Local Sustainable Development Effects of Forest Carbon Projects in Brazil and Bolivia: A View from the Field [1]

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SUMMARY

The Kyoto Protocol and its flexibility mechanisms triggered a global debate on the valuation of forests as source of environmental services important to economic growth and development. This article seeks to understand what benefits are made available to local communities through existing carbon sequestration schemes and what incentives there are for executors to involve local people more fully as partners or beneficiaries. Drawing on research from four pilot projects in Brazil and Bolivia on a gradient across *cerrado* and Amazon biomes, the authors highlight critical gaps remain in the understanding of the interfaces between people, forests and carbon, fundamental to successful project design, implementation and outcomes. In conclusion, the authors propose a set of generic project criteria and indicators to be considered by nationally designated agencies in their assessment of forest carbon projects, to promote socially and environmentally "friendly" project design.

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1. INTRODUCTION – THE GLOBAL CONTEXT

Forest carbon projects became a prominent feature of the international climate arena in 1995 with bilateral projects under a UN Framework Convention on Climate Change (UNFCCC) programme called Activities Implemented Jointly (AIJ), in which a number of such projects were initiated as pilots. In 1997, in Kyoto, negotiators to the global climate regime agreed to devise rules for a market-based instrument called the Clean Development Mechanism (CDM) based on Article 12, one of the Protocol's so-called flexibility mechanisms**.** The CDM foresees that developed countries and economies in transition can acquire carbon credits generated through projects implemented in developing countries to abate part of their greenhouse gas emissions reductions commitments agreed in the Kyoto Protocol. A key tenet to the CDM is that projects must contribute to the sustainable development (SD) of host countries according to national SD criteria. In Brazil and Bolivia, as in most developing nations, these criteria are in the process of definition, anticipating implementation of the CDM in the first commitment period over 2008-12 when (and if) the Kyoto Protocol is ratified.

The Kyoto Protocol and its flexibility mechanisms triggered a global debate on the valuation of forests as sources of environmental services important to economic growth and development. Pilot forest carbon projects focusing on conservation and restoration of degraded lands and industrial reforestation across a range of tropical biomes in Latin America illustrate how forest ecosystems can generate global and local co-benefits. In climate change negotiations, developing countries are perceived as *co-responsible but differentiated* due to their historically late industrialization (despite the recent rapid growth of some nations and their increasing per capita consumption of fossil fuels). There is consequently a great need for technology transfer and the CDM could address this by acting in a redistributive fashion while promoting clean production systems. Rather than hinder growth, there is in the CDM an intent to leverage project finance for activities that not only mitigate climate change but that also go the extra mile towards sustainability. In this sense, diversified climate portfolios may add biodiversity conservation and social benefits to combating global warming. But such win-win outcomes will most certainly be more complex and require project design sensitive to concerns such as local empowerment and social capital formation.

Climate change, and specifically those issues associated with land use, land use change and forests (LULUCF) are of increasing importance to Brazil and in Bolivia and assumed a high profile in debate over national environmental policy even prior to the signing of the Kyoto Protocol. Bolivia is among several Latin American countries that support the

inclusion in the climate agreement of payments for the ecosystems services of their forests, while the Federal government in Brazil remains opposed to the avoidance of deforestation as an alternative in the CDM. Yet, it remains a fact that 20 % of global carbon dioxide emissions result from land conversion in the tropics (IPCC, 2000). For example, the principal greenhouse gas emissions in Brazil arise from deforestation at the agricultural frontier, primarily in the Amazon region. It is difficult to assure reliable measurement of emissions from clearing and burning of biomass in tropical forests. The IPCC (2000) estimates a mean value of 120 t C/ha of carbon stock for tropical forests, but this figure may vary substantially, to as high as 250 t C/ha (Locatelli, 2001), based on local estimates. When forests are cut and burned, a large proportion of this carbon stock is immediately lost in the form of CO_2 emissions to the atmosphere.

