Local sustainable development effects of forest carbon projects in Brazil and Bolivia

A view from the field

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ENVIRONMENTAL ECONOMICS PROGRAMME

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Acronyms and abbreviations

AEP	American Electric Project
AFS	Agroforestry systems
AIJ	Activities Implemented Jointly
APOCOM	Became PRODECOM
CBD	Convention on Biological Diversity
CC	Climate Convention
CDF	Clean Development Fund
CERs	Certified Emission Reductions
CDM	Clean Development Mechanism
CIBAPA	Central Indigena de Bajo Paragua
COP	Conference of Parties to Climate Change
CSPBI	Carbon sequestration project of Bananal Island
DFID	Department for International Development
DNA	Designated National Authorities
FAN	Friends of Nature Foundation (Fundación de los Amigos de la Naturaleza)
FEMA	State Foundation for the Environment
FSC	Forest Stewardship Council
FUNAI	National Foundation of the Indian (Fundação Nacional do Índio)
G7	Group of Seven
IBAMA	Government environmental agencies
IEF	State Forest Institute
IIED	International Institute for Environmental Development
INRI	Agricultural Reform Law
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
MMA	Ministry of the Environment (Ministério do Meio Ambiente)
MDSP	Ministry of Sustainable Development and Planning
NATURATINS	Government environmental agency
NKMCAP	Noel Kempff Mercado Climate Action Project
ONF	Office National de Forêts (French)
ONFI	Office National de Forêts International
PCF	Prototype Carbon Fund (World Bank)
PEC	Parque Estadual do Cantão
PIA	Parque Indígena do Araguaia
PNA	Araguaia National Park
PNCC	National Climate Change Programme
PNI or IPN	Instituto Pró-Natura
PRODECOM	Community-development programme
PRONIC	Bolivian Joint Implementation Office
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
SEPLAN	Secretaria do Planejamento e Meio Ambiente,
SERNAP	The National Service for Protected Areas
SLA	Sustainable Livelihoods Approach
tC	Metric Ton of Carbon
TCO	Territories of their communities of origin
TNC	The Nature Conservancy
USIJI	US Initiatives Jointly Implemented

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Executive summary

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 have helped us understand how forest ecosystems can generate both global and local benefits. This study seeks to bridge critical gaps that remain in the understanding of social and environmental incentives and impacts at the interface between people, forests, and carbon, fundamental to successful project design, implementation, and outcomes.

Carbon sequestration projects aim to generate carbon credits based on Article 12 of the Clean Development Mechanism (CDM) of the Kyoto Protocol benefiting their executors, their financiers, as well as people globally. As one of the protocol's so-called flexibility mechanisms, the CDM (Article 12) foresees that developed countries and economies in transition can acquire carbon credits generated through projects developed in developing countries to abate part of their greenhouse-gas emission-reduction commitments ratified in the Kyoto Protocol. A key tenet to the CDM is that projects must contribute to the sustainable development of host countries according to national sustainable development criteria. In Brazil and Bolivia, as in most developing nations, these criteria are still being defined. The results of this study inform discussion towards definition of these criteria by designated government institutions, with participation by academic groups and NGOs.

This research project aimed to explore the extent to which carbon sequestration projects may actually contribute to national sustainable development as suggested by global policy, and to suggest avenues for project design and implementation to proactively enhance local benefits. More specifically, the study aims to assess the socio-economic and environmental impacts of three of the principal pilot carbon sequestration projects under way in Brazil (Plantar, Peugeot, and Bananal) and one (Noel Kempff) in Bolivia (see summary descriptions and principal conclusions below). The research was conducted through field visits to each project, involving interviews with key informants directly and indirectly associated with their implementation, as well as stakeholders in the state and national government. Interview guides applied to each stakeholder group are provided in an appendix.

Based on the typology developed by the project, two of the four projects evaluated are predominantly commercial in character, yet have different objectives in their respective sectoral contexts. The Plantar project aims to make the pig-iron sector viable through international carbon credits, whereas the Peugeot project aims primarily to counteract the negative environmental image of the high CO_2-emitting car-manufacturing industry. The Bananal project has more of an experimental character in its 'social carbon' profile, seeking to link local socio-environmental development to carbon generation. The Noel Kempff project in Bolivia stands out in its approach to carbon retention in the tropical forest by buying back logging concessions and promoting alternative activities to forest encroachment by local communities.

A common feature shared by all four pilot carbon projects 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 they learned by doing at the local level. As early starters, they often ran 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. This occurred 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 seek stakeholders' opinions objectively 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.

From the point of view of support for local development by projects, a key issue is the degree of social inclusion attained by participation of surrounding residents in the 'core business' of the commercial projects, i.e. the generation of carbon credits. Even if such participation is marginal to project objectives, it may come to have a more important effect on local development than that resulting from indirect economic spin-offs from project activities. For the communities, taking part more effectively as a project partner can bring many socio-economic benefits, not least of which are income generation and access to credit from the direct sale of environmental services as well as stimulating local capacity to undertake new projects.

Forest carbon projects, like some agricultural commodities, depend on a reasonably large minimum area to guarantee profitability. Owing to the considerable transaction costs, particularly those incurred in negotiating contracts, carbon monitoring, carbon credit commercialisation, and technical assistance for planting and growing trees, large areas are typically necessary to amortise these costs. Perhaps the most insidious effects of large-scale reforestation schemes are the reinforcement of already highly skewed land-distribution patterns where such projects must comply with Kyoto additionality by aggregating cleared areas rather than rehabilitating pre-existing 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, sugar cane and eucalyptus for cellulose and fuel. One way to avoid this re-concentration process is to involve local community members from the outset as partners in the undertaking, through outgrower activities, 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 them to 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 ramifications for local sustainable development and community capacity building. Forest carbon projects may be a source of new local employment and tax revenues, but may also disrupt existing labour arrangements, and may be overly reliant on external purchases and

services to the detriment of local suppliers. By promoting adoption of explicit criteria and indicators to reinforce such positive feedback effects on local sustainable development, this study contributes to debate and policy formulation in the implementation of the global climate accords. The study concludes by presenting a proposal for generic project criteria and indicators for assessment by nationally designated agencies (see summary table below).

The Plantar project

The Plantar Project is a typical commercial project. The project's justification for CDM eligibility is based on the company's continued use of charcoal as a reducer for pig-iron manufacture, rather than to convert to mineral coke, a tendency common among other parts of Brazil's charcoal-based iron industry. Plantar is a reforestation company incorporated in the late 1960s. Its revenues in 2001 were about R$136.5 million (approx. US$75m, from forest services, metallurgy, and sale of charcoal and seedlings. The project is situated in the central region of the south-east Brazilian state of Minas Gerais, long a source of charcoal to the metallurgical industries based there.

Project documents predict that Plantar could generate 12.88 million metric tonnes (Mt) of CO_2 emissions reduction equivalents (CERs) over a 28-year time span, seven years for reforestation and growth and 21 years for charcoal utilisation as an iron-ore reducer by the industry. These carbon credits would be generated through three project components: 7.9 Mt CO_2 from industrial activity (net emissions by substitution of mineral coke by charcoal); 0.44Mt CO_2 from improvement of charcoal kilns (methane emission reductions); and 4.54 Mt CO_2 from reforesting 23,100 hectares with eucalyptus and assisting in the regeneration of 478 hectares of native vegetation.

Part of the credits to be generated were negotiated with the Prototype Carbon Fund, or PCF, whose purchase commitment guaranteed a loan to Plantar by the Dutch Rabobank to finance part of the forest plantation. The agreement between Plantar and PCF includes sale of 1.5Mt of CO_2 credits, corresponding to about 12 per cent of the total CERs expected by the project. The negotiated price was $3.50 per ton of CO_2 (about $12.85/tC), determined by PCF estimates, resulting in potential credits totalling $5.25m.

The Plantar project has several social and environmental benefits as well as local development potential.

