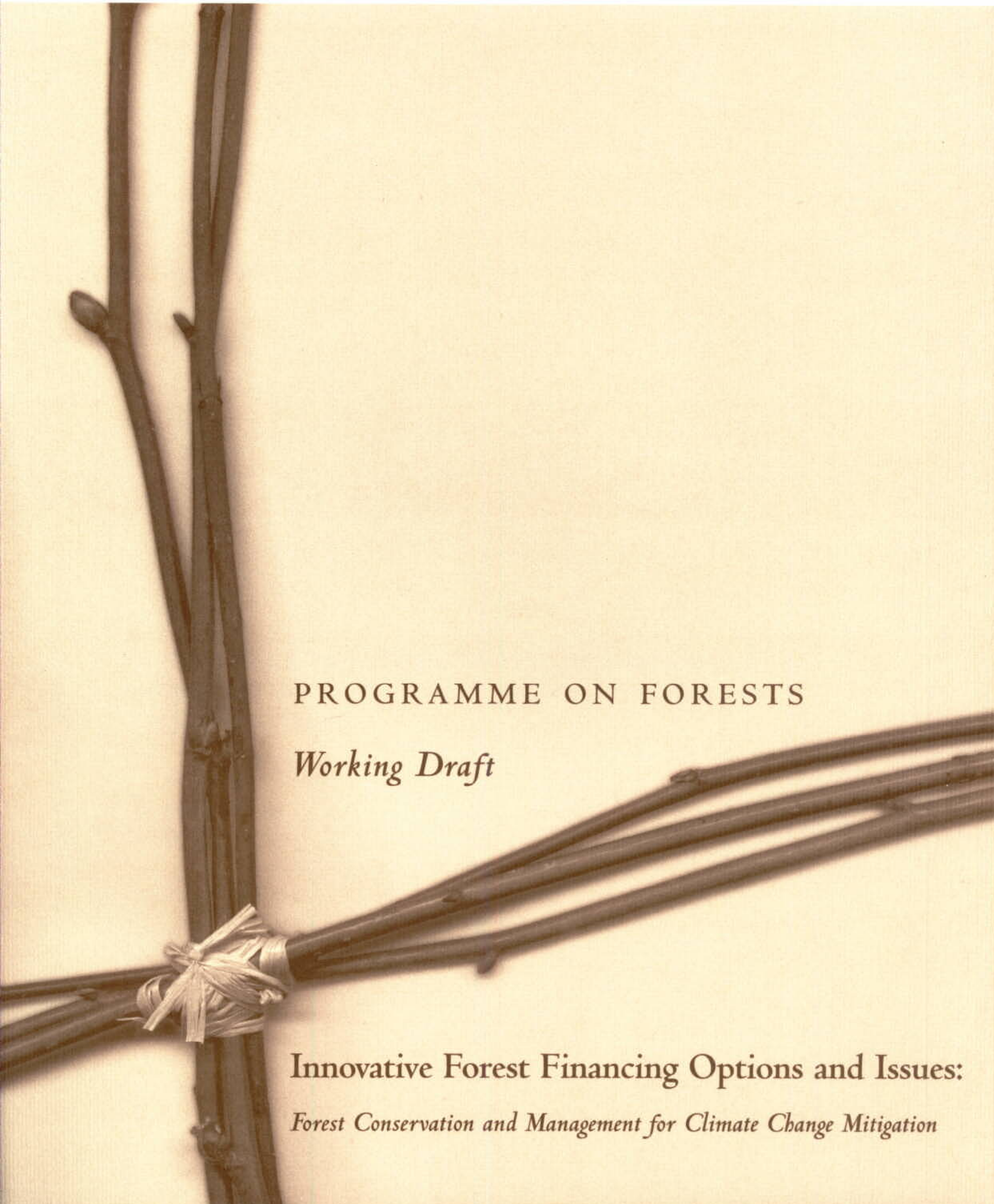

PROGRAMME ON FORESTS

Working Draft

Innovative Forest Financing Options and Issues:

Forest Conservation and Management for Climate Change Mitigation

PROFOR

INNOVATIVE FOREST FINANCING OPTIONS AND ISSUES:
FOREST CONSERVATION AND MANAGEMENT FOR CLIMATE CHANGE MITIGATION

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PREFACE

The Kyoto Protocol adopted in December 1997 at the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), reinforces the need for all Parties to take action to achieve sustainable development. The Protocol includes a number of so-called flexibility mechanisms to assist countries in this regard, including Joint Implementation, the Clean Development Mechanism, and emissions trading.

UNDP has a key role to play in reconciling climate change mitigation and sustainable human development. Indeed, the measures that are key to sustainable development and sustainable energy use (energy efficiency, renewable energy, new technologies, and forest conservation) are also measures that limit greenhouse gas emissions. UNDP's strategy is therefore to continue, expand, and accelerate its support to countries in achieving their sustainable development goals, but, at the same time, to provide technical assistance to programme countries in clarifying issues related to the new implementation mechanisms proposed under the Kyoto Protocol.

The goal of the UNDP's Programme on Forests is to promote sustainable forest management and related public and private sector partnerships at the country level. The program consists of three independent yet mutually reinforcing components: (1) identifying successful strategies for sustainable forest management (SFM); (2) strengthening National Forest Programs (NFPs) and Forest Partnership Agreements (FPAs) as instruments to promote SFM, and (3) developing innovative financing mechanisms for SFM, with a specific focus on public-private partnerships.

This issues paper focuses on the exploration of one potential innovative financing mechanism for SFM activities, namely the Clean Development Mechanism (CDM) created under Article 12 of the Kyoto Protocol. The materials specifically focus on issues associated with the potential use of forest protection and forest management as the basis for climate change mitigation projects under the CDM. Recognizing that significant uncertainties still exist regarding how the CDM will be interpreted and implemented, special attention has been given to the types of criteria likely to be proposed as negotiations proceed on the CDM.

As an issues paper, it is not the goal of this study to comprehensively review or solve all of the matters under discussion relating to climate change mitigation projects under the Kyoto Protocol, the Clean Development Mechanism, or even as the CDM applies to the forestry sector. Instead, the paper is primarily intended to foster and facilitate discussion of how climate change mitigation funding through the CDM or other vehicles might be used to assist the forestry sector and sustainable development goals of developing countries, and by association the objectives of UNDP's Programme on Forests.

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EXECUTIVE SUMMARY

As scientists, governmental decisionmakers, and the international community in general come to understand the impact of human activities on the global climate, the prospect of having to implement greenhouse gas (GHG) emissions reduction targets and timetables becomes ever more likely. With growing political and scientific consensus that the accumulation of greenhouse gases in the atmosphere can have serious deleterious effects on the global environment, the nature of the international policy debate has shifted dramatically from arguing about whether anything needs to be done to focusing on what can be done, when it can be done, and how much it will cost.

This Issues Paper examines the opportunities for climate change mitigation through forest and land use-based carbon offsets and places these opportunities in the overall context of evolving international policy negotiations and strategies for reducing the likelihood of significant human interference with global climate patterns. The intent is to frame a discussion of the best approach for an innovative forest financing project for non-Annex 1 countries with abundant forest reserves and a particular interest in the outcomes of international policy development in this area.

A Climate Change Mitigation Overview

Greenhouse gas emissions arise from numerous human activities and natural processes, including: land conversion and transformation, fossil fuel (coal and oil) burning, waste disposal, and livestock. As a result, opportunities for mitigating their accumulation in the atmosphere will arise from a number of different sectors within society. Current thinking about mitigation options looks at three broad categories:

- *Avoiding production of CO_2 in the first place* by improving energy production and conversion efficiencies, preventing the loss of threatened forests, promoting demand side management efforts, or subsidizing the switch from carbon-intensive fuels (such as coal) to less carbon-intensive fuels (such as natural gas or renewable energy sources).

- *Removing CO_2 from the atmosphere after it has been released* by planting new trees, improving management and growth rates of existing trees, changing agricultural practices to increase soil carbon uptake, or growing and utilizing energy crops.

- *Reducing the emissions or production of other greenhouse gases* by reducing emissions of methane (landfills, coal mines, natural gas pipeline leakage, and livestock), nitrous oxide (biomass burning and agricultural fertilizers), and chlorofluorocarbons and chlorofluorocarbon substitutes (air conditioning and propellants). These measures are usually expressed in terms of CO_2 equivalents, based on the global warming potential of the different gases.

In the forestry sector specifically, a number of mitigation options are available:

1) Slowing or stopping the loss of existing forests, thus preserving current carbon reservoirs.

2) Adding to the planet's vegetative cover, thus enlarging living terrestrial carbon reservoirs.

3) Increasing the carbon stored in carbon reservoirs such as agricultural soils and wood products.

4) Substituting sustainable biomass energy sources for fossil fuel consumption.

A significant number of carbon offset projects along these lines are already underway. We now have almost a decade of experience since AES Corp., a U.S. independent power producer (IPP), voluntarily undertook in 1989 to offset CO_2 emissions of a planned coal-fired power plant in Connecticut through a social forestry project in Guatemala, in what is considered the first offset project. Today, many companies both in the United States and internationally are investigating or actively pursuing forestry or other greenhouse gas mitigation projects around the world. Projects existing today generally fall into the following categories:

- Protected area establishment or reinforcement
- Forest management
- Reduced-impact logging and expansion of sustainable forestry practices
- Reforestation
- Soil carbon accumulation

Projects are underway in both industrialized and developing countries, including the United States, the Czech Republic, Russia, Guatemala, Paraguay, Costa Rica, Belize, Bolivia, Colombia, and Malaysia.

The Evolving Policy Framework

The U.N. Framework Convention on Climate Change (FCCC), signed by 155 countries at the U.N. Conference on Environment and Development in Rio de Janeiro in 1992, calls for stabilizing "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous [human] interference with the climate system." It calls upon the industrialized (or Annex I) countries to take measures to limit CO_2 emissions to 1990 levels by the year 2000 and to provide detailed information on progress towards this target.

The Kyoto Protocol goes a step further, establishing binding emissions reduction targets for industrialized countries. It also creates several "flexibility mechanisms" that will promote widespread pursuit of the kinds of carbon offset projects introduced above. Of most relevance to developing countries without formal emissions reduction obligations under the Kyoto Protocol is the newly created Clean Development Mechanism (CDM).

The Clean Development Mechanism

The CDM, created by Article 12 of the Kyoto Protocol, establishes a means by which industrialized countries and companies can pursue climate mitigation projects in developing countries and receive offset credits that can be applied against their own emissions targets. The CDM has the potential to facilitate the annual flow of billions of dollars from industrialized to developing countries for climate change, environmental protection, and sustainable development projects.

Under the terms of the Kyoto Protocol, decisions relating to the development of operational criteria and structures for the CDM are to be made by the first Meeting of the Parties to the ratified Protocol. This meeting is not likely to occur for several years. In an effort to reduce economic uncertainties associated with Protocol compliance, a great deal of work toward pinning down the meaning and functioning of the Protocol is likely to be undertaken in the next one to two years. Many countries and interest groups regard making progress on these issues as one of the primary challenges facing the Parties during the upcoming Fourth Conference of the Parties in Buenos Aires (COP-4) in November 1998.

How the CDM ultimately will treat land-use and forestry-based carbon offset projects is still widely regarded as unclear. Despite the range of options available, forestry has been a contentious topic in climate change mitigation. Concerns being voiced regarding the use of forestry for mitigation purposes fall into several broad categories:

- That forestry projects might cause environmental damage and impede socioeconomic development in developing countries;
- That forestry and land use change mitigation efforts might impede progress on achieving actual emissions reductions and interfere with technology transfer objectives;
- That biotic offsets involve more unsolved complex analytical issues than do energy and other GHG offsets, including monitoring and compliance issues; and
- That the mitigation benefits of land use-based offsets are potentially temporary.

Extensive work on forestry mitigation options, however, has shown that most of these concerns can be successfully addressed. Indeed, forestry and land use-based mitigation options are far more similar to other mitigation options than they are different. Of key importance in thinking about forestry-sector mitigation efforts are the co-benefits often associated with these projects. Forestry projects offer excellent opportunities for developing countries to advance a series of objectives ranging from sustainable development to biodiversity conservation.

Countries have a near-term opportunity to influence the course of CDM policy development and to ensure that their interests are represented. A number of Latin American countries, for example, are urging the inclusion of sinks as a mitigation strategy under Article 12 of the Kyoto Protocol, since forest loss constitutes their most significant source of GHG emissions and their most significant mitigation opportunity.

Predicting the Carbon Offset Market

Forestry and land use-based mitigation projects such as those outlined in this report are just one part of a larger set of mitigation options that will be available to governments and industries under any future GHG emissions reduction regime. As a mitigation technology, carbon sequestration in its various forms will need to compete with other technologies for funding in a competitive marketplace. It will no longer be enough to know that forestry-based options exist or that their technical potential is large; it will be a matter of determining how effectively these biotic options can respond to the needs of mitigation services purchasers, how well they can adapt to the eventual market for GHG emissions reductions, and whether they can cost-effectively compete with other mitigation technologies.

From the standpoint of a host country, forestry deals will be implemented if project benefits (to either the government or to private landowners) are larger than those from alternative land uses (e.g. logging, pasture). In other words, the benefits of the carbon offset must be greater than the opportunity costs. Benefits might include biodiversity conservation, watershed protection, enhanced ecotourism potential, and expanded marketing of non-timber forest products. These co-benefits will be weighed against the opportunity costs of diminished timber sales and secondary processing opportunities, such as value-added revenues, employment and other multipliers.

Designing a Forest-Based CDM Project

Based on the history of air emissions offsets generally, as well as current thinking around joint implementation and the CDM, it is possible to identify the general variables likely to be most important in designing CDM projects. The most important of these variables are introduced below:

- Being able to show that the project's greenhouse gas benefits would not have occurred "but for" the project.

