CONGO BASIN Information SERIES

March 2001

#24

Forest-Based Carbon Offset in Central Africa

Issues and Opportunities

Key Concepts

- If adopted, the Clean Development Mechanism (CDM) could offer the countries of Central Africa an opportunity to take advantage of their forest resources to provide competitively priced carbon sequestration and emission reduction projects to industrialized countries.
- Central African governments should strengthen their engagement in the CDM negotiations to ensure that forest projects are not excluded.
- Governments also need to demonstrate a willingness to deal with the political and technical obstacles and contractual obligations to ensure eligibility of forest projects under the CDM.
- If forest projects were linked to lasting improvements in the performance of public forest administrations, the CDM could be a positive force for change.
- One way to encourage better performance is to implement forest projects using risk-sharing schemes such as options contracts that provide long-term incentives for project compliance.
- Investments in forest science and remote sensing monitoring are justified if the skills and information generated are directly tied to forest management compliance verification.

Carbon Dioxide and Global Warning

Carbon dioxide is a potent greenhouse gas, and increased levels of carbon dioxide in the atmosphere have been linked to rising global temperatures with serious economic and environmental implications. Every year, carbon dioxide emissions from human activity pour over six billion tons of carbon into the atmosphere. About a third is absorbed by the world's forests. This discovery lies behind the proposal to limit the increase in greenhouse gas concentrations by planting more trees or by reducing deforestation. It has been estimated that forests could offset up to 15% of the world's greenhouse gas emissions. ■

Clean Development Mechanism

The Kyoto Protocol, negotiated in December 1997, gave a major boost to the notion of forest-based greenhouse gas mitigation. Under the Protocol, 38 industrialized countries and the European Union commit themselves to reduce greenhouse gas emissions by 2008-12 to a level 5.2% less than the 1990 level. To achieve this goal, the Protocol establishes legally binding emission reduction targets for industrialized countries, and three flexible mechanisms: emission trading within and among the industrialized countries, the Clean Development Mechanism (CDM), and a revised Joint Implementation (JI) Program.

If adopted, the CDM allows industrialized countries to achieve cost-effective reductions in greenhouse gas concentrations by investing in emission reduction projects, including forest-based carbon offset projects, in developing countries. Poor, forest-rich, tropical countries could therefore take advantage of their comparative advantage in providing an environmental service (rapid photosynthesis, carbon dioxide capture, and carbon accumulation in woody biomass and soil) to industrialized countries, where large emission reductions are relatively expensive to achieve. The potential value of greenhouse gas trades involving developing countries has been estimated at between $11 billion and $19 billion annually.

Although the rules of the CDM have yet to be worked out, several carbon-intensive companies have taken early action. This reflects the recent change in attitude of many large companies, which now openly accept that governments may bind them to reducing greenhouse gases emissions. Many are conducting audits of the amount of greenhouse gases emitted by their facilities and are taking on voluntary targets for emission cuts. Some are exploring forest-based carbon offset projects in an effort to achieve zero net carbon emissions. For example, Peugeot, the French car manufacturer, has invested $11 million in plantations and forest conservation in Brazil. Although the company receives no immediate financial benefit, it gains in public image, acquires experience managing this kind of project, and shelters itself from the risks of future regulation. ■

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WRI Biodiversity Support Program

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Project Eligibility

There are two broad classes of forest-based carbon offset projects. Emission reduction projects include preservation of forests under threat of conversion to other uses (e.g., permanent agriculture or pasture), shifting from conventional to better forest management (e.g., reduced impact logging, longer felling cycles, recuperation), and developing fuel plantations on previously deforested land. Sequestration projects include reforestation through permanent (i.e., non-wood production) plantations or natural regeneration, and shifting from slash-and-burn agriculture to agroforestry. Most cost estimates of supplying carbon sequestration services in tropical countries range from $2/ton to $25/ton of carbon.

Central Africa is home to the world's second largest contiguous area of dense moist forest and should be able to benefit from forest-based CDM investments. Table 1 gives the area of dense forest (defined as forest with a tree cover greater than 60%) for the six Central African countries and other large, densely forested, tropical countries based on an analysis of 1 km AVHRR data for 1992-93.