- The primary social benefit is expected to be the maintenance of 1,270 direct jobs, which could be lost were the company to close its doors, a scenario the company predicted would occur soon should carbon finance be denied, because of the absence of alternative sources of capital to permit investment in forest assets.
- The project has serious gaps with regard to local sustainable development, particularly with regard to the equity criterion. Given the region's focus on forestry, and Plantar's substantial technical know-how in high-tech cloned seedling production, there appears to be considerable potential to secure local development benefits through outgrowing under the forest farmer scheme. This could include the possibility of extending carbon credits to include such farmers. No such forest technology diffusion or social-inclusion efforts were proposed by the company, 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.

- The necessity to purchase large land areas for forest carbon accumulation could encourage a new process of tenure concentration, bringing harmful social consequences if schemes such as an outgrower approach are not included in the projects.
- Plantar's pre-existing FSC plantation certification assured investors that the company is meeting all applicable environmental and labour laws, as well as permitting it to launch a 'green pig-iron' label, associated with its chain-of-custody certification from plantation to industry. Prior certification according to these criteria does not necessarily assure social sustainability, however.
- The CDM 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.

The Peugeot/ONF/IPN project

The Peugeot carbon sink project has a primarily commercial objective. It seeks to create an environment-friendly image as a market strategy to counteract the negative environmental perception of the emissions-intensive automotive manufacturing industry. The fact that the investment is self-fulfilling and that the project does not intend to claim carbon credits, allows the developers a substantial margin of freedom to decide on project activities.

The project is located in north-west Mato Grosso, in the so-called 'Arc of Deforestation' of the Amazon basin. Reafforestation began at the same time as the opening of Peugeot's industrial facility in Rio de Janeiro in 2000. The project is implemented by Office National des Forêts (ONF), a government institution that tends to the public forests in France, in partnership with Instituto Pró-Natura (IPN), a social and environmental NGO which has had a long-term presence in the project region.

The publicity impact desired by the investor led to the establishment of an overly ambitious target – planting 10 million native trees in three years on 5,000 hectares – in an environment culturally and ecologically unfamiliar to the workers. As a result of this overly ambitious target, the project faced a number of hurdles during its initial phase, which forced it to change course. The principal barriers to successful implementation were the low survival rate of seedlings planted in vigorous *brachiaria* grass, and the repercussions of attempts made by the workers to surmount this hurdle by adopting aerial spraying with the herbicide Roundup. This, together with accusations of biopiracy against the workers, although never proven by public investigators, profoundly affected the project, forcing the workers 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 resulted in a number of changes: substituting the use of herbicides by manual weeding; reduction of reforestation targets from 5,000ha to 2,000 ha; 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; and enhancement of local integration through an environmental education programme and seedling distribution to local farmers.

The Peugeot project has several social and environmental benefits and considerable local development potential.

- In terms of carbon benefit, with the establishment of more realistic targets, the initial estimation of 2 million tC to be sequestered over 40 years has now been reduced to 500,000tC 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 to be reafforested is quite considerable in an area of agricultural frontier and rapid deforestation, where experience with native forest rehabilitation is very weak. In this sense, the project has attracted considerable attention and reaction in attitudes of local landowners. The potential for technology adoption would only be effective when combined with other social integration efforts such as extension assistance, environmental education, and financial support to sustainable land use practice. 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 cancelled.
- A forestry extension activity of seedling distribution of multi-use trees to smallholders is currently 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 between the project and local communities and surrounding land-reform beneficiaries.
- The involvement of local farmers in carbon schemes would be more effective than large-scale demonstration plantations to encourage sustainable land use practices. Project findings indicate that regional programmes in the process of implementation such as Proambiente can leverage such involvement. But learning from Peugeot has been timely and valuable.

The Bananal project

The Bananal project is essentially of experimental character. One of its aims was to learn how to format competitive carbon projects and open up future opportunities. As an experimental project it seeks to make no claim for tradable carbon credits, which gave a great margin of freedom to the developer to adapt its activities. The project was originally financed by AES Barry Foundation, a philanthropic group linked to a UK gas utility company, and implemented by Instituto Ecológica, a regional social and environmental NGO, based in Palmas, Tocantins.

The project is located in an ecological transition zone, covering three important Brazilian biomes: the Amazon forest; savannah bush land; and the marshland. The project has introduced the so called 'social carbon' meaning carbon generated with a priority focus on social aspects, for which reason it is considered a carbon project of developmental type. The forestry component is divided into three activities: protection of 200,000ha of standing mature forest, regeneration of 60,000ha of degraded *cerrado* woodland, and the reafforestation of 3,000ha of with an estimated gain of 25 million tC.

The project as originally conceived would strengthen forest conservation within parks in Ilha do Bananal as its central component, to be managed in partnership with the respective federal and state government agencies responsible. However, for a number of reasons these

partnerships did not materialise during the course of the project. This restricted the project aims to the social and research components.

The Bananal project has several social and environmental benefits as well as local development potential.

- The research component focuses mainly on the development of carbon-monitoring methodologies and studies of regional biodiversity. Monitoring of the deforestation rate in the areas where the project is active is foreseen throughout the project's life. Because the reafforestation activity was substantially reduced, the amount of carbon sequestered by project-related activities was cut sharply. However, the concept of using carbon funds to support official agencies to protect and restore conservation units could be fruitfully carried out by other projects. The key issue for baseline assessment is to consider deforestation as a reference for actions that may reduce its rate over a broader area in subsequent years.
- The project's social component focused on environmental education to schoolchildren and community members, support to income-generation activities, distribution of seedlings, and establishment of agroforestry systems. The primary project stakeholders for these elements are land-reform beneficiaries, community members, and indigenous groups. The project expects that raising environmental awareness may also contribute to carbon benefits, both by increasing tree planting and by reducing deforestation.
- The project pioneered introduction in Brazil of the Sustainable Livelihood Approach to assess 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 will require long-term support and assessment. Their impact on regional carbon stocks is indirect and difficult to measure.
- Lessons learned suggest that partnerships with government agencies need to be formalised 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.

The Noel Kempff Climate Action project

The Noel Kempff Mercado Climate Action project (NKMCAP) in Bolivia is one of the largest pilot projects undertaken globally. It is an emissions avoidance (avoided deforestation) project in which The Nature Conservancy (TNC), and a consortium of companies including American Electric Power (AEP), with the Bolivian government, has indemnified pre-existing logging concessions. The project seeks to avoid carbon-dioxide emissions from deforestation and lumber harvesting by conserving forests. Complementary activities include monitoring logging companies and assisting community development to enhance local sustainable agriculture, forest management, and social development benefits, thereby avoiding carbon 'leakage' by displacing economic activity to other areas.

The NKMCAP was established as part of the United State Initiative on Joint Implementation pilot phase. The offset sharing system provides 49 per cent of the offset credits to the government of Bolivia of which 20 per cent are shared with the project implementers

Fundación Amigos de la Naturaleza (FAN), 49 per cent to the industry contributors and 2 per cent to AEP, the lead investor, as a project development 'bonus'. The government of Bolivia is required by contract to spend the proceeds from the sale of offset credits on park management and biodiversity conservation activities at the project site and elsewhere.

The NKM National Park is situated in north-eastern Bolivia, bordering Brazil. Since the project's inception the Park has almost doubled in size, now comprising 1,523,446ha of diverse lowland and upland forests. By avoiding and reducing greenhouse-gas emissions from logging and agriculture, the project is now expected to protect up to 3.5 million tC over 30 years (after revising initial estimates). The remaining stocks of carbon in the park expansion area are monitored and compared with carbon stocks outside the park, still subject to harvesting.

The Noel Kempff project has several social and environmental benefits and local development potential.