- Showing that the project will have greenhouse gas benefits and that they will persist over the long-term.

- Addressing the potential "leakage" of the project's carbon benefits.

- Accurately quantifying the carbon benefits of the project.

- The ability to design an effective monitoring and verification strategy.
- Illustrating the magnitude and type of project co-benefits.

There is considerable scope for developing countries to offer CO_2 offset services through forest-based mitigation projects. The current policy context presents a unique opportunity for governments and policymakers to develop their knowledge of climate change issues and their positions on key developing policy issues. Countries that take an early lead in establishing viable and compelling forestry projects will be in a strong position to make a significant contribution to the design of the CDM and to influence the decisionmaking process as it relates to inclusion of forest and land-use based projects.

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1. BACKGROUND TO THE CLIMATE CHANGE ISSUE

The general subject of climate change is probably the most significant and most studied environmental subject. It has proven a contentious debate in several areas, particularly the underlying science, the potential impacts, and the options and costs of mitigating climate change. These three subjects are briefly reviewed below to set the stage for further discussion.

Climate Change Science

The science of climate change is based on the heat-trapping properties of certain atmospheric gases known as "greenhouse gases." The most important of these gases are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Naturally occurring concentrations of these gases have the effect, in conjunction with water vapor, of raising average global temperatures by about 33°C (59°F) from what they would be without any natural greenhouse effect. In doing so, these gases make life on the planet possible. There is no scientific dispute or disagreement regarding the basic functioning of the natural greenhouse effect.

The long-term correlation between greenhouse gas concentrations and global temperatures is well proven, thanks to analysis of ice core samples from Antarctica that trace CO_2 concentrations back 160,000 years. In recent years, atmospheric concentrations of greenhouse gases have risen rapidly due to human activities. Carbon dioxide, for example, is released into the atmosphere as a result of burning fossil fuels and clearing forests and vegetation. These activities emit close to seven billion tons of carbon as CO_2 to the atmosphere every year. Current concentrations of atmospheric CO_2 have reached 361 parts per million (ppm); this concentration is higher than at any time in the past 150,000 years. It is 30 percent higher than levels that prevailed before the Industrial Revolution. In addition, new gases with powerful greenhouse properties are being added to the atmosphere through human activities, including chlorofluorocarbons (CFCs), which have also been implicated in ozone depletion.

Concern over potential human interference with the climate system dates back to the work of Swedish chemist Svante Arrhenius in 1896. Arrhenius predicted that a doubling of CO_2 concentrations in the atmosphere would raise global mean temperatures by 4-6°C. It wasn't until the 1950s, however, that scientists began continuous monitoring of atmospheric CO_2 concentrations. The first theoretical models of atmospheric air current circulation were developed in the 1960s; these evolved into the family of general circulation models that are currently used to understand the functioning of the global climate and to project the potential implications of human activities on global climate. By the 1980s, more and more scientific attention was being focused on the climate change issue.

A scientific and political milestone in climate change policy development occurred in 1988 with the establishment of the Intergovernmental Panel on Climate Change (IPCC). The IPCC was charged with providing "internationally coordinated assessments of the magnitude, timing and potential environmental and socioeconomic impact of climate change." While it does not conduct climatic research itself, the IPCC is considered *the* body charged with reviewing and interpreting the myriad research efforts that are currently underway. The IPCC is the technical advisory body to the U.N. Framework Convention on Climate Change.

Since its creation in 1988, the IPCC has released two major reports. The First Assessment Report was issued in 1990 (IPCC, 1990a; 1990b; 1990c); the IPCC's Second Assessment Report was released in 1995 (IPCC, 1996a; 1996b; 1996c). The IPCC's first report concluded that "emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases. . . . These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface." The report predicted that "business as usual" emissions of greenhouse gases would result in 1.5 to 4.5 degrees C of warming and 65 centimeters of sea level rise by 2100. This is a rate of change unprecedented in human history. The report did not conclude, however, that human activities were already having a perceptible impact on the climate, stating that natural variability of the climate system was too great to allow the identification of a "human fingerprint" in the climatological record.

In the last few years, however, considerable progress has been made in the search for an identifiable human-induced effect on climate. In the Second Assessment Report (SAR), IPCC scientists concluded that a human fingerprint has now been detected in the climate record. As the computing power, sophistication of global models, and quality of available data continue to increase, IPCC scientists are becoming increasingly confident in their projections. The correspondence between climate models and observed temperature data has increased over the last few decades. While scientists caution that many uncertainties remain in the models and estimates, they have concluded that the evidence from pattern-based studies is sufficient to suggest a human fingerprint on global climate trends over the past few decades.   Furthermore, the SAR concluded that probability is very low that these correspondences could occur by chance as a result of natural internal variability.

Many observers believe that confidence in the science underlying climate change concerns will continue to increase in the future. First, the models and the data will continue to improve, as they did significantly even between 1990 and 1995. Second, the size of the climate change signal, assuming it exists, should become more and more obvious over time relative to natural climatic variability. Furthermore, even under "business-as-usual" conditions, global GHG emissions from fossil fuel combustion are expected to increase substantially – from 5.5 billion tons of carbon to 8.6 billion tons by 2010, according to the International Energy Agency.

As scientists and governmental decisionmakers increasingly accept the science underlying calls for GHG emissions reductions, the nature of the international policy debate has shifted dramatically. Instead of arguing about whether anything needs to be done, the debate is now focusing on what can be done, when it can be done, and how much it will cost.

Global Climate Change Impacts

With general agreement that climate change is likely to occur as a result of human activities, countries are increasingly concerned about what climate change could mean for them. A country's vulnerability to climate change is a function of both sensitivity to climate change and capability to adapt. The 1995 IPCC report said the following:

> "Human induced climate change represents an important additional stress, particularly to the many ecological and socioeconomic systems already effected by pollution, increasing resource demands and non-sustainable management practices. The most vulnerable systems are those with greatest sensitivity to climate changes and the least adaptability" (IPCC, 1996b).

The SAR identified specific impacts of potential climate change. Conclusions reached include:

- Climate change will "lead to an intensification of the global hydrological cycle and can have major impacts on regional water sources." Reductions in natural water availability could result in chronic shortages in regions that are already under stress and for which there is already competition among users.

- While global production of food and fiber is not likely to change significantly, the distribution of production losses could result in major shortages in some countries, especially in the tropics, if changes are not made in agricultural practices and crop selection.

- Compared to agriculture, the energy, industry, and transportation sectors may be more resilient to climate change. However, these sectors may still be susceptible to sudden changes and increased frequency of extreme events. The insurance industry, already stressed from a series of "billion dollar" storm events every year since 1987, is vulnerable to impacts of further extreme weather patterns that may result from additional climate change.

- Coastal populations could face increased threats from flooding and erosional land loss. Sea levels could rise as a result of thermal expansion of the oceans, the melting of polar ice caps and glaciers. Current national studies indicate that Bangladesh could lose 17 percent of its land area to a one meter rise in sea level. The Majuro Atoll in the Marshall Islands could lose up to 80 percent of its area. The most vulnerable human settlements would be those in damage-prone areas of the developing world that lack the resources to cope with impacts.

- The effects of climate change on human health will include increases in the potential transmission of vector-borne diseases (malaria, dengue and yellow fever, and schistosomiasis) via extension of the geographic distribution of disease vectors. Dengue fever has already been found to have spread to higher altitudes in South America than its previous range. In addition, rising temperatures and resulting increased air pollution may threaten the lives of those susceptible to heat, and more extreme weather events may contribute to increased mortality, injury, and psychological trauma.

- Climate change can have a potentially significant impact on the distribution of natural ecosystems which are adapted to specific climate zones. If forests die back there is no clear evidence that they will be replaced by successional species from other zones, as the process of adaptation is very slow.

Although it is difficult to specifically predict the impacts of climate change at the national level, it is likely that developing countries will be both more sensitive to climate change and less capable of adapting to its impacts than are industrialized countries.

Climate Change Mitigation Options and Costs

Greenhouse gas emissions arise from numerous human activities and natural processes. Opportunities for mitigating the atmospheric accumulation of these gases will therefore also arise from a number of different sectors within society. Current thinking about climate change mitigation options looks at three broad categories:

- *Avoiding production of CO_2 in the first place:* These options include improving energy production and conversion efficiencies, preventing the loss of threatened forests, promoting demand side management efforts, or subsidizing the switch from carbon-intensive fuels (such as coal) to less carbon-intensive fuels (such as natural gas or renewable energy sources).

- *Removing CO_2 from the atmosphere after it has been released:* These options include planting new trees, improving management and growth rates of existing trees, changing agricultural practices to increase soil carbon uptake, or growing and utilizing energy crops.

- *Reducing the emissions or production of other greenhouse gases:* These options include reducing emissions of methane (landfills, coal mines, natural gas pipeline leakage, and livestock), nitrous oxide (biomass burning and agricultural fertilizers), and chlorofluorocarbons and chlorofluorocarbon substitutes (air conditioning and propellants). These measures are usually expressed in terms of CO_2 equivalents, based on the global warming potential of the different gases.

A significant number of carbon offset projects along these lines are already underway. We now have almost a decade of experience since AES Corp., a U.S. IPP, voluntarily undertook in 1989 to offset emissions of a planned coal-fired power plant in Connecticut in the first offset project. Today, many companies both in the United States and internationally are investigating or actively pursuing GHG offset projects around the world. In addition to the forest-related projects described in a later chapter of this report, the following short descriptions offer a representation of the wide range of projects underway:

- Wisconsin Electric Power Company, Northern Indiana Public Service Co., and the Edison Development Company are assisting the city of Decin in the Czech Republic to reduce GHG emissions by repowering the heavily polluting, inefficient, brown-coal Bynov Heating Plant. The repowered plant burns natural gas and dramatically reduced CO_2 emissions as well as the serious air quality problems created by the previous facility.

- Merrill International, Charter Oak Energy, and Kenetech Windpower are claiming carbon offset status for a 20 MW windfarm being constructed near the town of Tejona, Costa Rica. The project will displace electricity that otherwise would have been generated using fossil fuels.

- TransAlta Utilities, a Canadian utility, is investing in a project in India to strategically supplement the diets of milk-producing animals to promote more efficient digestion and thereby decrease methane generation per unit head of cattle. TransAlta also developed but did not pursue a project to upgrade a major transmission and distribution system in India, for which it intended to claim the CO_2 benefits of the resulting efficiency savings.

These brief examples provide some insight into the range of measures already being pursued for offset purposes. Many more approaches have been proposed as carbon offsets, ranging from carbon sequestration in halophytes to reinjection of CO_2 into depleted gas and oil fields. The diversity of projects is likely to continue to increase.

Forestry-Based Mitigation Options

The primary kinds of land use-based measures that specifically have been discussed in the context of helping to mitigate climate change are:

1) *Slowing or stopping the loss of existing forests, thus preserving current carbon reservoirs.* Project opportunities include forest protection, forest management, harvest management, and off-site agroforestry.

2) *Adding to the planet's vegetative cover, thus enlarging living terrestrial carbon reservoirs.* Carbon offset opportunities include reforestation, afforestation, natural and assisted regeneration, fertilization, farm forestry, and soil management practices.

3) *Increasing the carbon stored in carbon reservoirs such as agricultural soils and wood products.* Offset opportunities could include paper recycling, substitution of wood for steel and concrete, and changes in tillage and fertilization practices.

4) *Substituting sustainable biomass energy sources for fossil fuel consumption.* Offset opportunities include transfer of biomass technologies, efficiency improvements in existing biomass utilization, and subsidization of biomass energy development.

As will be discussed below, more than a dozen projects are currently underway across a range of these mitigation approaches.

2. DEVELOPING CLIMATE CHANGE POLICY

After forming the IPCC in 1988 to evaluate the underlying science of climate change, in 1990 the United Nations General Assembly established the International Negotiating Committee (INC) to draft a global treaty to protect against climate change. The INC met five times between February 1991 and May 1992 to draft the terms of a Framework Convention that would set the stage for eventual agreement on more binding emissions limits. In June 1992, the FCCC was signed by 155 countries at the U.N. Conference on Environment and Development (UNCED) in Rio de Janeiro. The Convention entered into force in March 1994.

The Climate Convention calls for stabilizing "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous [human] interference with the climate system" (U.N. FCCC, 1992). It calls upon "Annex 1" countries (generally the industrialized countries and Eastern Europe) to take measures to limit CO_2 emissions to 1990 levels by the year 2000 and to provide detailed information on progress towards this target. It calls for international cooperation through transfers of financial and technological resources to developing countries beyond existing development assistance, particularly for countries more susceptible to climate change. The Convention also proposed “joint implementation,” a concept that would allow countries to partially meet their individual emissions reduction obligations through more cost-effective projects in other countries.

In April 1995, the first Conference of the Parties (COP) to the Convention was held in Berlin, Germany. It resulted in the “Berlin Mandate,” a major step towards global controls on greenhouse gas emissions. The Berlin Mandate reiterated the need for Annex I countries to adopt post-2000 commitments, and called for a protocol to the Convention to be drafted and submitted for consideration by the Parties at the third Conference of the Parties in 1997.

The Kyoto Protocol

In December 1997, the third Conference of Parties convened in Kyoto Japan and hashed out a Protocol that brings the international community a step closer towards implementing binding emissions reductions (U.N. FCCC, 1997).

In aggregate, industrialized countries committed to reduce their emissions of six key greenhouse gases by just over five percent from 1990 levels by a 2008-2012 budget period. Country-specific emissions reduction commitments by 2010 vary from 8 percent below 1990 emissions for European Union countries to 8 percent above 1990 emissions for Australia. Key players ended up with similar positions: 8 percent below 1990 emissions levels for the European Union, 7 percent for the United States, and 6 percent for Japan. Commitments are framed in terms of a budget period from 2008-2012, meaning, for example, that U.S. emissions over the five-year period are to average 7 percent below 1990 levels. The multi-year budget period is intended to even out impacts of annual weather or economic anomalies.