A key problem in Amazonia, and in particular Brazil has been the increase in deforestation since the 1990s, including the states of Mato Grosso (where one of our case study forest carbon projects is located), Pará and Rondônia, in declining order of intensity. Regulatory controls over clearing activities in forest areas have had limited efficacy in abating deforestation and promoting the environmental services that forests provide, such as carbon sequestration. In response, innovative approaches that make use of market mechanisms for conservation and land use management are emerging in many parts of Latin America. Pagiola et al. (2000) bring to light a number of initiatives where economic instruments can provide incentives to conserve forests and at the same time contribute new sources of income to support rural livelihoods. Brazil, for example, adopted fiscal instruments such as the Ecological Value-Added Tax at the state level for encouraging conservation and providing environmental services (May et al., 2002).

Landell-Mills & Porras (2002) reviewed 287 existing cases of different forest environmental services worldwide up to 2001, among which 75 refer to carbon sequestration projects, schemes or market formation. Their review aimed at learning the characteristics of the emerging markets, the conditions and the process of their development and their effects on social welfare, in particular their contribution to poverty alleviation. According to the authors, as the market matures, there is a trend of individual voluntary and experimental projects being replaced by multi transaction carbon schemes with increased intermediation by third party organizations, particularly in countries with higher market development and qualified services. The core demand of forest carbon projects comes from corporations with intense emissions followed by intermediaries willing to anticipate the generation of the product for the emerging market. Among host countries, developing nations predominate, followed by

those with extensive land area, thus with great potential for forest carbon sequestration. However, there has been little on-the-ground research to assess the real developmental benefits that have accrued to those communities that live in the vicinity of forest carbon projects, one of the most highly touted among the panoply of environmental service markets.

The potential for such projects to generate local sustainable development benefits remains contentious in the context of the emerging carbon market (Vitae Civilis, 2002), while mainstream traders and developers preoccupy themselves with strengthening market structure. Forest carbon projects involve diverse stakeholders and a range of concerns that cut across scales of governance. They may bring investors or beneficiary corporations, aiming to reduce their emissions cutting burdens, to partner with host governments and non-governmental organizations and local community organizations to achieve that objective. Corporations now realize that there is a high cost of NOT doing things right. Investor risk grows with the threat of catastrophic climate events and burning of forests. The stakeholder approach in corporate-community relations (May et al., 2002) is in part due to this need for risk amelioration. While it is certainly of interest to national development that there be international investment and transfer of technology for "clean development", the socio-environmental impacts of distinct project approaches at different levels should also be part of the criteria adopted for project approval.

Although it is stated in the Kyoto Protocol that it is up to the host government to approve CDM projects in line with national sustainable development priorities, most national governments do not have these criteria clearly defined. At present the Brazilian Government is in course of elaborating such criteria. In October, 2003, the Interministerial Commision on Global Climate Change, the Brazilian National Designated Authority, disseminated its proposed Resolution no. 1, a "Guideline on the implementation of CDM projects in Brazil", where some socio-environmental concerns are proposed in a brief annex (see www.mct.gov.br/climate), representing a first step towards sustainable development criteria against which projects will be assessed.

The research reported here explores the extent to which carbon sequestration projects can contribute to national sustainable development as a corollary to global policy, and to suggest avenues for project design and implementation that can pro-actively enhance local benefits. More specifically, the study aimed to assess the socio-economic and environmental impacts of four of the principal pilot forest carbon projects underway in Latin America, three in Brazil (Plantar, Peugeot and Bananal) and one in Bolivia (Noel Kempff).

The study sought to examine how different groups at different spatial levels, in particular communities in each project area are affected by the presence of forest carbon projects. The key question under study was how carbon sequestration schemes may contribute to local socio-environmental and development benefits in the case study areas, while contributing to global CO_2 emissions reductions. In each case, fieldwork sought to discern specifically: What benefits do forest carbon projects offer to local peoples and how are these benefits distributed among different stakeholders? Finally, the research set out to determine the extent to which project objectives are consistent with local socio-economic priorities and needs.

2. METHOD

A range of qualitative methods was selected to address the research questions. The general framework used to analyse the carbon projects included (a) case study analysis, (b) stakeholder appraisal and (c) documentary analysis.

(a) Case study analysis was chosen for its ability to illustrate a particular issue that reflects inherent interests of the researcher and not because it represents any other case, but also aims to provide insights into a particular issue by drawing more generalizable conclusions (Denzin & Lincoln, 2000). A case study draws focus to the question of what we can specifically learn from a single case, it is: "both a process of inquiry about the case and the product of that inquiry" (Stake, 2000:436).