- Before the park expanded, community members had no legal access to the land but had used the forest through informal usufruct rights for the past 100 years. The project established a buffer zone on the western side of the park, where three communities were located. The principal impact on the communities when the park was created was loss of employment in the logging concessions. Lack of participation in project design led to uncertainties about access to resources and income-earning activities, thus attracting initial opposition to park expansion by local people.
- A community development programme was initiated in this context of uncertainty and conflict, characterised by a lack of organised community representation. Model farms and planting trees promoted by the project had limited success, owing to inadequate analysis of how complementary these proposals would be with local labour availability, as well as the insecure land-tenure arrangements in the area. A project-led microcredit scheme was also problematic, as the majority of loan recipients were unable to repay their debts.
- The principal project benefits expected by the local people include land titling and sustainable forest management; these would stimulate local development, generating income to pay for health and education. Over time and through greater dialogue, trust was built between the project and communities. Community development objectives are now clearer and there is greater participation.
- Lessons learned suggest that the project had an overly centralised project design, unclear links between objectives, and too many activities. There was poor communication about access to resources by communities, resulting from little time and the pressures of the project cycle, a distant project site, and a 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 recognising local priorities.

Criteria and indicators for project review

Besides reviewing the environmental, social, and economic impacts on local sustainable development of each project, the study concluded by proposing a series of criteria and indicators for their assessment in reviewing CDM projects by Designated National Authorities (DNAs). These criteria and indicators are provided below as a guide for discussion among interested groups and government officials, in the hope of providing a basis

for incorporating local sustainable development concerns more explicitly in project review procedures.

Table 0.1 Criteria and indicators proposed for forest carbon project 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 (e.g., 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 recognised social and 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.

Component	*Criterion*	*Indicator*
	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. 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.
	Project impacts on soils will be monitored.	Changes in soil quality measured by chemical and physical analysis.
	The project includes an environmental education component aimed at the local population.	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.

1. Study background

1.1 The global context: countering climate change

Forest carbon projects have been recently proposed or initiated in developing countries on a trial basis, responding to growing concern over global warming. Such projects represent investments that are expected to benefit their executors, their financiers, as well as global society. At least part of their financial attractiveness arises from their potential to generate carbon credits based on Article 12 of the Clean Development Mechanism (CDM) of the Kyoto Protocol, adopted to implement the UN Framework Convention on Climate Change (UNFCCC). The CDM is one of the protocol's so-called 'flexibility mechanisms'. Article 12 foresees that an Annex-1 country (developed countries and economies in transition) can acquire carbon credits generated through projects developed in non-Annex-1 countries (developing countries) to meet part of their greenhouse-gas emission reductions commitments as defined by their adherence to the Kyoto Protocol. The carbon credits generated by such projects are based on the net greenhouse-gas emission reductions (primarily by fuel substitution or in terrestrial sinks) derived by a comparison between two scenarios: the without-project ('baseline') scenario and the with-project scenario. This comparison yields a net carbon figure that is also known as 'additionality'.

Besides net carbon emissions reductions or increments in terrestrial sinks, a key tenet of the CDM is that projects must contribute to the sustainable development of host countries according to national sustainable development criteria. In Brazil and Bolivia, as in most developing nations, these criteria are still being defined. However, discussion towards definition of these criteria is already taking place in government institutions, with some participation by academic groups and NGOs.

1.2 Global environmental services – incentives for conservation and development

Climate change and after that, land use, land-use change, and forestry (LULUCF) are of increasing importance to Brazil, and in Bolivia assumed a priority in national environmental policy even before that country signed the Kyoto Protocol. Although Brazilian government negotiators opposed the use of sinks in international climate change policy and express aversion to the inclusion of certain forest activities in the CDM, they admit that deforestation is the main source of greenhouse-gas emissions in Brazil. Most deforestation is caused by the expansion of the agricultural frontier, mainly in the Amazon region. It is difficult to measure reliably emissions from clearing and burning of biomass in tropical forests. The Intergovernmental Panel on Climate Change (IPCC) (2000) predicts a mean value of 120 metric tonnes of carbon (tC) per hectare for above-ground tropical forest biomass stock, but as will be seen, this figure may vary substantially, to as high as 200 tC per hectare, based on one local measurement.[1] A key problem in Brazil is the continued high rate of Amazon deforestation and burning, particularly in the states of Mato Grosso, Pará, and Rondônia, in descending order (INPE, 1996).

It is more difficult to establish a uniform system of management seeking to optimise carbon sequestration within areas of intense deforestation (La Rovere et al., 2001). The reason for

[1] This volume increases to 300 tC if an estimated 100t in soil carbon is included, according to an estimate for north-western Mato Grosso (Locatelli, 2001).

this is that such areas typically lie within transitional zones covering different ecotypes with lower biomass; hence measurement and validation of carbon increments remain problematic for forest carbon project development in natural forest biomes. The diversity in the transition zone landscape coupled with that of localised human dimensions cut across the key issues of forest, climate, and social development.

The potential for regulatory measures to succeed in reducing deforestation and protecting the environmental benefits that forests provide, such as carbon sequestration, have been limited. In response, innovative approaches to conservation and carbon sequestration are emerging among civil society and producer organisations in many parts of Latin America. A number of initiatives have begun to demonstrate the conditions under which market-based mechanisms can provide incentives to conserving forests and at the same time contribute new sources of income to support rural livelihoods (Pagiola et al., 2002). Brazil has begun to make use of fiscal instruments for encouraging conservation and providing environmental services, such as the ecological value-added tax (May et al., 2002) adopted initially by the states of Paraná and Minas Gerais, and more recently implemented in parts of the Amazon as well. Yet, the potential to harness markets for global environmental services as a mechanism to generate local SD benefits remains a contentious issue, with little in-depth research into the impact of market incentives on small or marginalised communities (see Vitae Civilis, 2002; Landell-Mills and Porras, 2002).

1.3 Official and NGO positions regarding forests in the Climate Convention

Climate change policy has been at the centre of the debate regarding the potential for market incentives to be used successfully to manage global natural capital. The establishment of an international carbon market, derived from national commitments to quantified reduction targets, is the first step towards use of such measures to reduce greenhouse-gas emissions of global concern. Climate policy decision-making has been particularly contentious in Brazil, and despite the Brazilian delegation's important and active role at the UNFCCC negotiations, the government position has been problematic for concerned national civil society groups.

Although Brazil was responsible for proposing the adoption of a Clean Development Fund at Kyoto, the government has always been opposed to the use of joint implementation projects to test the feasibility of pilot projects in the establishment of a carbon market, through bilateral project investments. The resistance to experiment with the Activities Implemented Jointly (AIJ) phase has been traced to concern for national bargaining power in bilateral projects where the investing partner has asymmetrical control over the direction of investment. Environmentalists, scientists, and civil society in Brazil have argued that this reluctance has considerably more to do with the current rates of deforestation in Brazil and its inconsistency in reporting that information (Fearnside, 2001). Similarly, NGOs in Brazil have been at loggerheads with their peers in the international arena. For example, while Friends of the Earth–Amazonia in Brazil favourably considered the use of market mechanisms as a potential means to curb deforestation, their international counterparts remain reticent to permit inclusion of forests as eligible activities in the CDM.

In contrast, Bolivia joined other Latin American nations as willing participants in the AIJ phase. The rationale for this participation was the initial perception on the part of national environmental interests that the carbon market might come to represent a substantial source of financing to protect remaining rainforest biodiversity. Lacking other equally compelling investment opportunities in the renewable energy segment, Bolivia and other nations with

substantial tropical forests formed a bloc that sought from the start to incorporate standing forests in the CDM.

Bolivia has since taken an active role in the debate over LULUCF and the CDM. The government's official position has been to promote the inclusion of avoided deforestation, regeneration of native forest, and agroforestry as allowable activities within the CDM. Bolivia stands to gain from the inclusion of both forest protection and reforestation projects as eligible schemes since activities related to LULUCF are responsible for 82.8 per cent of greenhouse gas emissions and represent 97.7 per cent of national CO_2 abatement potential (PNCC, 2001).