The Protocol's aggressive targets surprised many observers. Just as important as the stringency of the Protocol's commitments, however, is the flexibility it affords countries in complying with obligations. The Protocol provides two separate kinds of flexibility mechanisms:

- *Country-to-country emissions trading, in which a country with emissions below its targets can trade its "excess" reductions to another country.* This type of trading could significantly reduce emissions reductions requirements for some countries.

- *Project-by-project emissions reduction trading, covering projects pursued in industrialized and developing nations.* The concept behind joint implementation (JI) was given a big boost in the Protocol. Joint implementation projects, defined as projects carried out between industrialized countries, were approved through Article 6. Through Article 12, Parties also approved the pursuit of mitigation projects in developing countries. These projects will not be called JI projects, but rather will go through a newly established "Clean Development Mechanism" (CDM). Particularly surprising was a provision allowing emissions reductions achieved through such projects to be banked against future reduction mandates starting in the year 2000.

Many countries no doubt will wait for clarifications of important points before attempting to ratify the Protocol. Until clarification occurs, it will not be possible to understand the full implications of the Protocol or its associated costs.

Evolution of the Clean Development Mechanism

The concept of JI – allowing one country to obtain credit for a GHG reduction achieved in another country – was inserted into the original text of the Convention at the behest of Norway and other countries concerned about their ability to satisfy future emissions reduction obligations within their own borders. Contentious from the beginning, the JI concept was temporarily put on hold in order to test and evaluate the "activities implemented jointly" (AIJ) pilot phase, agreed to at COP-1. The AIJ pilot phase was seen as a pilot phase for JI, with the expectation by many Parties that it would transition into an operational JI phase by around the year 2000.

AIJ, however, also proved contentious. Although the AIJ pilot phase was originally supposed to be formally reviewed by the year 2000, Parties showed a reluctance to reach any formal conclusions about the AIJ program, or to even establish a procedure by which evaluation of the pilot phase would take place. This reluctance complicated efforts to discuss the pursuit of mitigation options outside a nation's borders within the context of the binding emissions Protocol being discussed in the period leading up to COP-3 in Kyoto.

The Clean Development Fund (CDF) was an alternative to the JI and AIJ approaches that was proposed by Brazil and supported by the G-77/China. The CDF was based on the principle of penalizing future industrialized country noncompliance with binding emissions targets. Monetary penalties levied on industrialized countries would be used to promote climate change mitigation and adaptation activities in developing countries. The CDF was not popular with Annex I countries, who continued to insist on flexibility to pursue off-shore mitigation projects as one element of any binding emissions reduction protocol.

A deal was ultimately struck between the key negotiating camps in the form of what is now known as the CDM. Through the CDM, the Kyoto Protocol creates a vehicle through which tens of billions of dollars could annually flow from industrialized to developing countries. It has the potential to fundamentally affect how much money is spent in developing countries on climate change, environmental protection, and sustainable development projects, and how that money is spent. Beyond being a funnel for financial flows, the approach reflected in the CDM is important to any future acceptance of the Kyoto Protocol by countries including the United States.

Implementing the CDM

The CDM is initially defined by Article 12 of the Kyoto Protocol, although in some respects the Article raises more questions than it answers. Key components of the CDM are:

- Certified emissions reductions will be awarded to Annex I project sponsors;
- Supplementarity is required for project activities;
- Assistance is provided in arranging funding of certified activities;
- Participation of private or public entities is invited;
- Early banking for projects is included as of the year 2000.

Although the CDM is formally part of the Kyoto Protocol, there is still a great deal of uncertainty regarding how it will be interpreted and implemented. A few issues stand out as points of potentially serious conflict over the evolution of the CDM:

- Operationalization of project additionality or supplementarity;
- Institutional structures and control of the CDM mechanism;
- Treatment of sinks, including forest conservation projects, which have played a major role before and during the AIJ pilot phase;
- Potential limits on the use of CDM projects in satisfying industrialized country obligations;
- Adaptation funding issues, both with respect to magnitude and process.

Under the terms of the Kyoto Protocol, decisions relating to the development of operational criteria and structures for the CDM are to be made by the first Meeting of the Parties to the ratified Protocol. This meeting is not likely to occur for several years. In an effort to reduce economic uncertainties associated with Protocol compliance, a great deal of work toward pinning down the meaning and functioning of the Protocol is likely to be undertaken in the next one to two years. Making progress on these issues is regarded by a number of countries and interest groups as one of the primary challenges facing the Parties during the fourth Conference of the Parties scheduled for November 1998 in Buenos Aires.

A Brazilian representative at a recent CDM workshop in Rio de Janeiro felt very optimistic about the CDM and its potential, and asked both developed and developing countries to think about the "many millions of tons of carbon that could be mitigated" under the CDM mechanism. He concluded that "it won't be the end of the world if CDM fails. But we will miss an excellent opportunity." His view, which was reflected by others, is that the CDM can meet the needs and interests of all FCCC participants. He was optimistic that the CDM can improve the political process for working on climate change and help bring developed and developing countries together in positive new partnerships and working relationships.

Achievement of the CDM's promise will almost certainly depend on the private sector in industrialized countries. Critics have argued that industrial nations are supposed to make funding available for near-term mitigation measures in developing countries through Annex II of the Convention. In today's era of shrinking government resources, however, governments are highly unlikely to ever come up with the kinds of funding required. This makes mechanisms such as JI among Annex I countries and the CDM important to the long-term achievement of the Convention's climate change mitigation goals.

As already noted, many questions remain regarding how the CDM will be interpreted and implemented. Governments and other interest groups are in a position over the next 6-24 months to influence the course taken by the CDM by considering where their interests lie and actively participating in the policy development process. A number of Latin American countries, for example, have identified the inclusion of forestry within the CDM's scope as being a high priority for this policy process.

Forestry Under the Kyoto Protocol

The outcomes of COP-3 are widely regarded as ambiguous as to the role forestry will play in future project-based mitigation efforts. The Parties' discussions of sinks at COP-3 were not generally in the context of project-based mitigation efforts. Rather, they primarily discussed sinks within the context of whether and how forestry would be netted against fossil-fuel emissions for purposes of determining compliance with emissions reduction targets.

The forestry outcomes of the Kyoto Protocol can be summarized as follows:

- Reforestation, afforestation, and deforestation since 1990 will be netted against other GHG emissions by Annex B (the former Annex I) countries.

- Sinks and source reduction projects that can meet an unspecified "but for" test will be eligible for crediting under Article 6 of the Protocol (joint implementation), albeit not until the first budget period. Although it is not specified, some observers argue that the types of projects eligible to be pursued under Article 6 should be limited to the categories of projects listed in Article 3.3 (reforestation, afforestation, and forest loss)

- The CDM provides only for crediting of "certified emissions reductions," but does not define the types of emissions reductions that will be included. While some environmental and developing country observers argue this means that forestry-sector projects should be excluded, many others disagree. It is interesting to note that a number of potential forestry interventions do constitute "emissions reduction" projects rather than sink enhancement projects.

There are still significant uncertainties when it comes to interpreting the Kyoto Protocol's implications for forestry projects in general and non-Annex I forestry projects in particular. This uncertainty will likely exist for some period of time, especially now that the Parties have directed the IPCC to conduct a broad-ranging evaluation of forestry mitigation issues. This evaluation will take place within the context of a Special Report to be submitted in time for consideration at COP-5 and the IPCC's ongoing Third Assessment Report, due out in 2001. The IPCC's work should significantly define the role sinks are able to play under the Kyoto Protocol, both domestically and internationally. The IPCC referral also removes key parts of the sinks debate from the largely politicized environment of the subsidiary bodies to the Convention.

3. INTEGRATING FOREST AND LAND USE-BASED MITIGATION OPTIONS INTO THE CDM: A TENTATIVE APPROACH

The CDM will play an important role in reducing the overall production of CO_2 globally. As stated, there are a number of ways in which this can be achieved, from energy efficiency technology to forest management. Although land-use practices and forestry play important roles in the global carbon cycle and thus in offsetting greenhouse gas emissions, a majority of CDM projects will facilitate energy efficiency and clean technology transfers between countries. In this manner, the CDM will moderate industrialization's contribution to climate change. However, the value of ensuring that the CDM also facilitates land-based forestry offsets should not be understated, for such projects will help balance atmospheric carbon accounts and provide numerous co-benefits in host countries.

In the context of making policy progress, countries have a near-term opportunity to influence the course of policy development under the CDM and to ensure that their interests are represented. A number of Latin American countries, for example, can be expected to strongly urge the inclusion of sinks as a mitigation strategy under the CDM, since forest loss constitutes their most significant source of GHG emissions and their most significant mitigation opportunity. Many delegates with little background in forestry or natural resources understand relatively little of these facts.

Forest Protection and Management for Climate Change Mitigation: an Issues Overview

Numerous studies, including those of the IPCC, have concluded that forestry-based and other biotic climate change mitigation measures have an important role to play in climate change mitigation efforts. As already noted, forest-based measures can reduce emissions to the atmosphere by reducing rates of deforestation and forest degradation, as well as increasing the incremental uptake of carbon by terrestrial biota, which can slow carbon emissions to the atmosphere by reducing rates of deforestation and forest degradation.

Forest loss and other forms of land degradation impose tremendous economic, social, and environmental costs on the people and resource bases of many tropical countries. Slowing forest loss and land-use degradation can often advance sustainable development, energy-production, and environmental goals. At the same time, carbon is preserved in or added to terrestrial carbon stores, thus mitigating climate change. Although the literature surrounding forestry-based carbon offsets places a heavy emphasis on reforestation potentials in tropical and temperate zones, there is little doubt that efforts to slow deforestation and to manage existing forests are just as important for long term climate change mitigation as efforts to accelerate reforestation.

The Noordwijk Declaration of December 1988, by establishing global targets for reversing the decline in global forest cover as a means for mitigating global warming, formalized the linkage between forestry and global warming at the political level (Ministerial Conference, 1988). Since then, evaluation of forestry as a mitigation option has proceeded at many levels. The FCCC specifically calls for forest conservation and enhancement of carbon sinks as a climate change mitigation effort, calling on Parties to “adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs” (U.N. FCCC, 1992). The Kyoto Protocol also calls on Parties to take measures, stating that “Annex I Parties shall implement policies relating to protection and enhancement of sinks and reservoirs, and promotion of sustainable forest management practices, afforestation, and reforestation” (U.N. FCCC, 1997). In many tropical countries, major opportunities exist to carry out these objectives of the FCCC and the Kyoto Protocol.

Linking Forestry and Implementation of the CDM

Forestry has had a long and contentious history with respect to its use as a climate change mitigation strategy. Because the international forestry and natural resources communities did not actively participate in the original climate change negotiations, and have not participated aggressively since then, an anti-forestry bias has emerged in the discussions. Interest groups ranging from some developing countries to environmental organizations have questioned forestry’s role in climate change mitigation or have pushed to eliminate the use of forestry projects. Yet it is clear that forestry and land-use related carbon offsets have played an important part in development of the carbon offset concept. As already discussed, forestry is widely acknowledged to have a significant climate change mitigation potential, including through the work of the IPCC. In its Second Assessment Report, for example, the IPCC concluded that 12-15 percent of cumulative anthropogenic emissions over the next 50-60 years could be offset through forestry interventions (IPCC, 1996).

Forestry should in no way be portrayed as "the" answer to potential climate change. It can – and should – be an integral component, however, of a societal climate change mitigation portfolio. Forestry and land-use mitigation measures can serve many environmental, economic, and social interests simultaneously, and offer some of the most societal cost-effective approaches to climate change mitigation. With significant effort, forest conservation and reforestation efforts could keep tens of billions of tons of carbon out of the atmosphere over the next several decades. It is also important to note the tremendous role that forestry-sector projects, appropriately designed and implemented, can play in biodiversity conservation, rural economic development activities, watershed protection, food production, and other areas that are high societal priorities.

Despite the range of options available, forestry has continued to be contentious as negotiations proceeded on the Kyoto Protocol, and the result is significant uncertainty about the role forestry will ultimately play. Concerns being voiced regarding the use of forestry for mitigation purposes fall into several broad categories:

- *Concerns that forestry projects will cause environmental damage and impede socioeconomic development in developing countries*. The hypothetical construct of massive plantations being pursued for climate change mitigation, with negative environmental and socioeconomic impacts, has been repeatedly used to justify that forestry's mitigation role should be limited.

Fortunately, there is no reason to anticipate that massive tropical reforestation projects will be a favored approach to climate change mitigation. Beyond the political and environmental issues raised, it is far from the most cost-effective mitigation approach. No forestry project pursued to date for climate change mitigation involves the plantation approach that has tended to concern observers.

- *Concerns that pursuit of forestry and land-use change mitigation efforts will impede progress on achieving actual emissions reductions and interfere with technology transfer objectives*. On this basis, forestry is sometimes portrayed as a climate change "negative," even when the technical ability of individual forestry projects to offset CO_2 emissions is undisputed. This concern involves three assumptions:

  1. <u>Land use-based emissions reductions are somehow less "real" than other reductions</u>. Yet there is no disputing the fact that more than 1 GT of carbon is released to the atmosphere annually through land-use change. Reducing these emissions is just as "real" as reducing other kinds of emissions.

  2. <u>Forestry mitigation opportunities will compose more than just part of a societal mitigation portfolio and will squeeze out other mitigation projects</u>. There is little empirical evidence to support this argument. While forestry has been a popular mitigation measure, the kinds of projects pursued through the AIJ pilot phase, for example, is extremely diverse.