(b) Appraisal of stakeholders' evaluation of projects sets the context within the wider framework of sustainable development, by integrating the three technical sustainability dimensions: economic, social and environmental; scrutinizing the various beneficiaries at different levels and by analyzing the impacts within a timeframe (long term/short term outlook). To do this the research entered into contact with the project developers and those who are directly and indirectly involved, be they laborers, project beneficiaries, appropriators of eventual carbon credits, local authorities, official environmental agencies, government organizations, local NGOs and farmers or workers' organizations. Each case study targeted from 20 to 50 semi-structured stakeholder interviews, which were analysed qualitatively. In the process, it was possible to identify those stakeholders at the local and regional level who could make use of or take part in the potential carbon incentive and thereby suggest in what way it could increase the potential benefit to local communities hence increasing its contribution to local development.

(c) Documentary analysis – the study relied also on documentary analysis from secondary sources (governmental agencies, universities, research institutes and several NGOs), as well as project documents furnished by developers and sponsors, and their respective websites to the extent that these helped to shed light on motivations and expectations.

3. THE CASE STUDIES

To facilitate evaluation a threefold typology of case studies was derived to include (i) commercial projects, (ii) conservation projects and (iii) development projects. These are described in Table 1, as they relate to the four projects reviewed and their specific stated objectives. At the time of initiation of research there were six ongoing forest carbon pilot projects underway in Brazil and one in Bolivia being implemented in connection with the first UNFCCC commitment phase. This research studied four of these projects. (The researchers approached the implementing organizations responsible for the additional cluster of three projects underway in Paraná, Brazil, but were refused access to project staff and documentation.)

Overall, we found that the implementers strongly imprint the approach adopted by the projects. For that reason, they are sometimes used to refer to the project itself. Two of the four projects evaluated in this paper are predominantly commercial, yet have different commercial objectives in the context of their respective sectors. The Plantar project aims to maintain the pig iron sector's viability by financing renewed industrial reforestation and fuel substitution , whereas the Peugeot project aims primarily to counteract the negative environmental image of the high CO_2 emitting automotive manufacturing industry. The Bananal project is more of an experimental project that stands out in its "social carbon" approach by anchoring local socio-environmental development with protection against loss of existing carbon stocks at the frontier through deforestation. The Noel Kempff Mercado Climate Action project in Bolivia illustrates similar features of conservation and development, whereby carbon stocks are retained or their leakage avoided by buying back logging concessions and promoting alternative activities to forest encroachment for local communities.

4. SOCIO-ENVIRONMENTAL BENEFITS AND LOCAL DEVELOPMENT POTENTIAL

(i) Plantar Project

Plantar, located in Curvelo (nursery and plantation) and Sete Lagoas (pig iron factory), Minas Gerais in the Brazilian *cerrado*, is one of the pioneers of fast growing industrial eucalyptus plantation technology, which it perfected during the 1970s and 80s built on generous federal subsidies, since discontinued. The company seeks carbon credits to enable it to maintain plantations used to produce charcoal to fuel its blast furnaces, and to sell certified "green pig iron" to the international steel industry, so differentiating it from the rest of the industry, based on carbon-emitting fossil fuels and electricity.

The CDM holds out the promise that it can guarantee and reinforce the economic sustainability of biomass based energy alternatives. This project, which juxtaposes the utilisation of forest biomass against fossil fuel exploitation, is a good example of this potential role for CDM. However, the promise of fuel substitution should be matched with social sustainability. The primary social benefit offered by the proponents of this project would be the maintenance of 1,270 direct jobs, which could be lost were the company to close its doors, a scenario the company predicts would shortly occur should carbon finance be denied, due to absence of alternative sources of capital to permit investment in forest assets.

Given the forestry vocation of the *cerrado* region and Plantar's substantial technical know-how in high technology clonal seedling production, there appears to exist considerable potential to secure local development benefits through outgrowing under a forest farmer scheme already existent in Minas Gerais. This could include the possibility for extending carbon credits to include such farmers. No such forest technology diffusion or social inclusion efforts were proposed by Plantar, however, which restricted its relations with the local community to a modest environmental education programme and certified "child friendly" status in respect of child labour laws.