1.4 Key stakeholders

Decision-making on all climate-related matters in Brazil is at the level of the federal government. It is spearheaded by a small number of technicians and scientists with little engagement with the broader stakeholder community. However, Brazilian NGOs have begun to organise around the climate change theme, and have assumed responsibility for implementation or partnership in several important pilot projects.

Likewise, the drivers of climate change policy in Bolivia are primarily a group of national champions supported by the involvement of some NGOS and other stakeholders. The Bolivian government's directive is to prioritise CDM projects, especially in rural areas. The national legal and institutional framework is oriented to support local communities through a policy of decentralisation. The law of popular participation advocates rights of indigenous peoples to territories of their communities of origin (TCOs) and decentralisation of decision-making to municipalities. Yet, institutional weaknesses are manifested in the lack of technical capacity, financial resources, and political instability, which hamper implementation of such supportive legislation in practice.

AIJ/CDM institutions have evolved in Bolivia since the 1990s. Since then the country has been engaged in establishing legislation for management of its natural resources and participation of local peoples in management of their own territories. The Ministry of Sustainable Development and Planning (MDSP) was established in 1994 to oversee national development processes. The institutional framework for carbon offsets in Bolivia includes the following legally binding instruments (Vargas, 1999):

- 1992 General Environmental Law;
- 1994 Popular Participation Law;
- 1995 Plan of Land Use for Santa Cruz;
- 1996 Forestry Law;
- 1996 Agricultural Reform Law (INRA); and
- 1994 Law of Ministers' Executive Power.

The UNFCCC was signed by Bolivia in 1994, and in the following year established the National Climate Change Programme (PNCC) including AIJ projects within the Ministry of Sustainable Development and Planning. The key role of the PNCC was to undertake the first national communication with the technical assistance of a US Country Study Management Team. The PNCC developed its national greenhouse-gas inventory based on 1990 levels, vulnerability and adaptation strategies and options for mitigation in the energy, forestry, and agricultural sectors. The mandate of the PNCC in relation to AIJ was to monitor, verify,

evaluate, and certify projects. The development of the National Action Plan for Climate Change in the Forestry, Agriculture, and Energy Sectors ensued from these early initiatives.

In 1998, a multi-institutional Council on Climate Change was established, which coordinates the state and other stakeholders to participate in the development and implementation of national climate change strategies. The same year the Bolivian Joint Implementation Office (PRONIC) was established. PRONIC is a mixed institution with representatives from the private and public sectors established to tackle the AIJ pilot phase and the development of the CDM (Figueres, 2002). PRONIC is legally a subsidiary entity to the MDSP.

Brazil has followed the following chronology of climate change decision-making and bringing into being institutions:

- A Climate Change Advisory Unit within the Ministry of Science and Technology (MCT) was created in 1991. MCT is the climate change focal point and coordinates the execution of the national activities carried out under the Climate Convention.
- There are three ministries involved to varying degrees in climate change issues. In addition to the MCT, are the ministries of Foreign Relations and Environment. The Ministry of Foreign Relations (MRE) is responsible for the general coordination of Brazil's position at the UNFCCC, through its Environment Department.
- The Ministry of Environment (MMA) has the main responsibility of providing support to MRE on the Biodiversity Convention. More recently, the secretary of sustainable development within MMA assumed some responsibility over climate concerns and the role of forests.
- In 1999 an Inter-ministerial Commission on Climate Change was created, jointly chaired by the ministers of MCT and MMA, gathering together several other interested ministries, with the responsibility to handle CDM issues. This commission was empowered to act as the Designated National Authority with respect to implementation of the Kyoto Protocol and to review CDM projects in Brazil.
- In August 2000 the Brazilian Climate Change Forum was established, having as its chairman the then president, Fernando Henrique Cardoso. The forum aims to gather stakeholders in the field of climate change. Most recently, in early 2002, a group of 28 NGOs created the Climate Observatory, to contribute to debate on the implementation of the Kyoto Protocol in Brazil.

2. Study objectives and methodology

2.1 Objectives

The overall aim of the research at hand is to explore the extent to which carbon sequestration projects may actually contribute to national sustainable development as determined by global policy, and to suggest avenues for project design and implementation to enhance proactively local benefits.

More specifically, the study aims to assess the socio-economic and environmental impacts of four major pilot carbon sequestration projects under way in Latin America, three of which are located in Brazil (Plantar, Peugeot, and Bananal) and one (Noel Kempff) in Bolivia. After defining study methodology and indicators, and summarising characteristics of the four case studies, each study site is characterised in social, spatial, environmental, and economic terms; and the different forestry activities implemented in the study sites in the Kyoto context.

Based on an analysis of impacts and lessons learned for each of the case studies, we conclude by distilling the factors that lead to variability in impact among sites, as a basis for making a preliminary assessment of key determinants of these impacts. Finally, we suggest design guidelines for carbon sequestration projects that would enhance their local socio-economic benefits.

The key question under study is how carbon sequestration schemes may contribute to local development processes in the case study areas, and specifically to discern:

- What benefits accrue to local people from carbon sequestration projects?
- How are these benefits distributed among project stakeholders?
- To what extent is provision of global environmental services in the form of carbon sinks consistent with local social and environmental priorities?

2.2 Conceptual basis

2.2.1 Sustainable development or sustainable livelihoods?

The general framework for the analysis of the carbon projects in this report is based on the concept of sustainable development as launched by the Brundtland report in 1987. Adoption of this principle is further justified by Article 12 of the Kyoto Protocol, which establishes that CDM projects must contribute to the sustainable development of a host country, according to each nation's domestic criteria for sustainable development.

Although we adopt the sustainable development concept as a starting point, we admit that sustainability is a broad and vague concept, which may be interpreted differently depending on the perspective, political position, and commitment of particular stakeholders. It is therefore essential that we clarify our views on the concept and its implications for forest carbon projects.

The central idea of sustainable development as advocated by the landmark Brundtland report is that development and environment cannot be separated; they are interdependent parts of

the same issue. Development cannot be sustainable if the resource base deteriorates over time. The report asserts, however, that 'care for the environment is not a goal per se but rather a means to make possible long-term development so that living standards in societies may be improved' (WCED, 1987). Social equity and economic progress are thus combined with environmental protection as the three pillars of sustainability. As the three pillars are inter-linked dimensions of sustainable development, they need to be present together; one dimension cannot compensate for the other at the cost of failing to attain sustainability in the long term.

The link between poverty and environment is paramount to policies for sustainable development, whereby not only are consumption patterns of the rich indicted, but poverty itself is also perceived as a root cause of environment degradation. This led the WCED commissioners to conclude that economic growth is needed not only to raise overall living standards, but also to give society the capital and tools to solve environmental problems. In this regard, the sustainable development concept suggests that technology and social organisation be put to the task of promoting economic growth within the constraints of ecological limits and absorption capacity. It is also recognised that economic growth in itself does not assure poverty reduction. Progress and poverty coexist. Social equity is flagged as a key element in sustainable development, and associated with the empowerment and effective participation of citizens (and their communities) in decision-making.

Without questioning the structural distribution or appropriation of resources in the capitalist system, the concept of sustainable development was adopted as a market convention in part because it rehabilitated the role of production and growth by incorporating the element of time. Sustainable development thus 'meets the needs of the present generation without compromising the ability of the future generations to meet their own needs'. Consequently the use of renewable resources ought to respect the limits of resilience in natural regeneration.

In addition to the time frame, operationally, the pillars of sustainability also function on a spatial basis. Thereby, depending on the level of spatial reference – global, national, regional, or local – different resources, ecosystems and social groups are affected. Despite the fact that the concept of sustainable development includes poverty alleviation as a major requirement to achieve sustainability, very often poorer groups are left behind. This may in part because of ambiguity on the part of environmental groups and public agencies that often perceive the poor as a causal factor in environmental degradation ('blaming the victim'). This exclusion may also be owing to the fact that poverty results in a lack of political capacity, social insertion, and information networking that would enable the poor to fend for themselves. Thus, criteria for sustainable development regarding the impact of carbon forest projects should give particular emphasis to strengthening local organisations and to empowerment of affected groups.