  3. <u>Forestry projects offer few or no technology transfer opportunities</u>. Yet a number of technical and resource technologies can be transferred through projects involving forest management, reduced impact logging, forest conservation, and reforestation. Transfer of these technologies will carry positive side-effects, much as is anticipated for technology transfer in other sectors.

- *Concerns that biotic offsets involve more unsolved complex analytical issues than do energy and other GHG offsets, including monitoring and compliance issues.*

- *Concerns about the potential reversibility of mitigation benefits of land use-based offsets, whether through physical or economic means.*

In many respects, these issues can be addressed through development and dissemination of better information about the role of forestry-sector offsets in a global climate change mitigation strategy and the degree to which appropriate land-use projects in the right places can advance rather than impede a country's economic and environmental objectives. The analytical issues raised in this list deserve serious attention, and they are beginning to get this attention.

Specific project examples that can be developed and presented to the Parties in a thoughtful and advanced way may be able to play a particularly short-term role in affecting policy. This is the approach being taken by a number of NGO-sponsored forestry projects, particularly those being pursued by The Nature Conservancy, but is also the approach being taken by Costa Rica and others.

A joint statement by two environmental NGOs, one based in the United States and the other in Costa Rica, provides a positive endorsement for the inclusion of land-based offsets in the CDM:

> "We conclude that, given the right legal and institutional framework, CDM forest projects could be potent tools in achieving climate benefits while protecting forests and benefitting local communities. We support linking a full range of forest and climate strategies through the CDM, not only because we believe this approach can work, but because we fear that any other approach will fail. If the legal and institutional framework for the CDM is not carefully designed, with both climate and other environmental and social impacts considered, the resulting investments and incentives could undermine both forest conservation and climate change goals. Furthermore, we believe that the CDM must provide socio-economic benefits for recipient countries, and especially for local communities. Otherwise, long-term support for CDM projects cannot be guaranteed, and projects may not last" (Center for International Environmental Law and CEDARENA, 1998).

4. EXAMPLES OF ONGOING FORESTRY PROJECTS BEING PURSUED FOR CLIMATE CHANGE MITIGATION PURPOSES

Since 1988 when Applied Energy Services Corp. announced the first carbon offset project, quite a few government and privately sponsored offset efforts have gotten underway, and more are being considered. Projects existing today fall into a number of categories:

- Protected area establishment or reinforcement
- Forest management
- Reduced-impact logging and expansion of sustainable forestry practices
- Reforestation
- Soil carbon accumulation

Given the absence of government mandates on emission reduction, the financing of forestry-based carbon offset projects to date has been entirely voluntary, and the participation of the private sector has been correspondingly scarce. Projects that have been undertaken thus far have generally received high levels of government support (for example, through the U.S. Initiative on Joint Implementation) or have raised funds through extensive marketing campaigns targeted at the private sector and conducted by a participating land or forestry conservation advocacy group. Those countries that have enacted policies supporting institutionalization of environmentally beneficial forestry investment (particularly Costa Rica) have attracted the lion's share of carbon offset capital.

Many forestry projects have been pursued for climate change mitigation purposes. Some were pursued prior to the initiation of the AIJ pilot phase; others have been pursued domestically within the United States, the Netherlands, or other industrialized countries. Approximately 100 projects have been recorded through the Convention Secretariat; 15-20 of these are forestry-based. They include the following projects:

1. Rio Bravo, Belize
2. CARFIX, Costa Rica
3. ECOLAND, Costa Rica
4. RUSAFOR-SAP, the Russian Federation
5. Krokonose/Sumava forest rehabilitation, the Czech Republic
6. Profafor, Ecuador
7. Reforestation in Vologda, the Russian Federation
8. Klinki forestry, Costa Rica
9. Biodiversifix forest restoration, Costa Rica
10. Uganda National Park FACE project, Uganda
11. Noel Kempff Mercado, Bolivia
12. Reforestation of Chiriqui Province, Panama
13. Bilsa-Reserve forest conservation, Ecuador
14. Reduced impact logging, Indonesia
15. Territorial and financial consolidation of biological reserves, Costa Rica

A large proportion of these projects have not yet been funded, or at least fully funded, and remain as proposed projects. The total amount spent on climate change mitigation forestry to date, including the projects listed above as well as other projects, is US$35-45 million. While a significant figure, it is a small fraction of the funding that could become annually available to forestry and other mitigation projects under a forestry-friendly CDM. Several projects of relevance to the concept of using climate change funding to advance forestry programs are briefly profiled on the following pages.

CARE Social Forestry Project (1989)

Country: Guatemala

CO_2 Equivalent: 70 million tons

Price per Ton CO_2: \$.03/ton paid by AES Corp.

Project Participants: United States – AES Corp.; CARE; U.S. Peace Corp.
Guatemala – Guatemalan Directorate General of Forests; local cooperatives.

Project Description: AES Corp. (an independent power producer) pioneered the concept of carbon offsets long before there was discussion of joint implementation. AES undertook the first carbon offset project in 1989 to offset the emissions of a planned 180 MW circulating fluidized-bed coal plant being built in Connecticut. Based on a comprehensive review undertaken by the World Resources Institute, AES chose to generate a net carbon benefit by expanding a pre-existing CARE social forestry project in Guatemala.

The carbon-relevant components of CARE's work in Guatemala consist of tree-planting in woodlots and agroforestry applications, increasing biomass yields through soil conservation techniques, and conservation of forest biomass through non-planting activities such as fire prevention. Farmers on small holdings are being trained and supported in planting trees to halt erosion, increase agricultural productivity, and increase wood supplies. Technical extension services encourage farmer cooperation and the formation of self-sustaining community organizations to establish, manage, and protect the forestry and agroforestry systems beyond the 10-year project period.

Carbon sequestration was accomplished by planting approximately 4.5 million trees over a 10-year period on 186,000 hectares. Approximately half the trees are used in "low-density" agroforestry applications, 20 percent in "high-density" applications, and 30 percent in woodlots. Although the trees will absorb CO_2, the trees themselves are intended to be used as firewood, building materials, and fodder. As a result, the long-term carbon benefit is presumed to be in the form of the indirect effects of the tree-planting on reducing forest conversion and firewood pressures in the area.

Financial Structure: Total project costs are cited in different sources as ranging from US\$8.8-\$14 million, depending on what is counted. The higher project number reflects the monetary value of Peace Corp volunteers' time, as well as the monetary value of U.S. AID's food-for-work program. The lower end of the project cost range refers more specifically to cash expenditures. AES's funding for the project totaled $2 million, provided as a 10-year endowment for CARE's project activities. The government of Guatemala committed to contributing at least $1.2 million. U.S. AID donated $3.6 million. CARE was charged with raising an additional $2 million through its own fund-raising.

The calculated cost of CO_2 depends on the project cost figure used. Using the more conservative figure of $8.8 million, the calculated cost of CO_2 is approximately $0.06. The price paid by AES on the basis of its cost-share is $0.03/ton.

Because it was so early in the mitigation process, and therefore does not meet several of the criteria currently set for offset projects under the AIJ pilot phase, the AES-Guatemala project has not been proposed for JI or AIJ status.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
AES Corp.	$2 million	23
USAID	$3.6 million	40
CARE	$2 million	23
Government of Guatemala	$1.2 million	14
Total	***$8.8 million***	***100***
Other (including in-kind contributions)	>$7 million	

Mbaracayu Forest Conservation Project (1990)

Country: Paraguay

CO_2 Equivalent: 53 million tons

Price per Ton CO_2: \$.04/ton paid by AES Corp.

Project Participants: United States – AES Corp.; The Nature Conservancy; USAID
Paraguay – Moises Bertoni Foundation
Multilateral agencies – The International Finance Corporation

Project Description: To offset its Barbers Point 180 MW coal-fired facility in Oahu, Hawaii, AES has helped fund establishment of a Nature Conservancy reserve in Paraguay. The project is intended to protect the Mbaracayu, one of South America's last remaining major tracts of undisturbed dense tropical forest. Forces threatening the area included commercial logging and the resulting conversion of forest to agriculture uses; colonization programs to the east of Mbaracayu are rapidly converting remaining forest tracts. Adjacent lands in Brazil are nearly 100 percent deforested.

The primary source of carbon offset is conservation of standing carbon in the 143,000-acre tract, although some social forestry is envisioned within the reserve and adjoining areas. The reserve will be managed for recreational purposes, ecotourism, and scientific research. Local indigenous tribes will continue to have access to the reserve for traditional hunting activities.

Financial Structure: The land area in question was originally used for commercial logging activities by a Paraguayan forest products company. The company defaulted on its loans and the land was forfeited to the World Bank. The International Finance Corporation agreed to sell the 225-square mile parcel to the Nature Conservancy for significantly below its market value of US\$5-7 million to assure its preservation.

The Nature Conservancy purchased the land from the International Finance Corp. for \$2 million. AES provided \$2 million to help purchase the land and establish the nature reserve. A Nature Conservancy partner, the Moises Bertoni Foundation, invested AES’s contribution plus another \$3 million through an endowment fund. The calculated cost of the CO_2 is based on the \$5 million cost and yields a calculated cost of CO_2 of \$0.09/ton. The CO_2 offset price, reflecting AES's agreement to fund \$2 million of the project in return for all the carbon credits, is \$0.04/ton.

For the same reasons as mentioned above, the Mbaracayu project has not been proposed for JI or AIJ status.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
AES Corp.	$2 million	40
Moises Bertoni Foundation	$3 million	60
Total	***$5 million***	***100***

AES Corp. - Oxfam (1992)

Country:	Ecuador, Peru, Bolivia
CO_2 Equivalent:	200 million tons
Price per Ton CO_2:	$0.01
Project Participants:	United States – Oxfam America; AES Corp. Regional – Coordinating Body of Indigenous Peoples' Organizations of the Amazon Basin
Project Description:	The Oxfam America-AES Amazon Program is a 10-year, US$3 million project to protect threatened rainforests by helping indigenous Amazonians gain legal title to and manage the resources of 1.5 million hectares of their traditional territories. By funding indigenous land-titling and resource-management projects in Ecuador, Peru, and Bolivia, the program claims that it will help save 500,000 hectares of pristine rainforest from imminent destruction.
Financial Structure:	Oxfam and AES will contribute to establishment of a US$1 million endowment fund. The endowment will be overseen by the Coordinating Body of Indigenous Peoples' Organization of the Amazon Basin (COICA). Formed in 1984, COICA unites indigenous peoples' organizations in the nine South American nations, allowing them to develop common positions on Amazon's future and to participate in the development of decisions that will affect their territories and lives. AES will provide $600,000; Oxfam America and other groups will add $400,000 to the AES grant, bringing the initial endowment to $1 million. AES will disburse an additional $2.4 million over 10 years. This money will support a comprehensive Amazon program that ties rainforest conservation to indigenous territorial rights efforts. The program funds projects in which indigenous peoples are working to gain legal title to their traditional lands, enforce laws against illegal resource extraction, and develop sustainable land management plans. For the same reasons as mentioned above, the OXFAM project has not been proposed for JI or AIJ status

Funding Source	**Amount**	**Percent**

	($US)	**of Total Funding**
AES	$3 million	88
Oxfam America and others	$0.4 million	12
Total	***$3.4 million***	***100***

ECOLAND: Piedras Blancas National Park (1994)

Country: Costa Rica

CO_2 Equivalent: 1.2 million tons

Price per Ton CO_2: $0.54

Project Participants: Costa Rica – Ministry of Environment and Energy; Conservation y Manejo de Bosques Tropicales; Regenwald der Osterreicher (Costa Rica and Austria).

United States – Tenaska Washington Partners II, L.P.; National Fish and Wildlife Foundation (NFWF).

Project Description: The Esquinas Carbon Offset Land Conservation Initiative (ECOLAND) was developed for Tenaska as part of a first-of-its-kind carbon offset requirement associated with Tenaska's power sales agreement with the Bonneville Power Administration. The project was developed with the active cooperation of the Costa Rican government, which originally proposed the Esquinas Forest and other potential project sites for consideration by Tenaska. The project was designed from inception as a climate change mitigation and carbon offset project and approval was sought through the USIJI joint implementation mechanism relatively early in its development.

The project is intended to result in permanent protection of primary tropical forest that otherwise would be deforested. The ECOLAND project involves the purchase and conveyance to the Costa Rican National Park Service of privately held lands located within the boundary of the declared but previously unprotected Piedras Blancas National Park. Lands purchased through the project are considered to be under imminent threat of deforestation through agricultural or pastoral expansion, or through logging.

The ECOLAND project has purchased privately owned land within the boundaries of the Piedras Blancas National Park through the cooperative efforts of COMBOS, an in-country environmental NGO, and the Osa Conservation and Sustainable Development Area (ACOSA), an inter-agency governmental entity charged with management and oversight of Osa Conservation Area parks. Title to the land has been turned over to MIRE-NEM, the Costa Rican agency responsible for forest conservation and park management.

Financial Structure: The project was developed specifically for Tenaska as part of a carbon offset requirement of a power sale agreement. Project development costs include costs associated with review of several potential projects prior to selection of the ECOLAND project, the USIJI application process, and other pre-implementation activities. Project implementation costs include land purchases and creation of a $40,000 endowment to cover annual implementation costs.

Total project funding was approximately US$1 million, primarily for land purchases. The calculated cost of CO_2 based on 1.2 million tons of benefit is $0.83/ton. Tenaska's negotiated price for the CO_2 offsets was $0.54/ton. This results from the fact that Tenaska is allocated 915,000 tons of CO_2 for its $500,000 investment, with matching funds making up the difference in the calculated cost of CO_2.