Furthermore, Plantar's need to purchase additional large land areas for forest carbon accumulation, indicates that such industrial plantation schemes for climate mitigation could encourage a new process of tenure concentration. Plantar's pre-existent Forest Stewardship Council (FSC) plantation certification assured investors that the company is meeting all applicable environmental and labour laws, as well as permitting it to certify its charcoal and final products through a chain of custody from plantation to industry. However, prior certification according to these criteria does not necessarily assure social sustainability.

(ii) Peugeot Project

Peugeot contracted with the French forest service ONF to execute a large-scale plantation of native trees in the Amazon frontier of northwest Mato Grosso, Brazil, for the purpose of carbon sequestration. No carbon credits were to be sought, but the experience was expected to serve as a basis for future commercial forest carbon endeavors. A regional NGO involved in smallholder extension, Instituto Pró-Natura (IPN), was also brought into the scheme to promote synergy with regional socio-environmental objectives.

The publicity impact desired by the investor led the partners to set an overly ambitious target – establishment of 10 million native trees in three years on 5,000 hectares – in an environment culturally and ecologically unfamiliar to the executor. As a result the project faced a number of hurdles during its initial phase, which forced it to change course. The principal barriers to the success of the reforestation were a low survival rate of seedlings planted in vigorous *brachiaria* grass, and the repercussions of attempts made by the executors to surmount this hurdle by adopting aerial spraying with the herbicide Roundup. This together with accusations of biopiracy against the executor, although never proven by public investigators, profoundly affected the project, forcing its executors to redirect their approach, and to adopt a more accommodating position with regard to relations with Brazilian public institutions.

The process of internal re-evaluation by ONF resulted in a number of changes: substitution of the use of herbicides by manual weeding; reduction of reforestation targets from 5,000 ha to 2,000 hectares; restoration of permanent protection areas in line with the state's rural land use licensing system; creation of a Scientific Advisory Committee with the participation of regional universities and government institutions; substitution of foreign equipment and expertise with local inputs; enhancement of local integration through an environmental education program and seedling distribution to local farmers.

In terms of carbon benefit, with the establishment of more realistic targets, the initial estimation of 2 M t C to be sequestered over 40 years has now been reduced to 500,000 t C over 100 years. However, this reduced target has not undermined the positive image associated with its financing by a well-known car manufacturer. The area reforested is quite considerable in an area of agriculture frontier and rapid deforestation, where experience with native forest recuperation is very weak. In this sense, the project has attracted considerable attention and reaction in attitudes of local landowners. However, a conversion toward more sustainable land use practices will only be effective when combined with other social integration efforts such as extension assistance, environmental education, access to markets

and financial support. When opportunities do arise, however, local farmers have been quick to climb on board.

In terms of social benefits, the project has created job opportunities in tree planting and maintenance, income generation through seed purchase and service tax levied by the local government. However, these benefits have been most significant only during the project's implementation phase. In the maintenance phase, beginning in 2003, employment and local tax revenues have fallen off quickly. The large-scale nursery established to expand carbon forest plantings in the region was de-activated. A forestry extension activity of seedling distribution of multifunctional trees to smallholders is being undertaken in partnership with IPN in line with the institution's role in disseminating agroforestry practices in the region. Along with modest donations for hospital facilities and the environmental education programme aimed at local schoolchildren, this component has promoted some measure of integration of the project with local communities and surrounding land reform beneficiaries. This suggests that a more direct involvement of local farmers in carbon schemes would be more effective than large-scale demonstration plantations themselves as a means to encourage sustainable land use practices over a wider landscape.

(iii) Noel Kempff Project

The Noel Kempff Mercado Climate Action Project (NKMCAP) was initiated as a partnership between the Bolivian government, regional NGOs, The Nature Conservancy (TNC) – one of the largest North American conservation organizations, and major energy and automotive corporations in the U.S. seeking to reduce their future carbon emissions liabilities. The project began during the JI phase of the UNFCCC, but is expected to seek credits under the Kyoto Protocol. NKMCAP assured a major expansion of national park area in tropical forests on the Bolivian border with Brazil, previously granted in concession to timber companies. It also provided for indigenous communities to have access for sustainable management of some forest areas, and committed funds toward local environmental improvements.