We therefore endorse the need for projects to promote local social and environmental benefits as a goal in itself. Moreover, this study focuses on how particular local populations are affected by the carbon projects under review, within a broader social context. The object of this approach is to identify those factors in project design and implementation that could assure greater social benefit and promote local sustainable development, with a realistic outlook regarding the starting point from which project developers and sponsors address these concerns.

There are several approaches focused on livelihoods of local populations, among them the sustainable livelihood approach (SLA) originally developed by Robert Chambers and Gordon Conway (Chambers and Conway, 1992). If SLA were to be adopted in this study, it would place particular emphasis on the impact on the poor of growing global markets for environmental services. The approach would involve an assessment of the tangible and intangible assets held by these groups (financial, human, social, physical, natural, and political), and the impacts of projects. The perception by members of the community themselves regarding change in their asset base is paramount.[2] The SLA is undoubtedly a helpful tool to assist in quantifying and qualifying any change in access to assets by a particular affected group. Nevertheless, the research team has opted instead for the SD approach for several reasons.

As the projects under review are as yet at an early stage of implementation (two to five years) and activities are in a dynamic process of adaptation, the impact on change in assets of local communities is thus far limited and in progress. The team opted to ground the analysis on an understanding of the overall project rationale, the expected results from the initial proposal, the reasons for changes, the preliminary results achieved so far, and finally the perspectives regarding achievement the proposals while the process is evolving. The contention is that the impact on local communities may be better elucidated if put in the perspective and context of the sustainable development approach. We hope to achieve this by integrating the three technical sustainability dimensions, by scrutinising the various beneficiaries at different levels, and by analysing the impacts within a temporal framework (long-term/short-term outlook).

Another rationale for choosing the sustainable development methodology is the necessity, in SLA, to compare the situation under study over time. Such a study would require access to project stakeholders in at least two moments: at the outset (point zero), and at the moment of impact assessment. Through the lens of time, it is possible to visualise change brought about by the project under study, by comparing the levels of the distinct assets over time, in the representative pentagonal diagrams used for this assessment. In the case studies presented here, because of limitations imposed by the time frame of the study itself, the temporal perspective is brought to bear through stakeholders' recall, rather than through measurement of indicators at distinct moments in time.

Another point of difference in these approaches regards our efforts to involve the perception of all actors involved in a given project, rather than restricting the impact assessment to the perception of local community members, who were often not treated as primary stakeholders by the project executors. This allows us to include the viewpoint of actors who for one reason or another have not been consulted or involved in the project, as well as those who directly benefited. These include project executors, service providers, public functionaries, and other relevant stakeholders. This approach was made possible by obtaining perceptions regarding the project through semi-structured interviews with a wide range of key informants.

Finally, SLA has difficulty in separating impacts of a project from those resulting from public policies or changes in the macroeconomic context, which may be more relevant in their impact at community level. The stakeholder appraisal method adopted here has sought to

[2] This approach is adopted by one of the projects (Bananal) to assess the social impact of the project on local communities (Santos and Santos, 2002).

separate those factors we deem to be influenced by the broader context, from those influenced by the project.

Although it is stated in the Kyoto Protocol that it is the host government's prerogative to approve CDM projects in line with national development priorities, most national governments have not clearly defined these criteria. At present, the Brazilian government is in the course of elaborating such criteria. The lessons distilled from the present project review are expected to contribute to the national sustainable development criteria for carbon project selection and impact assessment, in particular those related to local environmental and social development.

Bolivia has already established a set of draft National Sustainable Development Indicators under the guidance of the Ministry of Sustainable Development and Planning and the UN Development Programme (UNDP).[3] Reportedly, this process has involved major NGOs, as well as sectoral agencies and business representatives.

While it is certainly of interest to national development that there be international investment and transfer of technology for 'clean development', the social and environmental impacts of distinct project-level approaches should also be part of the criteria adopted for project approval.

2.2.2 Impact assessment

The impact assessment undertaken for this study is based on the concept of sustainable development as stated above. Project impact is analysed along each of the three dimensions of sustainability: environmental, social, and economic. Within each dimension, whenever pertinent, impacts are further scrutinised at, global, national, regional, and local level, as well as whether they provoke long-term or short-term effects. The study presents a matrix describing the different nature of impacts discerned in an effort to capture systematically their effects on direct and indirect beneficiaries at different spatial levels and temporal impacts of forest carbon project activities. Special attention is placed on the analysis of the social impact on local communities bearing in mind that the emphasis of the research is on the impacts and benefits that accrue to local people from these schemes.

The information for the impact assessment was based on published material and primary data obtained from interviews with key stakeholders carried out in 2001 and 2002 (see interview list in Appendix 1)[4].

2.2.3 Stakeholder consultation and data collection techniques

The purpose of the study is to examine how different groups at different spatial levels, in particular communities in each project's area of influence, are affected by the presence of forest carbon projects. To do this we entered into contact with the people who are developing these projects and those who are directly and indirectly involved, be they labourers, project beneficiaries, appropriators of eventual carbon credits, local authorities, official environmental agencies, government organisations, local NGOs, and farmers or workers' groups. In the process, we were able to identify those stakeholders at the local and regional

[3] The draft document, *Sustainable Development Indicators (First Generation)* was elaborated under the Capacity 21, Phase III project under the auspices of the MDSP and UNDP Bolivia in December 2002.

[4] Available at www.iied.org/eep/pubs/MarketsforEnvironmentalServicesseries.html.

level who could make use of or take part in the potential carbon incentive. In this way, we were able to suggest how it could increase the potential benefit to local communities and hence increase its contribution to local development.

The study involved the collection of literature and data from secondary sources (governmental agencies, universities, research institutes, and several NGOs) about the projects, initial proposal, implementation process, and social impact of carbon sequestration and emission-reduction activities. An exhaustive review of written sources on the four projects, including journalistic reporting, has also been carried out.

Primary qualitative and quantitative data are collected through semi-structured interviews to different sets of stakeholders be they individually or collectively (see interview guide in Appendix 2). The interviews intended to capture on the one hand different stakeholders' standpoints vis-à-vis the project and their opinion on how benefits could be enhanced or how negative impacts could be minimised. At the same time information from both project beneficiaries and non-beneficiaries served to validate data on implementation of activities supplied by project developers.

2.2.4 The Kyoto context analysis

The underlying argument for the inclusion of the CDM in the protocol is that activities in non-Annex 1 countries could compensate the greenhouse-gas emissions in Annex 1 countries and comparatively offer more cost-effective ways to reduce global warming. This compensation could be either through carbon sequestration through land use, land use change, and forest projects or by reduction of emissions from sources in host countries. The CO_2 sequestered or the emissions avoided must suit the Kyoto regulations in order to be approved as tradable Certified Emission Reductions (CERs). The main criteria examined are project baseline, additionality, leakage, and permanence. These criteria are briefly discussed in each of the projects so as to verify their suitability in the Kyoto context, and defined below.

The baseline is the projected scenario where the trend of emission is foreseen in the absence of mitigation interventions. Additionality is the avoided emission/sequestration under project intervention compared to the baseline trend (IPIECA, 2001). These two aspects are closely linked. Leakage occurs when additionality brought about by the project is lost when environmentally degrading practices or activities are shifted to an area within the same region where the project is located as a result of its implementation. Permanence is the guarantee in perpetuity of the net carbon stock obtained through the project's additional activities.

3. Forest carbon sequestration projects in Brazil and Bolivia

3.1 Typology of carbon sequestration projects

In 1999, the International Workshop on Carbon Sequestration and Rural Life (IIED/DFID, 2000) discussed existing projects in forest-based carbon sequestration and suggested that there are two main approaches adopted by forest carbon projects: those that maximise rural development; and those that maximise the carbon transaction. Each type defines the way the projects will be conducted and caters to the interests of different economic and social groups.