The project involves an innovative carbon-sharing calculation with the Costa Rican government. Tenaska and Costa Rica have agreed that Tenaska will receive the first 250,000 tons of carbon (915,000 tons of CO_2) benefit associated with the project; the remaining benefits will accrue to Costa Rica. The CO_2 benefits are assigned to Tenaska in equal increments in each of the first 15 years. Tenaska is the only private or NGO participant in the project receiving CO_2 offset credits.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
Tenaska	650,000	59
Rainforests of Austria	200,000	18
National Fish and Wildlife Foundation	250,000	23
Total	***$1.1 million***	***100***

Project CARFIX: Sustainable Forest Management (proposed)

Country: Costa Rica

CO_2 Equivalent: 21 million tons

Price per Ton CO_2: TBD

Project Participants: Costa Rica – Foundation for the Development of the Central Volcanic Mountain Range (FUNDECOR); Ministry of Environment and Industry

Project Description: Project CARFIX is a proposed forestry project located in central Costa Rica. This project aims to stabilize the existing natural forest and create additional forest cover in the Central Volcanic Conservation Area, which constitutes a 290,187-hectare buffer zone surrounding the World Biosphere Reserve of Braulio Carrillo National Park. The GHG benefits of the project accrue from conservation of existing carbon stocks and increased carbon sequestration on 108,265 hectares of forest land. Carbon emissions currently arise from illegal logging and land-use conversion by private forest-owners.

Financial Structure: Principal project costs include (1) *implementation costs:* identification of landowners, development of a plan for land management or reforestation, determination of topography and land ownership, plantation establishment, and infrastructure development; (2) *monitoring costs:* supervision of land utilization, measurement of biomass growth, protection and supervision of project land, Green Seal certification; and (3) *administrative costs*.

Proposed project revenue generation via sales of harvested timber, Costa Rican government incentives and the sale of carbon offsets. Over the 25 years of the project's lifetime, the developers expect the project to generate net revenues of US$32.8 million including funds from the sale of carbon offsets.

Financing is currently incomplete. Approximately $20 million is being sought from private- and public-sector sources.

Costa Rica Certified Tradeable Offsets (1997)

Country: Costa Rica

CO_2 Equivalent: 850,000 tons

Price per Ton CO_2: \$2.73

Project Participants: Costa Rica – National Power and Light Company, a private electricity generation and distribution company; the Costa Rican Electrical Institute, the national utility; Costa Rican Office on Joint Implementation, project manager.

Norway – Eeg-Henriksen Anlegg, construction company; Kvaerner Energy, turbine producer; ABB Kraft, Norwegian subsidiary of Asea Brown Boveri (ABB); the Royal Norwegian Ministry of Foreign Affairs; Department of Natural Resources and Environmental Affairs.

Project Description: This project involved a 4,000-acre reforestation and conservation area developed over 10 years at a cost of US\$3.4 million. The project's objective is to conserve and rehabilitate the forest in the upper Virilla river basin to achieve a reduction of atmospheric GHG emissions through biomass growth and avoidance of future emissions.

Forestry activities will improve existing hydrological resources in the watershed, increasing the efficiency of hydroelectric plants and enhancing the displacement of fossil fuel use in the national electricity system. Conservation of the forest area as a carbon sink will provide payments to private small and medium landholders for the environmental service of managing their lands, consistent with the objectives of Costa Rican Forest Law.

Financial Structure: Four of CFNL's hydroelectric plants will benefit from the increased watershed area resulting from the project; they will contribute US\$1.39 million. The Norwegian government is providing US\$1.7 million as part of the "Norwegian Climate Fund." Norwegian private-sector parties are providing \$300,000.

Project development is taking place within the legal and institutional framework of Costa Rica's Forest Environmental Services Payment (FESP) program. The FESP program is based on the 1996 Forestry Law, under which one-third of a 15 percent sales tax revenue on fossil fuels will be used to compensate private forest-owners for environmental services (*i.e.*, reduction of GHG emissions, protection of biodiversity, protection of aquifers and preservation of scenic areas for tourism) provided by forest protection and plantations.

The Costa Rican Office on Joint Implementation collects payments from investors and in return issues Certifiable Tradable Offsets (CTO) valid for at least 20 years. CTOs are issued to investors at a rate of US$10 per metric ton of carbon. Funds are passed along to the FESP financial administrator who compensates individual farmers upon proof of effective forest conservation or reforestation. For CTO purposes, proof of effective sequestration can be made anywhere in Costa Rica as long as it is part of the FESP program area.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
Costa Rica National Power & Light Company	$1.39 million	41
Royal Norwegian Ministry of Foreign Affairs	$1.7 million	50
Eeg-Henriksen Anlegg, Kvaerner Energy, ABB Kraft - Norway	$0.3 million	9
Total	***$3.39 million***	***100***

Scolel Té: Carbon Sequestration and Sustainable Forest Management in Chiapas (1996)

Country: Mexico

CO_2 Equivalent: 55,000 tons

Price per Ton CO_2: $2.73

Project Participants: Mexico – El Colegio de la Frontera Sur; Unión de Crédito Agropecuario e Industrial de los Estados de Chiapas y Oaxaca; Paja Ya Kac'Tic S.A. de C.V. (Unión de Crédito Pajal).

Project Description: Scolel Té is a forestry and land-use project that will assist farmers initially in nine Mayan indigenous communities with developing small agroforestry and forestry enterprises. The project's objective is to promote carbon sequestration and sustainable farming practices by providing local farmers with technical assistance and financial incentives to shift from agriculture to agroforestry, convert pastures to plantations, restore degraded forest, and better manage natural forest. The project is currently seeking funding for project expansion and is supported by the government of Mexico.

Financial Structure: Project development expenses (feasibility studies, establishment of institutional framework, sequestration monitoring) are funded primarily by the government of Mexico and the U.K. Overseas Development Agency. The project implementation investor, the International Automobile Association, pays $2.72/ton of CO_2 sequestered per year (total $55,000/yr) into a trust fund. This fund is administered by a University of Edinburgh project consultant, and local, government, and technical advisors. "Proto carbon offsets," which may be authenticated by the Mexican government, are issued by fund to the Association. Fund proceeds will be distributed to local farming cooperatives. Local farmers develop and register their own land management plans and receive technical and financial assistance. Land registered during the pilot period will accrue carbon benefits for the ensuing 27 years.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
Project Development		
UK Overseas Development Administration Forestry	213,200	56
UK Darwin Institute	65,000	17
Commission for Environmental Cooperation	20,000	5
Int'l Energy Agency's Greenhouse Gas R&D Program	82,000	22
Total	***380,000***	***100***
Project Implementation		
Int'l Automobile Federation/Int'l Carbon Sequestration Foundation	150,000	5
Undetermined*	3,150,000	95
Total	***3,300,000***	***100***

* The current level of funding will support sequestration of 55,000 tons of CO_2 out of a possible total of 1,200,000 tons of CO_2 over the project lifetime. American Forests and EIC will arrange for the sale of additional "proto-carbon credits" to support project activities. The current sale price of these credits is US$2.72/ton CO_2, which was used to calculate total funding needs of US$3,300.000.

Rio Bravo Conservation and Forest Management Project (1994)

Country: Belize

CO_2 Equivalent: 4.8 million metric tons

Price per Ton CO_2: $0.54

Project Participants: Belize – Program for Belize

United States – The Nature Conservancy; Winrock International; Wisconsin Electric Power Company; Detroit Edison Corp.; Cinergy; PacifiCorp.; UtiliTree Carbon Co. (consortium of approximately 40 utility companies).

Project Description: The Rio Bravo project was originally developed by The Nature Conservancy with support from Wisconsin Electric Power Co. The project is located within the Rio Bravo Conservation Management Area (RBCMA) of Belize, managed by the Programme for Belize. The RBCMA is a prime mahogany and Mexican cedar habitat; at one time it was considered the richest mahogany and Mexican cedar forest in Belize. The area was selectively logged for 150 years. These activities were carried out on a sustainable basis for most of that time. The national trend of conversion of forested land to cropland reached the northwest region of Belize in the 1950s. The area surrounding the RBCMA is actively being converted. The Rio Bravo project was structured to prevent the sale of the parcel to a Mennonite agricultural commune that had expressed its intent to purchase and farm the area.

The Rio Bravo project has two components. Component A involves the purchase of endangered forest land which without intervention would be lost to intensive agricultural use. Component B is developing a sustainable forestry management program designed to increase the total pool of sequestered carbon in a separate part of the project area. Pine savannah, for example, will be subject to management aimed at improving stocks of pine through promotion of regeneration. Specific measures to be employed by the project include:

- allowing primary timber stocks (broadleaf) and biomass of the area generally to recover to a higher maintenance level for carbon sequestration;

- creating conditions for regeneration of the primary timber species;

- sustainable harvesting of the broadleaf forest, applying a low-impact logging regime designed to minimize damage;
- marketing timber for use in durable products;
- protecting and enhancing pine forest stocks located on degraded savannah areas (including fire protection); and
- reforestation of cleared lands.

Financial Structure: The project involves the purchase of a 5,602-hectare parcel of endangered forest land funded through equal investments by five U.S. utility companies. The funds will be paid into a Nature Conservancy land bank fund over a 10-year period. TNC's fund acts as bank and provides capital as needed to the project developer. Upon valuation, credits are lodged with USIJI and subsequently distributed to investors on a pro-rata basis. Credits are re-valued annually by the program administrator. Project development expenses are partially funded by the utilities; however, the high costs associated with development of this early project prohibited full cost recovery.

If carbon credits are traded and sold in the future above their purchase price, a portion of the return (amount to be determined) will be payable to the government of Belize.

Total project cost is set at US$2.6 million by project developers, including costs of land purchase, monitoring and verification, and project administration. Based on this project cost and the estimated CO_2 benefit of 4.8 million tons, the calculated cost of CO_2 is $0.54/ton. This is also the CO_2 offset price in this case.

The project is the most complex offset project in existence in terms of the number of financial participants. Four individual utilities and one utility consortium of approximately 40 companies are involved in financing the project's US$3 million cost. Each financial participant will receive 20 percent of the project's carbon benefits.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
Wisconsin Electric Power Co.	$520,000	20
Detroit Edison Electric	$520,000	20
Cinergy	$520,000	20
PacifiCorp	$520,000	20
UtiliTree	$520,000	20
Total	***$2.6 million***	***100***

The Noel Kempff Mercado Climate Action Project (1998)

Country: Bolivia

CO_2 Equivalent: 50 million tons

Price per Ton CO_2: $0.20/ton

Project Participants: United States – The Nature Conservancy; American Electric Power Service Corp.; PacifiCorp; British Petroleum.

Bolivia – Fundación Amigos de la Naturaleza (FAN); government of Bolivia.

Project Description: The Noel Kempff Mercado Climate Action Project is a USIJI-approved project developed by The Nature Conservancy (TNC), Fundación Amigos de la Naturaleza (FAN, a Bolivian NGO), and the American Electric Power Service Corp. (AEP). PacifiCorp and British Petroleum are also funding the project. The developers hope to demonstrate an optimal balance between GHG mitigation, park protection, and sustainable micro-enterprise development. This project will achieve its GHG benefits in two ways. First, it will fund expansion of the Noel Kempff Mercado National Park, helping Bolivia to avoid destruction of carbon sinks and concomitant increases in carbon emissions. Secondly, it will facilitate increased carbon sequestration through efforts to improve logging practices outside park boundaries (with sustainable community development projects) and other efforts. In all, there are three primary components of the project's GHG mitigation strategy.

- Preventing the loss of carbon sinks and emissions resulting from commercial logging. The project will pay for cessation of logging activities in an endangered tropical production forest and will expand the boundaries of an existing park.

- Averting conversion of protected forested lands to subsistence agricultural use, as has historically been the case in the region. This will protect not only stands newly protected through the first component, but also existing forests in the rest of the national park. The project will accomplish this goal by establishing a mix of income-generating activities for local populations, establishing a park protection endowment fund, capitalizing a new genetic resources enterprise that will market orchids and other forest products, and constructing an ecotourism infrastructure.

- Mitigating GHG emissions in secondary areas beyond the expanded park by providing environmentally sustainable economic opportunities for local population groups and providing technical assistance to help loggers adopt sustainable forest management practices. This latter activity is intended to reduce the effect on carbon savings of displaced loggers' activities in unprotected areas.

The project will also fund supporting activities, including monitoring and verification, project oversight by the Bolivian government, park protection, scientific and technical research, enforcement of forest management requirements, and local government participation in the project.

Involvement of the Bolivian government in this work is central to the project's success. The necessary legal documentation required to implement the project includes a grant of sufficient and adequate authority by the government to project participants generally, and to FAN specifically, prior to project funding to ensure that FAN will be able to oversee, monitor, and assure park management consistent with full implementation of the project's components and measures for 30 years.

Financial Structure: Project proponents estimate that Component A will cost US$2.75 million. Component B will cost US$2.95 million, and Component C and auxiliary activities will cost $2.43 million. Miscellaneous costs bring the total cost to US$8.78 million. A basic calculated cost of CO_2 is $8,780,000 ÷ 51,282,470 tons or $0.17/ton of CO_2.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
The Nature Conservancy and FAN	$1,780,000	20
AEP	$7,000,000	80
Total	***$8,780,000***	***100***

Reduced Impact Logging - Innoprise and New England Power Co. (1993)

Country: Malaysia

CO_2 Equivalent: 500,000 tons

Price per Ton CO_2: $1.35/ton

Project Participants: United States – New England Power Co.
Malaysia – Zakyat Berjaya Sdn. Bhd.