Prior to the Park expansion the communities did not have legal access to the territory but had accessed the forest through informal usufruct rights during nearly 100 years. The project established a buffer zone on the western side of the Park, where three communities were located. The principal economic impact on the communities of Park creation was their loss of employment in logging concessions. Lack of participation in project design led to uncertainties about access to resources and income earning activities, bringing initial

opposition to the Park expansion by local communities. A community development programme was initiated in this context of uncertainty and conflict, facing an absence of organized community representation. Model farms and planting trees promoted by the project had limited success, due to inadequate diagnosis of the complementarity of these proposals with local labour availability, as well as to insecure land tenure. A project-led microcredit scheme was also problematic, as the majority of loan recipients were unable to repay their debts.

The principle project benefits foreseen by local community members include land titling and sustainable forest management, expected to stimulate local development, generating income to pay for health and education. Over time and through greater dialogue, trust was built between the project executors and local communities. Community development objectives are now clearer and there is greater community participation.

This study suggests that the project had an overly centralized project design, unclear links between objectives and as a result too many activities, poor communication about access to resources by communities, resulting from little time and the pressures of the project cycle, a distant project site and vast area to cover with few technicians. The project's strengths included provision of resources to communities in a context where local government is weak, and the project managers' ability to adapt to local realities and move closer to a partnership recognizing local priorities.

(iv) Bananal Project

Also an early starting project in respect to definition of Kyoto rules, the Bananal Island project is implemented by the environmental NGO Ecológica in areas surrounding the Araguaia National Park and in conservation and indigenous lands on and contiguous to Bananal Island in Tocantins state, Brazil. Financed initially through a competition sponsored by a UK subsidiary of energy multinational AES, the project involves partnerships with state and federal environmental agencies, local governments, indigenous communities and land reform beneficiaries.

The Bananal Project is essentially of experimental character. It aims at learning how to format competitive carbon projects and open up future opportunities. As an experimental project it does not intend to claim carbon credits, giving a great margin of freedom to the developer to adapt its activities.

The project was originally conceived to offer forest conservation and recuperation inside public parklands as its central component, to be managed in partnership with the

Federal and State Government environmental agencies. However due to lack of robust institutionalization of these partnerships, the planned activities did not materialize during the course of the project. This restricted the project targets to research and social components.

The research component focuses basically on the development of carbon monitoring methodologies and studies of regional biodiversity. Due to the substantially reduced forest activities, the amount of carbon sequestered or stocks retained due to project related activities must be cut sharply. However, the concept of using carbon funds to support official agencies' efforts to protect and restore conservation units could be fruitfully carried forward by other projects.

The project's social component introduced activities along the lines of what Ecológica has described as "social carbon". These actions focused on environmental education to school students and community members, support to income generation activities, distribution of seedlings and establishment of agroforestry systems. The primary project beneficiaries are land reform settlers, community members and indigenous groups. In addition to its interventions, the project pioneered introduction in Brazil of the Sustainable Livelihood Approach to assess the impact of this intervention on local communities with their participation.

The project itself did not generate significant employment. Efforts are underway to support sustainable income generation activities, but net results of such efforts for income and employment remain limited in terms of scale. The project expects that raising environmental awareness may also contribute to carbon benefits, both by increasing tree planting and by reducing deforestation. The impact of such consciousness-raising activities on regional carbon stocks is indirect and difficult or impossible to measure, however.

The evaluation suggests that partnerships with government agencies need to be formalized and budgets clearly defined to avoid political discontinuity, endangering results. Although the Kyoto Protocol does not allow credit under the CDM for avoided deforestation, in agricultural frontiers such as the Amazon region, complementary incentives such as forest valuation by the carbon market are urgently needed to guide proper land use. Government environmental agencies may thereby strengthen their capacity to protect unique biomes, and rural development agencies may thus induce landowners to restore mandatory permanent reserves or establish sustainable production systems.

Table 2 provides a summary of local development benefits for all four projects reviewed in the study.