In Brazil and Bolivia, discussion on including forest-based carbon sequestration in climate mitigation policy has been controversial. The positions of the different social groups (environmentalist NGOs, business NGOs, government, environmental institutions, business corporations, and scholars) sometimes coincide but more often diverge. In order to understand and situate the different positions in this debate, this study proposes the following typology for the carbon sequestration projects under study as a heuristic tool, classified in three categories with distinct priorities:

- Commercial projects: these should prioritise the generation of CERs for commercial reasons. National and international enterprises driven by the opportunity to take part in the emerging carbon market often head these projects. Such projects may be implemented directly by transnational corporations, whose industrial activities are intensive in emissions, 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 wishes to commercialise CERs and hence enhance sectoral competitiveness.
- Conservation projects: these should prioritise secondary environmental benefits such as local forest and biodiversity conservation. These projects are often mediated and implemented by NGOs – typically environmentalist – who also associate with international investor corporations that seek CERs and image association. In this association, the investors are assured a positive image from conservation outcomes at little real cost if CERs are generated, and the latter gain political and financial support for their conservation role. This type of project was undermined by the decisions at Marrakech that removed projects that would avoid deforestation as a basis for CERs in the first commitment period (2008–12).[5]
- Developmental projects: these should prioritise social along with environmental objectives. Some organisations expressed themselves initially as contrary to the incorporation of carbon sequestration in the protocol because of concern that the CDM should act solely as a compensatory measure to tackle emission reductions for climate mitigation. However, as carbon sequestration was approved in Marrakech as a modality of CDM projects, the initial opposition of these organisations was adjusted to advocate projects of a developmental nature, giving priority to the needs of local communities

[5] The Kyoto Protocol, as well as the additional implementation mechanisms contained within it, required complementary regulation, which was the objective of the Marrakech Accords, reached in November 2001 at the 7th Session of the Conference of the Parties to the Climate Convention (COP7). The decision regarding which activities (afforestation and reafforestation) would be acceptable in relation to LULUCF, was taken at COP7. In the COP planned for the end of 2003 (COP9), the parties agreed to refine further the definitions and project modalities that would be valid for these activities (Lopes, 2002).

while conserving the local environment. The developers[6] of this type of project also have established partnerships with transnational organisations seeking CERs, offering the investors an image of social responsibility as project financiers.

The purpose of creating a typology of these projects is to highlight the prevailing feature, without denying the existence of secondary components that are often present. However, projects tend to be skewed to the prevailing feature. These include, respectively: the economic component – the generation of carbon credits, driven by the carbon market; the ecological component – emission avoidance through contribution to the conservation of local ecosystems; and the social component – activities addressed to local communities. In practice, all projects reviewed present all three components in some combination. Subordination of one or more components may work against their results for sustainable development.

For instance, a conservation project may include a social component to involve local communities in order to reach its conservation goal, even though poverty alleviation as such is not its explicit objective. A commercial project may create significant employment depending on the sector's context, or may perform socially oriented activities in a complementary way, if by doing it improves the social responsibility image of the enterprise. A developmental project would have to include conservation issues in order to be sustainable, and would need to ally with investors in efforts to obtain CERs, combined with a social-responsibility image. By opting to work with the poorest landowners as a target group, however, there might be a trade off in the amount of carbon a project is capable of sequestering. Finally, all three types of projects are dependent to a greater or lesser degree on the concerns of international investors whose interests are primarily commercial.

3.2 Carbon sequestration case studies in Brazil and Bolivia

A common feature shared by all pilot carbon projects in Brazil and by the Noel Kempff project in Bolivia, is the fact that although all began with defined objectives, they have metamorphosed both in terms of their specific objectives and operational features. In other words, they are changing as the climate regime regulations evolve internationally, and as they learn by doing locally. As early starters, they run the risk of being left out of the categories defined as valid by the negotiators to the COP for carbon credits, while others are pure learning experiences. For instance, the Marrakech agreement ended up not incorporating forest conservation (avoided deforestation) for the first period of commitment of the Kyoto Protocol although some ongoing projects had already included such conservation in their carbon accounting. These credits may well be eligible for CERs later. On the other hand, the trade off for the high risk is the higher potential return[7] and the opportunity to occupy a strategic position as pioneers in the race for this new market.[8]

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[6] Most of these developers are associated directly or indirectly with organisations whose activities are admittedly social or developmental in nature. Some of these organisations are the World Resources Institute (WRI), the International Institute for Environment and Development (IIED), the Institute for Development and Sustainability (IDS); the Department for International Development (DFID), and Support for Sustainable Livelihood (SSL).

[7] While the reference price for carbon used in the World Bank's Prototype Fund (PCF) is $3.50 per ton of CO_2 ($12.81/tC), the pilot projects present a cost ranging from $5 to $6 per tC.

[8] It is also probable that even semi-official project funders such as the World Bank's Prototype Carbon Fund and its associated BioCarbon Fund incorporate elements of avoided deforestation and forest management as allowable project elements, despite their elimination by the negotiators to the CDM.

This study focuses attention on four of the principal forest carbon projects under way in Brazil and Bolivia.[9] The sponsoring investors have made a strong imprint on 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 report are mainly commercial, yet have different commercial objectives in the context of their respective sectors. The Plantar project aims to make the pig-iron sector viable through international carbon credits, whereas the Peugeot project aims primarily to seek a way to counteract the negative environmental image of the high CO_2-emitting car-manufacturing industry. The Bananal project has an experimental character in its 'social carbon' profile, seeking to anchor local social and environmental development with carbon generation. The Noel Kempff project in Bolivia stands out in its 'bio-carbon' approach to carbon retention in the tropical forest by buying back logging concessions and by promoting alternative activities to forest encroachment by local communities. This project is one of the oldest, largest, and well-known existing carbon projects. Further details on the four carbon projects analysed in this report follow:

- Plantar project: Plantar SA, a reafforestation and pig-iron industry, implements its own project, with partial financing obtained through the Prototype Carbon Fund (PCF). This project qualifies partly as energy substitution and partly as forest carbon sequestration. The project's main profile is commercial, and at national level responds mostly to the economic needs of a domestic industry.
- Peugeot/ONF/IPN: The French government Office National de Forêts (ONF), in partnership with a Brazilian NGO Instituto Pró-Natura (IPN), implements the Reafforestation Project for Carbon Sequestration in Cotriguaçu/Juruena, Mato Grosso on behalf of PSA Peugeot-Citroën. The project is predominantly commercial and responds to the needs of environmental image promotion of the investing enterprise.
- Bananal/Ecológica: The Brazilian NGO Instituto Ecológica implements, without mediation, a project of predominantly development character: Carbon sequestration Project of Ilha do Bananal in Tocantins, phase I and II, with financing from the AES Barry Foundation and others. The main objective is 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 the local communities.
- Noel Kempff: The Noel Kempff Mercado Climate Action project (NKMCAP) in Bolivia is one of the largest pilot projects undertaken globally. It is an emission-avoidance (avoided deforestation) project of predominately conservation character where The Nature Conservancy (TNC), and a consortium of companies including American Electric Power (AEP), together with the Bolivian government, have bought back concessions from logging companies to donate land to a national park. The park has almost doubled in

[9] Unfortunately, three additional projects representative of the conservation type were not included in the case studies reviewed, at the specific request of the project developers. All three lie in the municipality of Guaraqueçaba and contiguous coastal areas in Paraná, Brazil, under the implementation of the Sociedade de Proteção da Vida Selvagem e Educação Ambiental and The Nature Conservancy (TNC). The three Guaraqueçaba sites combined are expected to receive total investments from the US automotive and energy sector superior to any of the other projects reviewed, and all aim to provide carbon credits to their sponsors. The removal of these interlinked projects from this study was due to project redefinition underway at the time of the research, and concern by the developers that our research could stimulate undue expectations by local beneficiaries (Clóvis Borges, personal communication). The NKMCAP, of similar project type, involving a similar portfolio of investors and project developers and also seeking carbon credits, was included in the case study series as a substitute.

size since the inception of the project, now comprising 1,523,446ha of diverse lowland and upland forests.

