controls (aerial photographs, terrestrial surveillance) as well as financial methods (insurance, contingency funds) have also been used. Certain promoters have calculated the additionality of their project by arbitrarily taking into account a margin of error based on leakage. The Government of Costa Rica only delivers half of the emission credits that could be distributed in order to compensate for the eventual leakage in its national projects.

References

Baumert, K.A., 1999: The Clean Development Mechanism: understanding additionality. In: Promoting Development while Limiting Greenhouse Gas Emissions: Trends and Baselines. United Nations Development Program (UNDP) and World Resources Institute, United Nations Publications, New York, N.Y., USA, pp. 135–145.

Brown, P., 1998: Climate, Biodiversity and Forests. World Resources Institute, Washington, DC, USA, 35 pp.

Brown, S., M. Burnham, M. Delany, R. Vaca, M. Powell, and **A. Moreno**, 2000: Issues and challenges for forest-based carbon-offset Projects: A case study of the Noel Kempff Climate Action Project in Bolivia. Mitigation and Adaptation Strategies for Global Change, (sous presse).

Chomitz, K.M., E. Brenes and **L. Constantino**, 1999: Financing environmental services: The Costa Rican Experience and its implications. The Science of the Total Environment, 240, 157–169.

Dixon, R.K., 1999: The U.N. Framework Convention on climate change Activity Implemented Jointly (AIJ) Pilot: Experiences and Lessons Learned. Ed. Kluwer Academic Publishersz. Dordrecht/Boston/London. 421 pp.

GIEC, 1997: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories [J.T. Houghton, L.G. Meira Filho, B. Lim, K. Tréanton, I. Mamaty, Y. Bonduki, D.J. Griggs, B.A. Callander (eds.)]. Intergovernmental Panel on climate change, Meteorological Office, Bracknell, United Kingdom.

– Volume 1: Greenhouse Gas Inventory Reporting Instructions. 130 pp.
– Volume 2: Greenhouse Gas Inventory Workbook. 346 pp.
– Volume 3: Greenhouse Gas Inventory Reference Manual. 482 pp.

GIEC, 2000: Special Report on Land Use, Land-Use Change and Forestry. [Robert T. Watson Ian R. Noble Bert Bolin N.H. Ravindranath David J. Verardo David J. Dokken (eds)]. Intergovernmental Panel on climate change, Meteorological Office, Bracknell, United Kingdom, Bracknell, United Kingdom. 377 pp.

Lile, R.; Powell, M.Toman, M., 1998: Implementing the Clean Development Mechanism: Lessons from U.S. Private-Sector Participation in Activities Implmented Jointly, Discussion paper 99-0088, Resources for the Future, Washington, D.C.

Matsuo, N., 1999: Baselines as the critical issue of CDM—possible pathways to standardization. In: Proceeding of the Global Industrial and Social Progress Research Institute (GISPRI) Baseline Workshop, 25–26 February. GISPRI, Tokyo, Japan, pp. 9–21.

Michaelowa, A., 1998: Joint Implementation—the baseline issue. Global Environmental Change, 8, 81–92.

Michaelowa, A., 1999: Baseline Methodologies for the CDM—Which Road to Take. Paper presented at the Institute for Global and Environmental Strategies (IGES) meeting, 23 June 1999, Tokyo, Japan, 12 pp.

Moura-Costa, P., M. Stuart, M. Pinard and **G. Phillips**, 2000: Issues related to monitoring, verification and certification of forestry-based carbon offset projects. Mitigation and Adaptation Strategies for Global Change, (sous presse).

Pinard, M. and **F. Putz**, 1997: Monitoring carbon sequestration benefits associated with reduced-impact logging project in Malaysia. Mitigation and Adaptation Strategies for Global Change, 2, 203–215.

Puhl, I., 1998: Status of Research on Project Baselines Under the UNFCCC and the Kyoto Protocol. Organization for Economic Cooperation and Development and International Energy Agency Information Paper. Organization for Economic Cooperation and Development, Paris, France, 15 pp.

Tipper, R. and **B.H. de Jong**, 1998: Quantification and regulation of carbon offsets from forestry: comparison of alternative methodologies, with special reference to Chiapas, Mexico. Commonwealth Forestry Review, 77, 219–228.

Tipper, R., B.H. de Jong, S. Ochoa-Gaona, M.L Soto-Pinto, M.A. Castillo-Santiago, G. Montoya-Gómez and **I. March-Mifsut**, 1998: Assessment of the Cost of Large Scale Forestry for CO_2 Sequestration: Evidence from Chiapas, Mexico. Report PH12, International Energy Agency Greenhouse Gas R&D Program, Cheltenham, Gloucester, United Kingdom, 87 pp.

United Nations climate change convention Secretariat (UNCCCS), 1997: UNFCCC AIJ Methodological Issues.

Internet Sites:

www.aesc.com - site describing the projects undertaken by AES.
www.efi.fi - European Forestry Institute site. Possibility to download the CO_2FIX model with its description.
www.gcrio.org - American information site on research concerning global change. Publications and numerous links.
www.gefweb.org - GEF site. Description of GEF projects.
www.ifc.org - International Finance Corporation site (World Bank).
www.ipcc.ch - Intergovernmental Group on climate change site. LULUCF Report. IPCC, 2000 can be downloaded.
www.ji.org - American site for MOC projects.
www.nefco.org - Nordic Environment Finance Corporation site. Economic data on MOC projects.
www.oecd.org - Organization for Economic Cooperation and Development site. Economic statistics and reports on flexibility mechanisms.
www.pfbelize.org - Belize conservation project site.
www.wri.org - World Resources Institute site. Model for the creation of reference scenarios available on line. Publications on research concerning reference scenarios.
www.unfccc.int - official site of the United Nations Framework Convention on climate change. reports of MOC projects on line

Africa, though contributing relatively little to Climate Change, could be one of its major victims.With this publication, FAO seeks to inform African carbon sink experts and the African forestry sector about Climate Change, the agreements reached, the current state of the Clean Development Mechanism, other opportunities for forest conservation, adaptation and mitigation, and about prerequisites for implementation. Insofar as the negotiations continue to evolve rapidly, this publication should be seen as "shooting at a moving target".

Y9704E