5. CONCLUSIONS AND PROPOSED CRITERIA AND INDICATORS

A common feature shared by all four pilot carbon projects we assessed, is that although they began with defined objectives, they have metamorphosed both in terms of their specific objectives and operational features. In other words, the projects adapted as the climate regime regulations evolved internationally and as they learned by doing locally. As early starters, they often run the risk of being left out of the categories defined as valid by the negotiators to the Conference of Parties for carbon credits and some projects never went beyond defining themselves as purely learning experiences. Overall, however, the projects evolved in response to local pressures for social and environmental responsibility, primarily through ad hoc efforts on the part of innovative field managers to adapt project actions to incorporate activities such as agroforestry extension, environmental education, microcredit and marketing assistance, even when such activities were not contemplated within original project budgets.

It became clear from the study that stakeholder participation should be enhanced when designing, implementing and evaluating outcomes of forest carbon projects, as is true for all development projects. In the four projects reviewed, participation of local community members was found to have been limited. It is necessary to objectively seek stakeholders' opinions and to ensure that the project concept be transparent to all since its inception. Social assessment should be pursued through participatory processes, which may significantly affect the potential that local social development occurs as an offshoot of CDM projects.

Regarding the contribution of these projects towards local sustainable development, a key issue is the degree of social inclusion attained by participation of surrounding residents in the generation of carbon credits. Even if such participation is secondary to a project's main objective, it may come to have a more important effect on local development than that resulting from indirect economic spin-offs of project actions. For the communities, taking part more effectively as a project partner can bring many socio-economic benefits, not least of which being income generation and/or access to credit from the direct sale of environmental services as well as stimulating local capacity to undertake new projects.

Forest carbon projects, like production of some agricultural commodities, depend on a reasonably large minimum area to guarantee profitability. Due to the considerable transactions costs, particularly those incurred in negotiation of contracts, carbon monitoring, carbon credit commercialization and technical assistance for planting and growing trees, large areas are typically necessary to amortize these costs. Perhaps the most insidious effects of large-scale reforestation schemes would arise from the reinforcement of already highly

skewed land distribution patterns in these two countries, where such projects must comply with Kyoto additionality by aggregating cleared areas rather than recuperating pre-existent degraded plantation sites. From a social perspective, this requirement would contribute to a new source of rural land concentration. In this sense, the carbon market would repeat the same process that occurred with other agricultural and industrial forest commodities in developing countries, such as coffee, sugarcane and eucalyptus for cellulose and fuel. One way to avoid this reconcentration process is to involve local community members from the outset as partners in the undertaking, through outgrower schemes, similar to contract plantations used in many forest enterprises the world over.

It is clear that executors must be urged to involve local people more as partners or beneficiaries, and not solely to permit that they comment on project proposals. In general, projects have erred by giving far more attention to their purported global environmental benefits in terms of potential for net carbon absorption, and far too little to their potential repercussions for local sustainable development and community capacity building. Forest carbon projects may be a source of new local employment and tax revenues, but, depending on the project design and arrangements they may also be disruptive of existing labour arrangements, and may be overly reliant on external purchases and services to the detriment of local suppliers.

Going beyond the review of environmental, social and economic impacts on local sustainable development of these projects, we conclude this study by proposing a series of criteria and indicators that may be applied by Designated National Authorities (DNAs)in reviewing forest CDM projects. These criteria and indicators are presented in Table 3 below as a guide for discussion among interested groups and government officials, in the hope of providing a basis for incorporation of local sustainable development concerns more explicitly in project review procedures. By promoting adoption of explicit criteria and indicators to reinforce such positive feedback effects on local sustainable development, this study hopes to contribute to debate and policy formulation in the implementation of the global climate accords.

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Table 1 Examples of carbon forest projects in Bolivia and Brazil