As with other CDM projects, host governments must approve carbon sequestration projects. The Marrakech agreement establishes that the host country has the prerogative of confirming, in writing, if the activity of a candidate CDM project contributes or not to the country's sustainable development. Since the criteria for approval is still in debate, two of the three projects reviewed in Brazil (Peugeot/ONF and Ilha do Bananal) have not been subjected to the scrutiny of the Interministerial Commission for Climate Change, the Designated National Authority, because they do not seek CERs. The Plantar project is the only exception. Since the Plantar project was financed by the PCF, an entity formally constituted by the World Bank to stimulate and promote projects to reduce greenhouse emissions, it had to go through all the formalities required by the bank, including obtaining the formal approval of the Brazilian government.[10] The Noel Kempff Climate Action project gained formal approval in Bolivia in 1995 when the governments of Bolivia and the US signed a letter of intent for AIJ/JI cooperation.

The map overleaf (Figure 3.1) shows the distribution of forest carbon projects reviewed in this study.

[10] In fact, however, since there were no national rules or procedures in place for the formal review of CDM projects, the Plantar project obtained a 'no-objection' letter from the Minister of Science and Technology (coordinator of the Inter-ministerial Commission on Climate Change, the Brazilian-designated national authority), which satisfied the PCF requirements in lieu of formal procedures.

Figure 3.1 Location of pilot forest carbon projects reviewed in this study

4. Description and analysis of the Plantar project

According to typology previously introduced, the Plantar project is a typical commercial project. The project has as its central objective the generation of carbon credits that can be commercialised according the rules established in the Kyoto Protocol. Part of these credits was already negotiated with the Prototype Carbon Fund (PCF) managed by the World Bank. The project is based on two main components: maintenance of charcoal as a reducer in the pig-iron industry instead of mineral coal (coke) and reafforestation with eucalyptus. In the next sections we will introduce a historical review of the project's format, its baseline construction, as well as the expected impacts on local sustainable development. Concluding this case study, we stress some lessons learned, as well as recommendations for policy proposals that could be incorporated in new projects with the same characteristics.[11]

4.1 Project background

4.1.1 Project objectives

The Plantar Company's objectives with this project is to sell carbon credits to international companies that need these credits to discount their greenhouse-gas emissions obligations in their respective countries. Part of the credit to be generated was negotiated with the PCF. Thanks to these purchase commitments, Plantar was enabled to negotiate with the Dutch Rabobank to finance part of the forest plantation component of the project. The Plantar project was one of the first projects analysed and accepted by the PCF for carbon finance.[12]

Box 4.1. Prototype Carbon Fund

The Prototype Carbon Fund seeks to develop the carbon market, with the specific goals to: minimise project risks; reduce transaction costs; and enhance learning experience. The fund was set up with total capital of $145 million aimed to support about 30 projects globally. Fund shareholders are governments and the private sector, with quotas of $10 million and $5 million, respectively. The World Bank expects PCF products to be competitively priced, of high quality, project based and to provide a high-value knowledge asset (Meyrahn, 2002).

The Plantar project is based on the continued use of charcoal as a reducer for pig-iron manufacture, rather than to allow the industry to follow its current trend to convert to use of mineral coke, common in the rest of the global steel industry. According to its proponent, the additional revenue derived from sale of carbon credits would increase the profitability of charcoal-based pig iron, allowing the company to maintain its forest activities instead of abandoning them, or converting to coke-based operation (Ecosecurities and PCF, 2002a).

4.1.2 Pig-iron production background

All over the world, pig iron initially was produced by use of charcoal. In the 1970s, thanks to economies of scale and decreasing supplies of fuelwood, nearly all global pig-iron

[11] It should be mentioned that the PCF's approval of certified carbon emissions reductions to the Plantar project signalled the market's interest in further projects of this type in Brazil's charcoal-based steel industry. Another, larger enterprise of the same type, V&M Tubes, was recently adopted for investment through support of the government of the Netherlands.

[12] See Annex 4.1 for a listing of PCF shareholders and investors.

manufacture migrated from charcoal to coke (mineral coal). In Brazil, pig-iron production was able to remain based on charcoal thanks to two main factors: abundant iron ore and remaining native forests, particularly in the case of Minas Gerais (Moura, 2002). However, after the exploitation and gradual depletion of native forests, the sector was stigmatised as an environmental villain with growing awareness of the environment over the past three decades. In 1986, the state forest law of Minas Gerais ruled that the pig-iron industries must begin to use an increasing share of fuelwood derived from planted forests in their blast furnaces, to reach the level of 100 per cent by the mid-1990s. According to Moura (2002), director and shareholder of Plantar, this is the Achilles heel of the pig-iron industry: forest establishment demands twice as much investment as that necessary for the industrial segment.

Box 4.2 Comparison of coke and charcoal-based pig-iron manufacture

Coke route: Coal mine → Coal-mining operation → Coke plant → Blast furnace → Pig iron
Charcoal route: Plantations → Wood → Carbonisation → Blast furnace → Pig iron
Source of carbon → Carbon → Carbonisation reduction obtainment

According to Instituto Brasileiro de Siderurgia cited in Ecosecurities and PCF (2002a), the pig-iron sector of Brazil produced 27.7 million tons in 2000. According to the vice-president of the Pig Iron Industry Union, Afonso Paulino (2002), from 20 to 30 per cent of this production is based on use of charcoal as a reducer. Part of the production is destined to steel manufacture, and the remainder to foundries.