Project Description: New England Power Co. entered into a 1992 agreement with Zakyat Berjaya Sdn. Bhd. (RBJ, a subsidiary of Innoprise, a large Malaysian forestry concession owner) to develop and implement reduced impact logging (RIL) techniques on 1,400 hectares of commercial forest land held under concession by the company. This project was one of the first offset projects pursued and one of the earliest to obtain USIJI approval. The project goal was to demonstrate that alteration of forest management practices (harvesting techniques) in natural commercial forests can provide credible forest-based greenhouse gas offsets on an industrial scale.

The demonstration land is in an area of virgin uninhabited lowland dipterocarp rainforest. Historical harvest practices within the concession area have been extremely destructive, frequently destroying as many as 50 percent of untargeted trees and compacting up to 40 percent of the land area. This limited the potential for regrowth within the remaining forest stand.

RIL guidelines were developed for the project with the goal of reducing logging damage by 50 percent through pre-cutting of vines, directional felling, and planned extraction of timber on properly constructed and utilized skid trails. Vine-cutting reduces felling damage because the tree crowns are not tied together; it reduces post-felling vine infestations because there are fewer fallen vine stems to re-sprout. Guidelines requiring stream buffers and restricted harvesting on severe slopes (>35 degrees) also reduce damage and contribute to conservation of residual forest. The result will reduce CO_2 emissions during and after the harvesting process; enhance sequestration potential in the residual forest; make logged forest less susceptible to fire; and reduce soil erosion, which conserves soil carbon.

Financial Structure: The budget for the pilot project is US$650,000: $450,000 for direct project costs and $200,000 for monitoring and research costs. This is the incremental cost. The calculated cost of CO_2 is $1.35/ton. This is also the price that New England Power has paid for the CO_2 offset.

All GHG benefits will accrue to New England Power.

Funding Source	**Amount ($US)**	**Percent of Total Funding**
New England Power	650,000	100
Total	***650,000***	***100***

5. DEVELOPMENT OF A MITIGATION MARKET, WITH A FOCUS ON THE FORESTRY SECTOR

It is widely expected that a market will develop to help promote achievement of emissions reduction targets. This market may be nationally based, as in the emissions trading system contemplated under Article 17 of the Kyoto Protocol, or project-based through the joint implementation or CDM provisions of the Protocol. Ultimately a single market is likely to integrate the several mechanisms that may be in use. The flexibility of an emissions market allows parties to pursue least-cost solutions that simply do not exist under traditional command and control approaches.

Land use-based and forestry-based carbon offset projects, often referred to as "biotic mitigation" projects, are just one part of a much larger set of climate change mitigation technologies that will be available to governments and industries under future GHG emissions reduction regimes. Other opportunities occur in the energy and transportation sectors. Carbon sequestration, in its various forms, will have to compete for funding with these other technologies in a competitive marketplace. It will no longer be enough to know that forestry-based options exist, or that their technical potential is large; it will be a matter of determining how effectively these "biotic" options can respond to the needs of mitigation services purchasers, how well they can adapt to the eventual market for GHG emissions reductions, and how cost-effective they are in comparison to other mitigation technologies.

It is important, therefore, to think about the specific characteristics of land use-based carbon sequestration and storage technologies as they relate to the future market for mitigation services. Relevant characteristics will include the cost, timing, persistence, risk, quantifiability, leakage potential, and sometimes additionality of the mitigation services provided by the forestry and other biotic sectors. Future market demand will depend on variables associated with an eventual mitigation regime. Variables that will affect the demand and likely competitiveness of different mitigation measures within the larger grouping of mitigation technologies will include:

- Severity of the emissions reduction mandates;
- National and international mechanisms used to achieve the required reductions, potentially including GHG trading, new source offset requirements, and taxes;
- Scope of the emissions reduction mandate (*e.g.*, across the board, limited to specific sectors, or limited to specific gases), and the flexibility available to emitters to comply with the mandate (*e.g.,* on-system reductions, offsets limited by greenhouse gas or geography, greenhouse gas trading, and joint implementation).

The form in which these variables are combined into any eventual mitigation regime will significantly influence the general market for mitigation measures and the relative strength of markets for mitigation technologies. It is not yet possible to conclusively answer the question of what the market demand for forest and land use-based carbon offset technologies will be and how successfully different biotic mitigation measures will be able to respond to that demand. Several policy and practical conclusions, however, can be reached:

- Biotic mitigation technologies are a legitimate and potentially important part of a societal portfolio as a result of their relatively low costs, co-benefits, and climate change mitigation benefits. The very fact that a billion tons or more of carbon are released to the atmosphere each year through forest loss should make the importance of forestry-based mitigation clear.

- As with many other mitigation technologies, the mitigation services provided by many biotic options do not perfectly match the common idealized definition of a mitigation measure. Issues of CO_2 benefit persistence, risk, timing, and quantifiability will have to be addressed for many biotic mitigation technologies to effectively compete in the future mitigation marketplace. At the same time, biotic mitigation measures can have significant advantages with respect to co-benefits, cost-effectiveness, and the ease with which any required additionality showing can be made.

- It is important that forestry and land-use based options receive full consideration during the policymaking process. The relative quality of the mitigation services they offer should not be overlooked. To date, forestry and land-use based options have not had the same kind of representation other options and other technologies have enjoyed.

- Biotic mitigation technologies have become embroiled in political debates over North-South financial assistance, technology transfer, and joint implementation. Due to technical challenges associated with many biotic mitigation technologies, they have been an easy target for critics seeking to achieve agendas in which biotic measures have little role to play.

Between the technical challenges popularly associated with forestry mitigation approaches and the relative lack of influence of the forestry and related communities at the policy negotiating table, forestry and land use-based mitigation options face significant hurdles. The ability of proponents of such approaches to convincingly show that these technologies can yield valuable climate change mitigation benefits may ultimately prove as important to the future of these technologies as policy and regulatory developments at the national and international levels.

Supply Side Issues for Forest-based Mitigation Projects and Cost Factors

From the standpoint of a host country, forestry deals will be implemented if project benefits (to either the government or to private landowners) are larger than those from alternative land uses (*e.g.*, logging, pasture). In other words, the benefits of the carbon offset must be greater than the opportunity costs. Benefits might include biodiversity conservation, watershed protection, enhanced ecotourism potential, and expanded marketing of non-timber forest products. These co-benefits will be weighed against the opportunity costs of diminished timber sales and secondary processing opportunities, such as value-added revenues, employment, and other multipliers.

An important factor in determining the demand for forestry deals lies in the relative costs for overseas emitters of implementing offset projects in their own countries. If risks and costs are lower in a proposed host country, then forestry offset opportunities will arise. The same may also apply to the relative costs of energy-sector deals. Existing estimates of mitigation costs must be interpreted with caution for purposes of extrapolating to the future value of other projects. There are several reasons for this:

1. Those investing in projects today are often taking advantage of the cheapest mitigation options, or the “low hanging fruit.” These options will become harder to find over time.

2. There is no functioning supply and demand for GHG mitigation, in the sense that current supply of potential mitigation projects significantly outstrips demand.

3. Existing and proposed mitigation projects differ enormously in design, conformance to proposed evaluative criteria such as additionality and quantifiability, and basic financial and performance risk.

4. Ways in which offset studies and even individual project developers report the costs of mitigation projects differ dramatically. Some costs are reported as social costs, while some are reported as private costs.

5. Questions remain about what kinds of forestry may or may not qualify for future crediting under the Kyoto Protocol and the CDM.

As a result, estimating a price for any offsets accruing from forest financing projects will need to be approached in an original way.

Although the market for climate change mitigation projects is still nascent, it does exist. Several dozen JI and AIJ projects are already underway, with some two dozen in the forestry sector. A range of prices exists for these projects. Current estimates of what offsets will cost under the CDM range from US$5.00 to US$20.00/ ton CO_2. This is a significant increase over current offset prices of US$0.01 to US$4.00/ton. If the marginal costs to reduce one ton of CO_2 is $1.00 in a non-Annex I country versus, say, $30 in Denmark, then offset projects will migrate offshore, where the host country will have ample scope for negotiation ($29) on the price per ton of emissions credit.

An interesting innovation in the development of a mitigation market is Costa Rica’s development of CTOs. To help finance acquisition of privately held lands in protected areas and provide incentives for forest management practices throughout the country, the government of Costa Rica developed CTOs in order to provide foreign investors with high-quality forest-based carbon credits to offset their CO_2 emissions at their domestic sources. Costa Ricans benefit by having new incentives for managing their lands in an environmentally sound manner. The structure established by the Costa Rican government under the Private Forestry Project uses payments for "environmental services" on private lands to encourage tree plantations, conservation and sustainable forest management. These activities provide greenhouse gas reduction benefits. Payments are made possible by the CTOs, which are given to entities that contribute to the National Fund for Forestry Financing. Norway is an early participant in this program. Under the Protected Areas Project, JI funding is obtained by the sale of CTOs to purchase land from landowners with holdings in the national park system.

6. PROJECT FINANCING MECHANISMS AND STRATEGIES

Forestry mitigation projects to date have been supported by a combination of public and private funders. These can be classified as follows:

- *Domestic private capital:* In Costa Rica, some project implementation expenditures have been paid for by private domestic capital from the National Power and Light Company. Domestic sources of carbon emissions can also be attracted to investments in carbon offsets.

- *Domestic government funds:* Government forestry funds may also be utilized to finance carbon sequestration projects. A Russian afforestation project in Saratov has been funded partially with funds from Russia's Forest Service.

- *International private-sector capital:* As northern carbon emitters increasingly focus on the need to offset emissions through investments in carbon sinks, utility companies will become the primary source of project implementation capital for forestry-based offset projects. To date, American and Dutch utilities have been the largest investors in such projects.

- *Federally funded intermediaries:* A government-sponsored and -financed body such as the Costa Rican Office on Joint Implementation can act as the project bank, collecting capital from project funders and utilizing its own capital when necessary to satisfy the capital needs of the project developer.

- *NGO intermediaries and trust funds:* Nongovernmental entities have also acted as bankers for projects. In the Rio Bravo project, the Nature Conservancy has assumed this role. The Conservancy collects payments from investors, which are paid into a fund which is additionally capitalized by TNC to provide funds for the project developer in Belize as needed. In Mexico, a project specific trust fund charged with managing project capital flows has been established for the Scolel Te project.

- *Overseas development funding* : A variety of governments have earmarked funds specifically for investment in climate change development projects. The U.S. Environmental Protection Agency, the U.K. Department for International Development, the government of Norway, and others have committed funds to the sustainable forestry sector in developing countries.

In projects where a private-sector investor has been in place from the project's inception (*e.g.*, as in the case of Tenaska the ECOLAND project in Costa Rica), the investor has typically covered project development expenses. In many cases, however, development expenses have had to be covered by governmental funds (domestic or international "climate fund" monies) or through advocacy groups. Many projects have depended on upfront purchases of private lands, particularly those that aim to sequester carbon through protection of parcels of endangered forest land and expansion of national parks. Land purchases must be financed through large upfront payments. However, investor funds to support the project budget may not be front-loaded, occurring instead over several years.

When cash inflows from project implementation funders lag behind project implementation expenditures (*e.g.*, for the purchase) financial intermediaries with lending capacity must fill the gap. Most projects require a financial intermediary of some kind. An exception would be the direct investment of New England Electric Power in its reduced impact logging project in Malaysia; the company is providing funds to the project developer as needed.

Strengths and Weaknesses of Project Financing Structures to Date

Factors Supporting the Financing of Forestry-Based Carbon Offsets

➢ *Participation of a strong financial intermediary with lending capacity:*

Capital inflows to support project implementation are typically paid in equal installments over a period of 5-10 years. Incorporation of a well-capitalized financial intermediary with lending capacity enables project developers to cover the typically high levels of initial expenditures involved in project implementation (*i.e.*, tree planting, land purchases). For Rio Bravo, TNC filled this role through a specially designated land fund; in Costa Rica, the Forest Environmental Services Program has lending capacity due to its access to tax revenues. Project success would be facilitated by a sufficiently capitalized financial intermediary either in country or offshore that is willing to provide project implementation funds at a low cost.

➢ *Presence of a regulatory body to oversee valuation or authentication of carbon credits*:

The role of the USIJI in verifying valuation of carbon credits from projects supports the credibility of the credits. Authentication of carbon credits by the Mexican and Costa Rican governments will provide a strong foundation for future validity of those carbon credits. Given that under the Kyoto Protocol parties can employ carbon credits obtained post 2000 toward compliance with quantified emission limitation and reduction commitments in the first commitment period, a host country would benefit from early establishment of a carbon credit regulatory and authenticating body. Careful consideration should be given to the role of such a body versus that of independent verifiers of projects.

➢ *Direct benefit of investing in forest land to carbon emitting companies:*

In certain instances, such as the Costa Rica/Norway Reforestation and Conservation project, private-sector investors can reap benefits. In that project, the Costa Rican Power and Light Company stands to benefit directly from preservation of watershed area for its hydro facilities.

- *Supporting legal and institutional framework within host country:*

In Costa Rica, the legal and financial support provided for environmentally beneficial forestry projects by the 1996 Forestry Law has provided liquidity to project developers while reducing country risk.

Challenges Facing Financing of Forestry-Based Carbon Offsets

- *Absence of a regulatory impetus to invest in carbon mitigation projects*:

The primary motivations for forestry-based carbon offsets thus far have been their value as demonstration and education tools; intergovernmental relationship-building exercises; and public perception of environmental benefits resulting from private-sector funding. Until concrete emissions reduction targets and timetables are established, private-sector participation will be strictly voluntary, and hence limited.

- *Attracting private-sector capital:*

The viability of a large-scale program of forestry-based mitigation will depend upon participation of private-sector entities in funding project implementation. Funding for implementation of the Rio Bravo project was facilitated by TNC's participation, an advocacy group with resources to effectively market the opportunity. Scolel Te has received some private-sector funding; however, the absence of a group with resources to effectively market to the private sector has resulted in a funding shortfall. ECOLAND was developed specifically for the private sector as part of a carbon offset requirement associated with a power sales agreement. Potential project developers could benefit by forging relationships with highly regarded international forest and land conservation advocacy groups to build support and attract potential private sector financiers.