Table 1: Dense Tropical Forest Areas Per Country

Country	Dense forest (x000 km²)	Country (x000 km²)	Dense forest
Democratic Republic of Congo	1,272	Brazil	3,910
Gabon	222	Indonesia	1,031
Congo Republic	217	Peru	713
Cameroon	200	Columbia	564
Central African Republic	46	Bolivia	541
Equatorial Guinea	25	Venezuela	459

The eligibility of forest-based projects under the CDM is very controversial. If not designed properly, the CDM could encourage the clearing of old growth forest in favor of fast-sequestering, but biologically impoverished plantations. Many groups are also opposed to any scheme that would let industrialized countries trade away their responsibilities for reducing their own emissions. If forest cover maintenance projects were deemed ineligible, Central Africa would be effectively excluded from the CDM. But even if these projects were accepted, industry's interest in financing CDM projects is likely to be greatest in countries where companies have already invested, where the learning and public relations benefits are high, and where the risks are low. By all three criteria, Central Africa finds itself at a disadvantage relative to Brazil, Malaysia, and other tropical countries.

The main barrier to CDM investment in Central Africa is high risk associated with bad forest management and poor governance. Several countries have introduced reforms aimed at promoting efficiency and transparency in the forest sector. But implementing these reforms has proved to be a formidable challenge, because of opposition from vested interests, and high levels of policy instability and political risk. Until these governance constraints are resolved, some observers argue that forest-based CDM funding risks are doing more harm than good. ■

Use of bulldozers for logging.

Emission Reduction Projects

France, the region's major donor and source of forest science expertise, generally favors emission reduction over sequestration projects, because they tend to be more permanent. Several potential emission reduction projects exist. A 43,000-ha eucalyptus plantation near Pointe Noire in Congo Republic not only exports pulp, but generates enough

charcoal to meet two-thirds of the city's energy needs. If the plantation is managed for sustained production, carbon emitted during charcoal burning is sequestered by the plant growth. By displacing the cutting of slower-growing old growth forest and/or fossil fuel consumption, the plantation thus contributes to reduced carbon emissions through higher standing biomass.

A concern regarding such projects is whether fast-growing and water-demanding eucalyptus plantations would displace biologically rich natural forest, thereby forfeiting the biodiversity co-benefits that CDM projects could likely promote. Although possible, the few large-scale fuelwood plantations that exist in Central Africa are all located on degraded land that form an urban halo around the major cities (e.g., Bangui, Yaoundé, Kinshasa, Kisangani).

Forest protection is another form of emission reduction. But the inclusion of forest conservation in the CDM has run into considerable opposition, because of the risk of moral hazard, whereby landowners would have an incentive to clear some forest in order to benefit from avoided deforestation. There is also doubt about the wisdom of countries receiving windfall profits without having to undertake any kind of economic innovation. A mechanism that granted money for nothing could undermine much-needed reform in a sector that is notoriously prone to corruption. Another concern about forest protection is leakage, whereby better behavior at the project site is offset by worse behavior elsewhere. Many protected areas in Central Africa abut logging concessions. Given high demand for the region's wood, expanding a protected area to cover a forest slated for logging would probably displace logging to another location. Finally, the eligibility of avoided deforestation risks swamping the market with carbon credits from Brazil, where the rate of deforestation is higher and forests cover over twice the area of all six Central Africa countries combined.

It may be possible to control for leakage by broadening the region of interest from the project to the country or regional level. It may not be necessary to monitor the entire forest estate. Satellite analysis by INPE, the Brazilian space agency, has shown that deforestation in Brazil is highly clustered. Between 1991 and 1996, 82% of forest clearing took place in three states (covering less than 25% of the forest area), and 86% was less than 25 km from areas that were deforested before 1978. But implementing such a system requires human and technical assets that are beyond the reach of most countries in the Central Africa, none of which monitor and report on forest conditions on a regular basis. ■

Reduced Impact Logging

Reduced impact logging (RIL) has been proposed as a CDM-eligible project. RIL involves such practices as forest mapping, careful planning and building of roads and skid trails, climber cutting, directional felling, minimal use of bulldozers, and avoiding logging in the proximity of rivers and on steep slopes. Such practices can demonstrably reduce the amount of waste and damage to the cut trees and to the residual stand, thereby reducing carbon emissions. Because RIL leaves the forest in better condition, it also promotes higher carbon sequestration. In conjunction with other policy measures, RIL could also reduce pressure on the region's remaining large tracts of intact forest. The broad-based adoption of RIL is consistent with the thrust of the World Bank-supported forest policy reforms, which are aimed at increasing harvesting efficiency. Tests from Brazil show that RIL may be profitable.