Typology	**Project name and country**	**Aims**	**Activities and land area**
Commercial projects – These prioritize the generation of certified emissions reductions – CERs for commercial reasons. National and/or international enterprises driven by the opportunity to take part in this emerging carbon market often head these projects. Such projects may be implemented directly by transnational corporations whose industrial activities are emissions-intensive, in search of CERs to complement their reduction commitment, or by a national industrial sector such as the lumber industry or the biomass energy sector that wish to sell CERs.	**Plantar Project Brazil**	Continued utilisation of charcoal as a reducer for pig iron manufacture, rather than to convert to use of mineral coke, a tendency common among other segments of Brazil's charcoal-based iron industry.	12.88 M t (million metric tonnes) of CO_2 emissions reduction equivalents (CERs) over a 28-year time horizon, seven years corresponding to reforestation and growth and 21 years corresponding to charcoal utilisation as an iron ore reducer by the industry. These carbon credits would be generated through three project components: a) 7.9 M t CO_2 from industrial activity (net emissions by substitution of mineral coke by charcoal); b) 0.44 M t CO_2 from improvement of charcoal kilns (methane emissions reductions); c) 4.54 M t CO_2 from reforesting 23,100 hectares with eucalyptus and assisting in regeneration of 478 hectares of native vegetation. The agreement between Plantar and PCF includes sale of 1.5 M t of CO_2 credits, corresponding to about 12% of the total CERs expected by the project. The negotiated price was US$3.50 per ton of CO_2 (about US$ 12.85/t C), determined by PCF estimates, resulting in potential credits totalling US$ 5.25 M.
	Peugeot-ONF project Brazil	Rehabilitation of degraded lands in northwest Mato Grosso, in the so-called "Arc of Deforestation" of the Amazon basin. The project seeks to create an environment friendly image as a market strategy to counteract the negative environmental perception of the emissions-intensive automotive manufacturing industry.	Rehabilitation of 10 million native and exotic trees in 5.000 ha formerly in cattle pasture, generating an estimated 2 M t C over 40 years.

Typology	Project name and country	Aims	Activities and land area
Conservation projects – These prioritize environmental benefits such as forest and local biodiversity conservation. These projects are often mediated and implemented by NGOs – typically environmentalist – who also associate with international investor corporations in search of CERs. In this association the investors depends on the developer to manage the conservation and the latter gains political and financial support for their conservation mission conserving the local environment. The developers of this type of projects also have to establish partnerships with transnational organizations seeking CERs as well as to promote an image of social responsibility as project financiers.	**Noel Kempff Mercado Climate Action Project Bolivia**	Emissions avoidance (avoided deforestation). The Project seeks to avoid carbon dioxide emissions from deforestation and forest harvesting by conserving forests. Complementary activities include monitoring of indemnified logging companies and assisting community development to enhance local sustainable agriculture, forest management and to enhance social development benefits, thereby avoiding carbon "leakage" due to displacement of economic activity to other locales.	Expansion of National Park by 634, 286 ha to a total of 1,523,446 ha of diverse lowland and upland forests. By avoiding and reducing greenhouse gas emissions from logging and agriculture, the project is expected to protect up to 3.5 M t C over 30 years
Development projects – These prioritize social objectives along with environmental ones. Some organizations initially objected to the incorporation of carbon sequestration into the Kyoto Protocol due to their concern that the CDM are a loop hole for developed country to avoid real emission reduction targets. Some organizations therefore advocate projects of a developmental nature, giving priority to the needs of local communities while	**Bananal/Ecológica Brazil**	To generate experience in the elaboration and implementation of carbon projects that may link the carbon certificate generation and social responsibility image of transnational companies to the needs of local communities. The project has introduced the concept "social carbon" that is carbon generated with a priority focus on social aspects.	Protection of 200.000 ha of standing mature forest, regeneration of 60.000 degraded cerrado wood land, and the implantation of 3000 ha of agroforestry with an estimated gain of 25 M t C