- *Funding project development expenses:*

For projects where private-sector financing is not assured from the beginning, upfront development expenses prior to implementation represent an additional financing hurdle. Early stage/first "in country" projects tend to have atypically high development costs. The early stage establishment and identification of potential project developers will encourage the availability of capital and expertise for development of forestry-based offset projects.

7. ANTICIPATING PROJECT EVALUATION UNDER THE CDM

Based on the history of air emissions offsets generally, as well as current thinking around JI and the CDM, it is possible to identify variables likely to be considered important for designing offset projects generally, including the innovative forest financing concept. The most important of these variables, and those that will need to be addressed in designing any CDM project, are introduced below.

- Additionality of project funding and carbon benefits, including specification of baseline and "with project" cases
- Potential severity of leakage of carbon benefits
- Quantifiability of carbon benefits and associated uncertainty
- Likely reliability of project activities and resulting carbon benefits
- Development of monitoring and verification strategy
- Permanence of the carbon benefit
- Magnitude and type of project co-benefits

Additionality of Project Funding and Carbon Benefits

The only project criterion specifically mentioned in the Kyoto Protocol is additionality: projects will have to show that their CO_2 benefits are "additional to any that would occur in the absence of the certified project activity." Two types of additionality are commonly mentioned. The first is financial additionality, and refers to whether the dollars in question were truly motivated by CO_2 mitigation concerns (as opposed to purely financial "business-as-usual" considerations). The second is carbon additionality, and refers to whether the CO_2 benefits in question would have occurred "but for" the project being funded. In moving toward an operational JI phase, additionality has been a major source of debate.

Ideally, project selection and design should favor projects in which a "but for" baseline can be relatively securely established. In the case of forest protection projects there is usually little question as to the additionality of project funding. Proponents of a conservation effort should also, however, be able to argue convincingly that the proposed forest protection would not have occurred otherwise, and indeed that the forest otherwise would have been lost. Although in the longer term any offset regulatory system will have to develop a more sophisticated and standardized approach to this issue, the "but for" test is commonly mentioned by environmental and other interest groups skeptical of carbon offsets.

The most widely accepted approach to demonstrating CO_2 additionality is by developing a "baseline case" for the project area and comparing it to a "with project" case. For a forestry project, the baseline is the level of carbon storage that would have existed in the absence of the offset. Establishing the baseline scenario requires concrete knowledge of future trends including economic, sociological, and political practices. "Baseline case" and "with project" case establishment are widely recognized as being among the most difficult issues in creating a quality carbon offset, whether in the forestry or energy sectors.

Potential Leakage of Carbon Benefits

The IPCC states that "[i]n the absence of binding targets in developing countries, it would be difficult to determine the net emission reduction effects due to a specific joint implementation project, since nationwide indirect and direct effects on emissions must be counted" (IPCC, 1996). This problem refers to what is normally referred to as leakage. Leakages occur because the project boundary, within which a project's benefits are calculated may not be able to encompass all potential indirect project effects. Simply expanding a project's boundary, however, could bring in tertiary and even less direct effects that could overwhelm any attempt at project-specific calculations.

Forestry, and particularly forest protection, is often characterized as being "leakage-prone." Many involved in climate change debates have criticized biotic offsets for being more susceptible to leakage than non-biotic offsets. Critics have noted that socioeconomic variables and associated leakage could sabotage the efforts of a forest protection offset. People who live near new forest preserves, for instance, are likely to still have a need for wood products or land, and may, therefore, simply turn to another forest resource. The World Resources Institute noted an interesting case of economic leakage in reviewing the Carton de Colombia project. Although this project was not designed to be a carbon storage project, it can teach something about potential leakage. As WRI notes (Brown, Cabarle and Livernash, 1997):

> "Carton de Colombia aimed to maintain a sustained yield through natural regeneration and by minimizing damage to residual trees in a lowland tropical forest on Colombia's Pacific Coast. However, the job opportunities created by the pulpwood producer triggered an influx of colonists who could not all be absorbed and employed. As a result, timber poaching and conversion of recently harvested areas to agriculture nullified potential project gains."

Others have noted that the economics of timber and wood products would lead to leakage as reduced harvesting in one area would merely serve as an opportunity for another supplier to increase supplies to the market from another similar area.

Quantifiability of Carbon Benefits and Associated Uncertainty

Quantifiability refers to direct quantification of the carbon offset benefit associated with the forest management, environmental, and socioeconomic effects that occur as a result of a mitigation activity. Measurability requires more than simply confirming that a protected forest remains in tact or that a reforested area is still growing. Measurability requires that a baseline against which to measure the impacts of the project be established and that a methodology for quantifying the carbon benefit be in place and executed.

The ability to obtain accurate estimates of projected GHG benefits and to track GHG benefits once a project is implemented are important components of any offset project. Quantifiability of offset projects varies widely, although the general issues associated with offset quantification and verification can be grouped as follows:

- scope of the project boundary and treatment of potential leakage
- establishment of the project baseline
- required precision of benefit measurements
- assignment of carbon benefits to project proponents
- monitoring and verification stringency
- possible ongoing adjustment/verification of the project's baseline
- risk management or insurance practices

Specific standards for these areas have yet to be developed, but clearly could have significant implications for the scope and cost-effectiveness of CDM opportunities.

A number of variables will influence quantifiability of a carbon offset project.

Existence of a Clear Prior Baseline for the Area

- *Has land use been stable, with the threat being discreet and new?*
- *Has land use change patterns been complex and due to numerous discreet variables?*

Availability of Site-Specific Ecosystem and Carbon Data

- *Has the area been surveyed?*
- *Is good carbon data available from other similar ecosystems?*
- *Is there homogeneity of geography and vegetation?*
- *Are there multiple forest types?*
- *Is the forest cover relatively uniform over the project area?*

Clarity of Future Baseline and "With Project" Cases

- *Would most observers agree on a given baseline and with project case?*

Magnitude of the Uncertainty Band

- *Even given agreement on baseline and "with project" cases, what proportion of the carbon benefit is considered certain verses the proportion that would depend on predictable variations in highly site-specific biomass and other variable?.*

Likely Reliability of Project Activities and Permanence of Carbon Benefits

Reliability refers to the likelihood of a project being implemented the way that is anticipated, and hence that the projected CO_2 benefits will occur. Critical to the success of any mitigation project is the documentation that a project will produce the carbon benefit predicted and avoid economic or political threats that may impede achievement of benefits. There are a number of potential threats to the reliability of forest protection carbon offsets. Among the variables that can be used to assess these threats, the ability to counter these threats, and hence the likely reliability of the carbon benefits, are the following subsidiary variables. Unlike additionality and leakage, project reliability is relatively easy to grasp. Although there are many ways in which project reliability can be threatened, it is not inherently as troubling an issue to deal with as the prior two issues.

Article 12 of the Kyoto Protocol states that projects undertaken through the CDM must provide "long-term benefits related to the mitigation of climate change" (U.N. FCCC, 1997). Permanence of carbon benefits has been a key issue for forestry and some other project types. This criterion is generally poorly understood by project practitioners, however. Indeed, the permanence of different land-use based mitigation measures can range widely. The permanence issue in forestry-based mitigation efforts stems from two primary sources:

- Some project categories are intended to be permanent (*e.g.*, forest conservation, wood product substitution, biomass energy), but may face risk factors that might interfere with that permanence.

- Some project categories are not intended to be permanent, raising the question of how to factor intentionally temporary carbon benefits into a climate change mitigation regime.

When considering the issue of permanence with regard to how energy projects compare to forestry project, many commentators assume, for example, that fossil fuel emissions reduction projects yield permanent benefits. Yet this conclusion may be overly simplistic. To the extent that fossil fuels represent finite resources for which economically recoverable resources may ultimately be depleted, the benefits of current emissions reductions may be less than permanent.

Benefit permanence becomes particularly complex when considering projects involving harvesting of timber or other biomass. The fate of harvested carbon becomes crucial in determining the long-term or "permanent" impacts of the project or type of measure involved. In some cases, the fate of this carbon is becoming harder to assess given rapid evolution in the energy and products markets. As fossil fuel prices have continued to fall and product technology has made it possible to utilize larger fractions of harvested biomass, net carbon flows associated with forestry practices continue to shift.

Virtually no literature discusses permanence issues; very little systematically assesses biotic risk variables that may interfere with the permanence of a project's benefits even when a project is designed to generate permanent benefits. Work by the Center for Clean Air Policy led to the conclusion that projects providing for carbon benefits that would be at least 50-75 years in length could be considered equivalent to emissions reductions (Center for Clean Air Policy, 1993). A more recent review carried out in the context of British Columbia's GHG trading system concluded that a system can be designed in which forestry-based credits are "identical to reduction credits (appropriately qualified as to duration)" (Alchemy Consulting, Inc., 1997).

Many observers consider permanence to be the trickiest issue in forestry-based mitigation efforts. In addition, although it can be framed technically, the permanence debate is fundamentally policy-based. Policymakers ultimately will need to determine what permanence means for offsets and how these definitions will apply to forestry and land use-based projects. How the issue is resolved could have significant implications for the scope and magnitude of forestry projects that would be permitted to proceed.

A number of variables will influence the reliability and permanence of a project's carbon benefits:

Complexity of Threat Facing Area (e.g., number of variables having to be influenced, controlled), and Complexity of Protective Project Interventions

- *What are the competing demands on the area?*
- *What are the land-tenure systems and land-titling requirements?*

Is the National Political Context Stable , Particularly vis a vis Land Use Policy?

- *Governmental and nongovernmental forestry experience; infrastructure experience?*
- *What is the current status of forestry-concessions, land availability, and energy policies?*
- *Are political and economic structures stable?*
- *What are the infrastructural development plans?*
- *Are there potential environmental, economic, or social crises facing the country?*

Does the Local/National Political System Support Environmental Issues?

- *Has interest been expressed in hosting JI projects?*
- *Is there experience with implementation and negotiation of JI/AIJ projects?*
- *Do area communities feel threatened by environmental preservation initiatives?*

How Political an Issue is Deforestation and Forest Protection?

- *What are the institutional and economic sources of deforestation*?
- *Is land availability an issue in current political/economic concerns?*
- *Is foreign intervention in land-use planning a political football?*

How Stable is the Local Political and Economic Context?

- *Is there unchecked poverty in region?*
- *What are the long term income opportunities?*
- *What are population growth rates and urbanization trends?*

Susceptibility of Area to Fire, Disease, Pests?

- *Are there forest management practices already in existence?*
- *Is the surrounding area severely degraded?*

Does Necessary Governmental Infrastructure and Capacity Exist, or Can it be Created?

Ease of Development of Monitoring and Verification Strategy

Project selection and design should build in verification and measurement protocols and anticipate the possibility that more stringent protocols may later need to be retrofitted on to the project. Offset projects will involve certain implementing steps, ranging from extension activities in a social forestry project to boundary protection in a forest preservation project. Projects will differ considerably in a sponsor's ability to verify that these steps result in the intended reduced carbon emissions or enhanced sequestration. In the case of forest protection, offset verification must be maintained on an ongoing basis since the project could in principle "fail" at any time.

Beyond verifying that a reforested area is still growing or that a protected forest remains intact, the C sequestration benefit must be assessed. This presents difficult methodological questions that have only begun to be evaluated. Several methods of assessing carbon benefit are in principle available:

- Reliance on observable C accumulation, e.g. through empirical measurement. This is most appropriate in cases such as commercial reforestation or fossil fuel displacement where C accumulation can be readily observed.

- Reliance on indirect and assumed benefits, *e.g.,* the use of conversion factors to convert from successful sustainable agriculture implementation to an estimate of forest area protected. This is most appropriate where it is implausible to observe the sequestered C; however, this approach can be highly uncertain.

- C flow modeling, *e.g,*. the use of simple or dynamic computer models to attempt to predict C sequestration on the basis of a set of quantifiable variables. Although modeling could prove valuable, it can be a difficult task.

Magnitude and Type of Project Co-Benefits

Project design should emphasize the identification and promotion of environmental and economic co-benefits resulting from a project, including:

- Importance of area from a biodiversity perspective;
- Socioeconomic and rural economic development benefits associated with project implementation;
- Importance of area for other environmental reasons, including soil and water conservation; and
- Technology transfer benefits (*e.g.*, forest management, conservation).

8. DESIGNING A FORESTRY-BASED CDM PROJECT

For forestry-based CDM projects, a number of project criteria will need to be evaluated and addressed. The following is a brief list of administrative and technical tasks to present a framework for initiating any given CDM proposal:

Packaging the Project as a CDM Project

- Building a "without project" baseline of the forestry sector and associated carbon emissions.

- Building a "with project" reference case of the forestry sector and associated carbon emissions.

- ➢ Identifying and analyzing project interventions

- ➢ Demonstrating additionality of the proposed project

- ➢ Identifying and assessing carbon benefit leakage potentials.

Assessing and Demonstrating the Reliability of the Project's Carbon Benefits

- ➢ Assessing the quantifiability of project benefits and quantifying them

- ➢ Assessing and quantifying environmental and other co-benefits

- ➢ Developing a monitoring and verification strategy

    - Identifying project costs
        - setting project price
        - transactional issues
            - -- credit-sharing
            - -- government guarantees
            - -- integration of the project into CO_2 trading systems

- ➢ Design potential financial mechanism for use in the project

9. CONCLUSIONS

There is considerable scope for developing countries to offer GHG offset services through forest-based projects. The current timing presents a unique opportunity for the government and people of heavily forested countries to develop their knowledge of climate change issues as well as their own position with regard to their level of involvement in carbon trading. The proposed UNDP Programme on Forests intends to demonstrate that forest-based GHG offset projects could generate significant cash flows and additional benefits for participating non-Annex I countries. These actors need to consider carefully the costs and benefits of pursuing carbon offset projects. The purpose of establishing a model for innovative forestry financing project is to demonstrate the value of this type of offset to the participants in the next round of the Conference of Parties in Buenos Aires (COP-4) in Buenos Aires and beyond.