A modeling exercise in Cameroon suggests that RIL can lower tree death and subsequent carbon missions by 8 ton/ha in forests within 300 km of the port of Douala. Carbon savings drop off with distance, and are very low beyond 900 km. Since RIL costs $135/ha to implement in Malaysia, this translates to a carbon emission mitigation cost of $17/ton. This is a conservative estimate, because the cost of implementing RIL in Central Africa may be significantly lower, around $20/ha. Nevertheless, $17/ton is comparable to existing tropical forest-based offsets, and cheaper than emission reductions in industrialized countries. As logging intensifies in Central Africa under the influence of policies that encourage harvesting a wider range of species, the cost per ton of carbon sequestered by RIL should drop. In Malaysia, where the forests are more homogeneous and higher intensity harvesting is possible, RIL could save 40 ton/ha at a cost of $8/ton.

What contribution could RIL make to carbon dioxide emission reductions in Cameroon, assuming an average carbon savings of 6 ton/ha?

Table 2: Net Value of RIL within CDM to Cameroon

RIL Unit Costs	Value of Carbon	
$/ha	$17/ton	$6/ton
$135/ha	($4,950,000)	($14,850,000)
$20/ha	$12,300,000	$2,400,000

If RIL were implemented in all of Cameroon's forests, of which 150,000 ha are logged each year, it would yield a net revenue stream of US $12.3 million/year, assuming that carbon was traded at $17/ton and RIL costs were $20/ha. If, however, costs were much higher (i.e., $135/ha) and the value of carbon less (i.e., $6/ton), then RIL would result in a net loss of over $14 million.

The emission savings associated with RIL in Cameron would amount to less than 1% of France's total carbon emissions of 100 million tons/year. But since the marginal cost of emissions reduction in France is high (because of its reliance on nuclear energy), investing in forest-based carbon offset projects in Central Africa may be attractive, given France's economic and political interests in the region. ■

Risk Management

Forest-based carbon offset projects in developing countries are considered to be much riskier than emission reduction projects in industrialized countries, which usually involve the permanent installation of clean technology. Project-specific risks include uncertain initial conditions; natural hazards, such as fires, poor project design; and out of project events, such as a new road unexpectedly built; whereas, country-specific risks include political instability and policy swings. Market risk includes the existence of a carbon market and the rules by which it will operate.

No CDM credits have yet been sold, because the rules have not been finalized. Nevertheless, different financing schemes have been proposed that would influence project and country-specific risk, project cost, and hence project viability (Table 3). The most common approach is project-specific financing, whereby the host country or intermediary organization negotiates the price per ton of carbon sequestered with an investor (e.g., The Nature Conservancy's Noel Kempff project in Bolivia). Because most of the risk lies with the investor, the price tends to be low (<$5/ton). Grouping several projects under a single marketing umbrella can help reduce the risk of project failure. Alternatively, carbon can be treated as a commodity that is sold at a fixed price to many investors (e.g., Costa Rica sells certified tradable offsets on the Chicago Board of Trade). To insure against project and market risk, a reserve of offsets is set aside, not sold. Credits sold under this scheme tend to be priced higher (>$10/ton).

Table 3: Analysis of Project Financial Viability

Possible carbon offset contracts	Bearer of project financial risk	Bearer of market financial risk	Direst financial incentives for performance	Relative effect on price
Project financing (quantity and price depend on project performance)	Investor	Investor	Weak	Negative
Carbon sold as a commodity at a fixed price (quantity and quality guaranteed)	Host country	Investor	Moderate	Positive
Carbon sold as an option (price and quantity guaranteed)	Host country	Host country and investor	Very strong	Positive