Table 2 Summary of local development benefits

Project	Beneficiary group	Activities	Observable results
Plantar	Company employees	Jobs maintenance	1,270 jobs in the nursery, forest and industrial areas
	Small retail and services enterprises	Multiplier effect in the local economy	Job and economic activity permanence
Peugeot	Rural workers	Jobs in reforestation	Seasonal, concentrated in planting period (100 jobs in rainy season, over three years, 20 jobs in dry season)
	Agrarian settlers Small landowners	Native seed purchase	About 500 people benefited. Demand only while planting continued (through 2002).
		Distribution of seedlings of forest and orchard species	29 small farmers participate, with a total planting area of 70 ha.
	Juruena municipal population	Increment in the Service Tax (ISS)	More money for application in health, education and agriculture
Noel Kempff	Community members	Provision of credit incentives and rotating funds	93 microprojects (approximately 48% of families in the zone). Majority had not succeeded due to poor repayment of debt in part caused by cultural and infra-structure problems. Majority of loans had not been repaid preventing new loans being taken.
		Agroforestry and technology transfer	1 farmer (0.5% of families) successfully adopted agroforestry model system to project standards. A small number of unsuccessful trials and some in progress.
		Employment	Approximately 6 out of 12 park guards from the community.
		Acquisition of logging concessions	Reduction in the number of jobs derived from this activity. In one of the communities approximately 13 families of 26 (50%) were affected by loss of jobs.
		Land title and community based organisation	Support to process of transferring land rights, which can enhance existing local conflicts in the process. Unclear property rights issues resulted. New roles and responsibilities for the CBO and village committees and headmen.
Bananal	Agrarian settlers	Financing a sweet factory using native fruits of the *cerrado*	R$ 200 (US$ 60) / month gross revenue to the group.
		Distribution of seedlings of forest and orchard species	Lacking registry of distribution and follow up monitoring Educational effects are positive
		Training and capacity building courses	Training and motivation for implantation of agroforestry systems
		Native seed purchase	Process is only at initial stage

Table 3 Sustainable Development criteria and indicators proposed for forest carbon evaluation

Component	Criterion	Indicator
Social	Project budget shows evidence of financial commitment to the social component	✓ Percentage of budget allocated to social activities ✓ Number and salaries of permanent staff in social segment
	Smallholders in communities surrounding project participate directly in the project's "core business" (carbon sequestration)	✓ Number of smallholders involved in carbon schemes ✓ Tons of carbon sequestered by smallholders ✓ Percentage of total predicted net additional carbon to be obtained by smallholders
	Land tenure concentration in project area is not exacerbated by project activities	✓ Prior land concentration in project area (area and number by size class) ✓ Total area purchased for project purposes
	Net employment is generated by the project	✓ Change in number employed due to project investment
	Employment quality for community participants is improved by the project	✓ Length and seasonality of employment over project lifetime ✓ Average salary and benefits compared to local standards ✓ Existence of training for employees
	Net income is generated by the project among local participants	✓ Change in net real income among project participants ✓ Financing made available by project for local micro enterprises ✓ Technical and managerial training courses offered ✓ Project staff time dedicated to technical assistance toward local income generation ✓ Ratio between project personnel and no. of families assisted ✓ Inputs (eg., seedlings) are distributed to participating community members
	Knowledge and learning is generated and disseminated based on project activities	✓ Existence of scientific advisory committee ✓ Existence of partnership with research institutions ✓ Number of papers published on project results
	Community members have participated directly in project design	✓ Existence of stakeholder or livelihood assessment ✓ Record of public hearings ✓ Participatory Rural Appraisals
	Forest management has been subject to prior certification	✓ Existence of prior internationally recognized socio-environmental certification of forest use
Environmental	A net increase in terrestrial carbon storage is anticipated due to the project	✓ Total tons of CO_2 sequestered (net tons) by project and by hectare
	Local biodiversity will be maintained and/or enhanced by the project	✓ Proportion of area under permanent protection in relation to total project area ✓ Protected areas or biological corridors established

Component	Criterion	Indicator
		established ✓ Compliance with land use / environmental legislation
		✓ Proportion of area reforested with native species
	Biodiversity effects of the project will be monitored	✓ Change in population of keystone species
	Project impacts on water resources will be monitored	✓ Changes in water quantity measured by flow ✓ Changes in water quality measured by periodical chemical or visual assay
	Soil monitoring	✓ Changes in soil quality measured by chemical and physical analysis
	Environmental Education	✓ Population served by environmental education activities ✓ Number of teachers from public network involved
Economic	The project will have a favourable effect on the national balance of payments	✓ Share of foreign capital in overall financial profile (%) ✓ Volume of external capital investment (US$)
	The project will have a favourable income multiplier effect in the regional market and local communities	✓ Value and share of resources generated by project that remain in local communities
		✓ Percentage of total labour used by project contracted locally
		✓ Percentage of project inputs acquired in regional market or in local communities
	The project is cost-effective and competitive with other climate abatement initiatives	✓ Internal rate of return on project investment ✓ Cost per ton of carbon

Figure 1. Forest carbon project locations.