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ANNEX 1: GLOSSARY OF CONCEPTS AND TERMS

Activities Implemented Jointly (AIJ): The term assigned to joint implementation projects undertaken during the pre-year 2000 pilot phase, created at the FCCC's first Conference of the Parties in April 1995. There will be no official inter-country crediting of carbon credits during this pilot phase. It is not yet clear how AIJ projects will differ from JI projects with respect to long-term crediting. See *Joint Implementation*.

Additionality: Reflects the extent to which the results of a climate change mitigation project differ from what would have occurred under other circumstances. A project's benefits are most obviously additional if it can be shown that carbon changes associated with the project would not have occurred "but for" this specific project and that the project would not have occurred "but for" the availability of carbon offset funding. Additionality normally is thought of involving complex issues of corporate intent, project timing, and project finances. Because of the difficulties associated with defining an additionality standard, it is unclear whether and how it will be incorporated into long-term carbon offset policy.

Afforestation: Generally refers to planting of trees on ground where trees have never existed or were last present hundreds of years ago. Afforestation carbon offset projects bear an additional burden of showing ecological compatibility.

Biofuels: Biofuels include wood, wood waste, agricultural crop residues, dedicated energy crops, and food waste, as well as gaseous and liquid fuels produced from these feedstocks. Most biofuel technologies are considered capable of producing carbon offsets, although lifecycle CO_2 emissions can become important.

Biogas: The gas produced from the anaerobic decomposition of organic material in a landfill, wastewater treatment facility, or animal waste treatment facility. Biogas utilization in cases where it otherwise escapes to the atmosphere or is flared is a potential source of carbon offsets.

Biomass: See *Dry Biomass*.

Carbon: In the context of carbon offsets, the mass of elemental carbon emitted or sequestered. Used to provide consistency of measurements between different chemical configurations of carbon (e.g., between carbon in CO_2 and carbon in biomass). Carbon's molecular weight is 12, while the molecular weight of CO_2 is 44. Multiplying by 3.67 takes a figure expressed in carbon tons to tons of CO_2.

Carbon Accounting: The issues associated with measuring, calculating, and valuing the relative benefits of greenhouse gas mitigation measures.

Carbon Cycle: All carbon reservoirs and exchanges of carbon from reservoir to reservoir by various chemical, physical, geological, and biological processes.

Carbon Discount Rate: Analogous to a financial discount rate, a carbon discount rate applied to future carbon flows is used to account for the fact that carbon benefits today may be valued more highly than carbon benefits in the future.

Carbon Offset: A mechanism by which the impact of emitting a ton of CO_2 can be negated or diminished by avoiding the release of a ton elsewhere, or absorbing a ton of CO_2 from the air that otherwise would have remained in the atmosphere. It can be helpful to differentiate between an emissions reduction and a carbon offset. Demand side management efforts pursued inside a utility's service territory, for example, would constitute an emission reduction; efforts pursued outside a utility's service territory, whether domestically or internationally, would be categorized as CO_2 offsets since the impacts of the project would not show up in the utility's emissions statistics.

Carbon Sequestration: A flow of carbon by which it is absorbed or taken out of the atmosphere and stored in a terrestrial or oceanic reservoir. This differs from preservation of existing carbon stocks in a reservoir.

Carbon Ton-Year: A ton-year of benefit refers to avoiding the presence of one ton of carbon in the atmosphere for one year. The ton-year unit can be used to compare carbon benefits of offset projects whose effects may differ over time. It is analogous to "renting" the services of an offset ton for one year. For example, a forestry project may initially sequester only small amounts of carbon while storing large amounts in later years; a demand side management project may avoid a consistent amount of emissions throughout its shorter duration. Converting these amounts to ton-years can be viewed as allowing more consistent comparisons of project benefits.

Certified Emissions Reductions: The quantified reduction of greenhouse gas emission reduction produced through a CDM project. The certified emissions reduction could be used against Annex I country targets under Annex B of the Kyoto Protocol, or traded.

Clean Development Mechanism (CDM): The CDM grew out a proposal originally put forward by Brazil (and supported by the G-77/China) called the Clean Development Fund (CDF). The CDF’s focus on development carried over to the CDM. Established in Article 12 of the Kyoto Protocol, the CDM is a mechanism for aiding sustainable development and allowing cost-effective off-shore project-based climate change mitigation. Article 12 states the purpose of the CDM to 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.”

Co-Benefits: Non-CO_2 benefits of a project, including environmental, economic, and societal benefits.

Deforestation: The conversion of forested to non-forested land. Deforestation can involve the cutting and burning of trees to provide land for agricultural purposes or clearing for residential and industrial uses.

Dry Biomass: The total oven-dry organic matter (as opposed to green or wet biomass). Dry biomass is approximately 50 percent carbon by weight. Dry biomass may typically be half the weight of wet biomass.

Executive Board: The executive board was established within the CDM in Article 12 of the Kyoto Protocol. The executive board will supervise the CDM. A main responsibility of the executive board will be oversight of operational entities. Operational entities will certify individual project activities. Because different types of institutions in different regions may serve as operational entities, the executive board will need to assure consistency in CDM activities and certification. It is still unclear who will sit on the board and for how long.

Forest Degradation: The ecologically deleterious depletion by human activity of standing woody biomass and organic matter in forests, often associated with over-utilization of the forest for fuel or timber.

Forest Management: Usually used in the context of activities that promote growth and yield of merchantable timber, including fertilization, pesticide and herbicide applications, thinning overstocked stands, replanting understocked stands, and selective logging. These activities often increase the amount of carbon sequestered in the stands because of increased yield. Forest management can also refer to measures that increase total biomass loading without increasing merchantable timber.

Forest Protection: Preventing forest degradation or deforestation. Since carbon stored in forests is released when forests are degraded or destroyed, forest protection is in effect an emissions reduction measure. There may also be a carbon sequestration component associated with the forest's potential for ongoing carbon uptake.

Global Environmental Facility (GEF): A financial mechanism that provides grant and concessional funds to recipient countries for projects and activities that aim to protect the global environment. It is jointly implemented by UNDP, the United Nations Environment Programme, and the World Bank. The GEF was launched in 1991 as a pilot program and entered its operational phase in 1995.

Global Warming Potential (GWP): The instantaneous radiative forcing that results from the addition of 1 kilogram of a gas to the atmosphere, relative to that of 1 kilogram of carbon dioxide. Over a time horizon of 100 years, methane has a GWP of 21, nitrous oxide has a GWP of 310, and Perflourobutane has a GWP of 7,000.

Greenhouse Effect: A popular term used to describe the roles of water vapor, carbon dioxide, and other greenhouse gases in keeping the Earth's surface some 59° Fahrenheit warmer than it would be in the absence of the gases. These gases allow shorter wavelengths of solar radiation to enter the atmosphere, but slow the escape of longer wavelength energy radiating from the Earth's surface.

Greenhouse Gases: Any gas that contributes to the greenhouse effect in the Earth's atmosphere.

Intergovernmental Panel on Climate Change (IPCC): A panel established jointly in 1988 by the World Meteorological Organization and UNEP to assess scientific information relating to climate change and formulate realistic response strategies. The IPCC is the Framework Convention's scientific advisory body.

Joint Implementation (JI): Refers to a provision of the Framework Convention that would allow countries to pursue climate change mitigation projects outside their borders to achieve their own CO_2 emissions reduction commitments. JI activities are argued by proponents to have the potential to dramatically reduce the overall cost of curbing emissions, since countries with limited or expensive mitigation options would be able to pursue more cost-effective opportunities elsewhere. See *Activities Implemented Jointly*.

Kyoto Protocol: The document produced at the third Conference of the Parties in Kyoto, Japan, in December 1997. The Protocol requires most Annex I countries to reduce emissions below 1990 levels by 2010. The Protocol also contains the CDM to support sustainable development through offshore project-based climate change mitigation.

Leakage: The presence of market, behavioral, or physical feedbacks to a project's implementation that can result in the loss of some or all of a project's projected carbon benefits. For example, a residential weatherization project would not reduce the anticipated level of CO_2 emissions if residents turn their thermostats up to a higher temperature than they would have without the weatherization. A reforestation project's benefits could leak if other landowners reduce the tree planting they otherwise would undertake. The number of potential leakage points, as well as the likelihood and magnitude of the potential leakage, will affect the project's credibility.

Merchantable vs. Total Biomass: Merchantable biomass refers to the amount of tree biomass that can be effectively converted into wood products. This is often the measure of wood volume that is most readily available for commercial species in different soil and climate regimes. Total biomass includes non-merchantable biomass, such as twigs, branches, roots, debris, and other associated organic matter.

Methane (CH_4): A hydrocarbon gas that is the principal constituent of natural gas. It is generally considered to be 21 times as powerful a greenhouse gas as CO_2 over a 100-year timeframe.

Nitrous Oxide (N_2O): A potent greenhouse gas, the primary anthropogenic emissions of which are thought to come from agricultural fertilizers, and to a lesser degree, fossil fuel combustion and biomass burning. It is considered to be 320 times as powerful a greenhouse gas as CO_2 over a 100-year time frame. It should be differentiated from oxides of nitrogen (NO_x).

Operational Entities: Established with the CDM in Article 12 of the Kyoto Protocol to certify project activities for the CDM. The Protocol states that operational entities will be designated by the Conference of the Parties. It is unclear which institutions will serve as operational entities. Development banks, commodities exchanges, and stock exchanges have been mentioned as potential operational entities. Development banks are mentioned for their experience in project administration, while market institutions like stock and commodities exchanges are favored for their market experience. The operational entities will likely serve as the meeting place for investors and project developers.

Project Baseline: The project baseline is the starting point for measuring changed emissions and sequestration associated with a climate change mitigation project. A project cannot claim emissions reductions unless a case is made that demonstrates that the proposed project practices are "additional" to baseline circumstances. Establishing the baseline scenario requires concrete knowledge of future trends including economic, sociological, and political practices. Methodologies for project baseline measurements vary and a decision on how project baselines will be used in the CDM have yet to be made.

Project Boundary: A conceptual line drawn around a project to encompass the emissions sources and sinks that will be considered in a project's carbon benefit calculations. The boundary is not necessarily geographical. Project boundaries can be drawn narrowly (encompassing an individual parcel of land or industrial facility) or broadly (encompassing global timber or energy markets). How boundaries are drawn will significantly affect the potential for carbon benefit leakage. See ***Leakage***.

Project Emissions, Direct: Greenhouse gas emissions that are released from sources on the site of a project. Examples include CO_2 emissions from fuel burned on-site, methane emissions from on-site coalbeds, carbon sequestered on-site.

Project Emissions, Indirect: Greenhouse gas emissions that are released from sources not on the site of a project. Examples include CO_2 reductions from a power plant as a result of an electricity DSM program or upstream fugitive natural gas emissions from fuel conversion.

Project Implementation Case: The project implementation case starts from the baseline and projects future emissions or sequestration (or both) within the project boundary with the carbon offset project in place.

Project Monitoring and Verification: Refers to activities to monitor and verify the carbon benefits projected for a project. Can use funder or third-party processes.

Quantifiability: The ability to obtain accurate estimates of the CO_2 benefits associated with an offset project. Quantifiability can vary widely by offset type and project boundary, and can involve direct, modeled, or proxy measurement. The credibility of a project can be affected by how easy it is to quantify.

Reforestation: Generally refers to planting trees on land that has been cleared of forest within the relatively recent past. May or may not refer to planting trees on land that has just been harvested.

Reference Case: The project reference case starts from the baseline and projects emissions and sequestration inside the project boundary without the carbon offset project. The reference case should include foreseeable regulatory and economic changes from the baseline condition (i.e., a requirement to cap landfills). The project reference case is also known as the "but for" case or the "alternative case."

Reliability: Refers to the likelihood that the offset project will be implemented as intended and that it will achieve the anticipated CO_2 benefits. Involves assessment of the project's design and implementation; performance of analogous projects; prevailing social, political, and economic situations; and identified risk variables. While credibility concerns the project concept, reliability focuses more on the likely realities of project implementation.

Soil Carbon: The amount of carbon stored in soil biomass and organic matter.

Supplementarity: A feature of the CDM that limits Annex I use of the CDM in meeting national emission reduction targets. The Kyoto Protocol states that emissions reductions through the CDM will be supplemental to domestic emission reductions. The exact quantification of supplementarity under the Protocol remains unclear.

U.N. Framework Convention on Climate Change (FCCC): An international agreement signed at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro outlining policy measures for reduction of greenhouse gas emissions and calling on signatories from developed countries to reduce CO_2 emissions to 1990 levels by the year 2000. The convention was signed by all U.N. members and has been ratified by 151 countries; it came into force in 1994. The first Conference of the Parties was held in Berlin in April 1995.

U.S. Initiative on Joint Implementation (USIJI): In an attempt to lead and guide international policy relating to joint implementation, the United States undertook the U.S. Initiative on Joint Implementation in 1994. The USIJI program was designed in part to test criteria that might later be applied to an international JI program. It was also designed to increase private sector investment in developing countries and provide an opportunity for expanding markets for environmentally beneficial technologies. Projects eligible for USIJI consideration were identified as those involving renewable energy, forestry, agriculture, demand and supply side efficiency, industrial emissions, transportation, and methane reduction.