A third approach, which has been proposed in Nicaragua, is a risk-sharing scheme, whereby the investor purchases an option to acquire an offset at a higher, but predetermined future price. This approach has several advantages. A relatively small foreign investment is required, but the seller gets a small amount of money immediately, which may be needed to get the project going. The host party also has a long-term incentive to make the project work, thereby reducing the project risks. Finally, the option price does not have to be discounted too much as a result of current uncertainty. Risk-sharing schemes are particularly attractive in Central Africa, where governments have pressing short-term funding needs, and commitment to better forest management is vulnerable non-market risks. ■

Biomass Monitoring

The CDM depends on the scientific validation of the sequestered carbon. Tests in Noel Kempff, Bolivia show that field-based carbon monitoring can be relatively inexpensive (e.g., <$0.25/ton of carbon offset). But it is unclear if this approach can reliably measure changes in biomass over large areas. A study of field biomass measurements performed over the same boreal forest stands by two groups shows differences as large as 90 ton/ha for the same stand, and that the differences are greater for larger biomass values. The main reason for these differences is the spatial variability within each stand, which is likely to be even higher for old growth tropical forests. An alternate method is radar remote sensing. The standard approach is to fit a regression curve to a set of backscatter and ground-based biomass measurements. The curve is then used to estimate biomass over other areas and forest stands. But this approach is invalid if the forest types deviate from those used to obtain the regression. A more fundamental problem is that the radar backscatter saturates at about 150 ton/ha of biomass, yet biomass densities can reach 400 ton/ha in mature tropical forests. Until specialized biomass mapping sensors are available, it may be possible to use time-series optical data to build a forest class baseline, and then map changes between classes over time. Forest classes can be tied to standard biomass densities, and between-class changes then used to estimate carbon lost or sequestered. The launch of Landsat 7, which is designed to provide complete global coverage four times a year at a cost of less than $600 per 190 by 190 km scene, makes this approach technically and financially feasible.

Several projects, such as the World Bank's Regional Environmental Information Management Project (REIMP) and the French API-Dimako in Cameroon have tried to improve forest management by increasing the supply of technical training and data. But their contribution to better forest management has been limited by the lack of effective demand. Linking forest-based carbon offset projects to forest monitoring could increase the impact of such projects by boosting the demand for forest science, remote sensing, and other technical skills.■

Role of Government

Governments must formally approve CDM projects on their territory. They can also influence, directly and indirectly, the level of project risk. A key issue for forest-based carbon offset projects is the coherence between the goal of the project and the thrust of government policy as it affects forest management. There are three degrees of coherence. The deep integration approach implies a tight coherency between project and policy goals. This is evident in Costa Rica, where the government is committed to taking advantage of the CDM as a source of sustainable development financing. The technology transfer approach implies that the government picks a sector to benefit from the CDM. It appears that East European governments, for example, might have targeted the power sector for reform. Finally, the island approach implies minimal government buy-in to the project goals or integration within broader forest and land-use objectives. Under these conditions, risks escalate. Government attitudes are therefore critical to the likely success of forest-based carbon offset projects. ■

Forest cleared by a bush fire.

For More Information

Technical Reports:

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Totten, M. 1999. *Getting it right: Emerging markets for storing carbon in forests, forest trends and WRI.* Washington, D.C.: World Resources Institute.

CARPE ... What Is It?

Central African Regional Program for the Environment (CARPE)

Launched in 1995, the *Central African Regional Program for the Environment (CARPE)* engages African NGOs, research and educational organizations, private-sector consultants, and government agencies in evaluating threats to forest integrity in the Congo Basin and in identifying opportunities to sustainably manage the region's vast forests for the benefit of Africans and the world. CARPE's members are helping to provide African decision makers with the information they will need to make well-informed choices about forest use in the future. BSP has assumed the role of "air traffic controller" for CARPE's African partners. Participating countries include Burundi, Cameroon, Central African Republic, Democratic Republic of Congo, Equatorial Guinea, Gabon, Republic of Congo, Rwanda, and São Tomé e Principe.

Web site:
http://carpe.umd.edu

The Biodiversity Support Program (BSP) is a consortium of World Wildlife Fund, The Nature Conservancy, and World Resources Institute, funded by the United States Agency for International Development (USAID). This publication was made possible through support provided to BSP by the Africa Bureau of USAID, under the terms of Cooperative Agreement Number AOT-A-00-99-0028-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID.

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