4.1.3 Project location

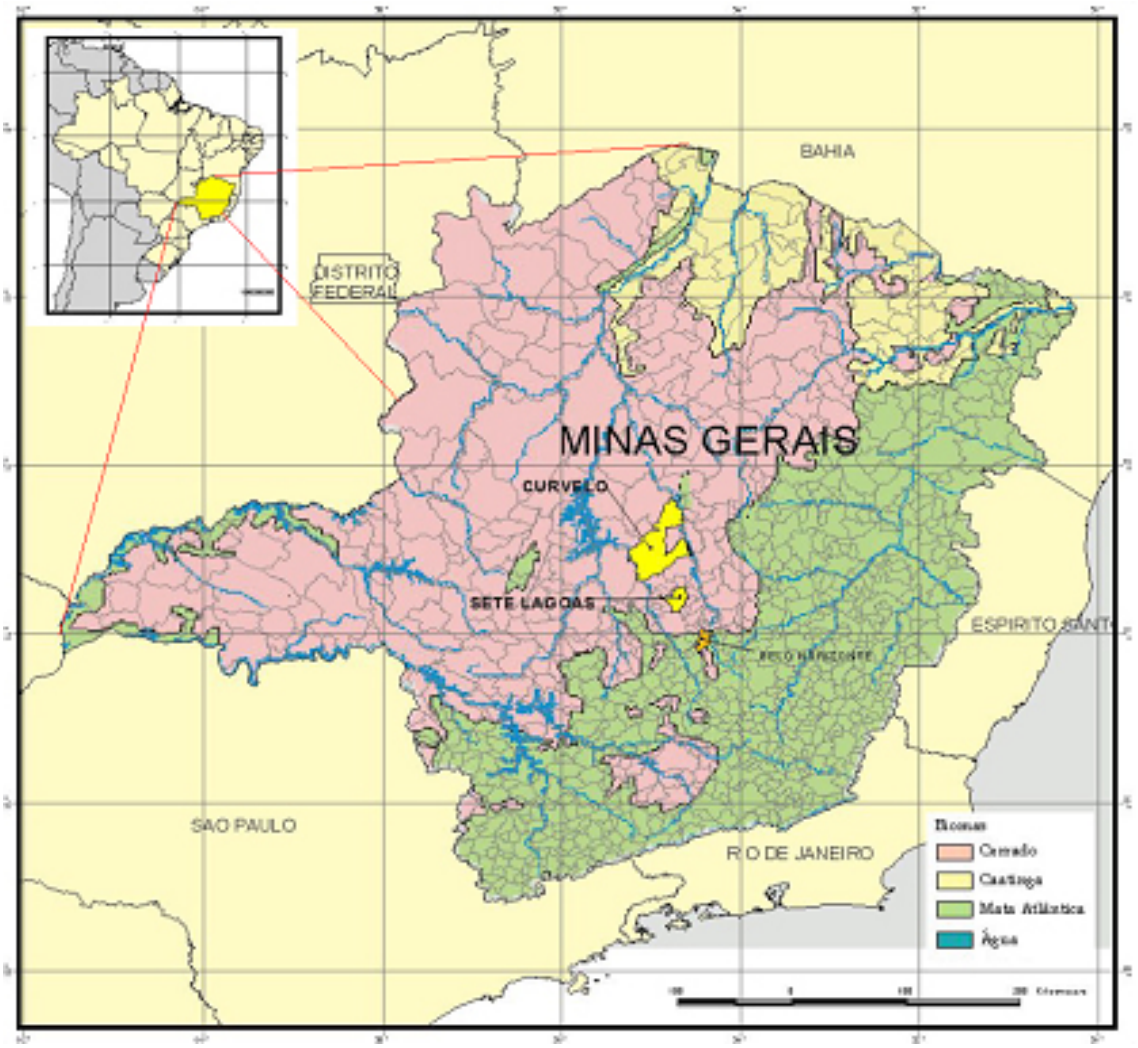
The project is situated in the south-east Brazilian state of Minas Gerais, in the state's central region, historically a source of charcoal to the metallurgical industries of Minas Gerais, about 150 to 250km north of the state capital Belo Horizonte (see Figure 4.1). The project will be established in the municipalities of Curvelo and Felixlândia. These municipalities, known in the past as the 'portal to the backlands' of Minas Gerais, supported extensive beef cattle ranching. Throughout the twentieth century, with demarcation and division of land, these municipalities followed two distinct pathways in agrarian development. First, they were partially transformed into medium-sized properties (80 to 100ha) based on low-productivity dairy cattle allied with some subsistence farming, particularly in the smaller ranches, although there still exist some extensive beef cattle ranches, like a farm recently acquired by Plantar. Second, they were transformed into large eucalyptus plantation areas, acquired by major reafforestation companies beginning in 1967, with policies of fiscal incentives.

According to some local rural leaders (Salvo, 2002), the Curvelo region has few economic options. Agricultural potential is limited, because there is insufficient precipitation and dairy cattle farming, the primary economic activity, is in crisis, because the herds are still managed by traditional means.[13] One of the better options would be reafforestation, because besides the planting and maintenance activities, there is the labour demand by carbonisation activities. Another advantage of eucalyptus is the possible sale for other purposes, for

[13] The majority of milk producers affiliated to the Curvelo Rural Union produce an average of 100 litres/day (Salvo, 2002).

example, as wood for sawmills. On the other hand, the traditional producer still sees eucalyptus as an activity restricted to large enterprises.[14] Another potential regional productive activity would be the sustainable management of the *cerrado*, as yet nonexistent in practice, owing to the lack of operational reference standards established by the state Institute of Forests (IEF).

Figure 4.1 Map of Minas Gerais



According to several interviewees in this study (Canabrava and Salvo, 2002), the main economic driver of the region in the last decades was that of native fuelwood-based charcoal production for sale to the pig-iron industries. All large or small landowners had in charcoal their savings account or funds for pasture establishment. This movement, whether legal or otherwise, was the principal factor responsible for the major reduction in native vegetation in

[14] There is some experience of eucalyptus planting in association with cattle that, in the opinion of the former president of the Curvelo Rural Union, Mário Salvo, would be very interesting as a means to attract landowners of the region, historically and culturally bound to cattle, to eucalyptus planting.

this region. On the other hand, it was also responsible for income generation in a region destitute of other alternatives, even with all of the imputed negative aspects of this activity with regard to workers' health and safety.

4.1.4 Plantar SA

Plantar SA is a forest company that was incorporated at the end of the 1960s, with the advent of fiscal incentives for reafforestation, and has been operating in the project region since that time. The company began pig-iron production in the municipality of Sete Lagoas, about 100km away from its forest area. Different from the other companies in the pig-iron sector, most also located in the same region, Plantar began its industrial operations after having established its own forest supply. One of its objectives was to aggregate value to its forest product. Today, the company is 50 per cent self-sufficient in charcoal supply. The revenue of the Plantar group was about R$140,900,000 in 2001, divided as shown in Table 4.1.

Table 4.1. Revenues of Plantar SA in 2001

Revenue source	*Amount (current R$)*	*% Distribution*
Services	65,100,000	48%
Metallurgy	48,900,000	36%
Charcoal sale	14,900,000	11%
Seedling sale	7,600,00	5%
TOTAL	136,500,000	100%

Source: Plantar SA (2002)

The company owns about 100,000ha in Minas Gerais, of which it currently uses about 23,000. The remaining area was acquired at the time of government fiscal incentives, and most of them are considered inadequate for eucalyptus plantations with current technology. One of the company's goals is to develop technology so as be able to produce eucalyptus in such marginal areas (Moura, 2002). On termination of fiscal incentives for reforestation in 1987,[15] the company started to search for alternatives to ensure its economic sustainability based in the following pillars (Moura, 2002):

First, Plantar sought to increase its forest productivity. The company is currently one of the leaders in the sector in the use of clonal technology in Brazil working with tree-clone varieties that produce no less than 30 to 35m^3/ha per year, compared to the traditional varieties, which produce between five and 15m^3/ha/year. The company produces 15 million seedlings from seed and 25 million cloned seedlings annually. It uses these seedlings in its own planting and also sells them to customers in Minas Gerais and several other states. Thanks to its recognised capacity in the sector, one of the company's main activities is the sale of services in eucalyptus plantation and maintenance to some of the biggest pulp and paper companies in Brazil.

Second, Plantar sought to incorporate an environmental differential in its products. Along this line, the company's first response originated from demand for briquette charcoal with an eco-

[15] In the 1960s and 70s, the federal government of Brazil stimulated a series of productive activities through fiscal incentive policies, among them a policy to foment reafforestation. Although this policy had beneficial effects on development of these activities (approximately 4 million hectares were reafforested), they suffered several criticisms over wastage, poor application, and corruption (BDMG and IEF, 1999). During the 1980s, with the reduction of the state's investment capacity, most of these policies were cancelled. This policy was in force from 1967 to 1987.

label certificate. According to company director, Geraldo Moura (2002), an importer was willing to pay a premium price of $30 extra per ton of certified briquette charcoal. The Forest Stewardship Council (FSC) has certified the company's silviculture operation in Curvelo since 1997, thus allowing its charcoal to carry the respected FSC label. According to Moura, the next step will be the certification of 'green pig iron' with ISO 14.000 label, thus aggregating value to the product. The executives of the company suggested to ISO 14.000 certifiers that they insist on use of green pig iron by steel manufacturers who supply the automotive industry, as a means of complying with environmental criteria in their production line chains of custody. Finally, the great new possibility could be then the sale of carbon credits based on components described below that would generate a greater rate of return on investment.

4.1.5 Project components

The project includes a plantation of 23,100ha of eucalyptus in the area of Curvelo and Felixlândia, in the Minas Gerais *cerrado* (savannah) region. The plantation is located in an area occupied by pastures or eucalyptus plantings at the end of their third and ultimate rotation cycle. In addition to plantations, the project aims to improve the design of approximately 2,000 charcoal kilns to reduce around 70 per cent of the globally harmful methane and locally unhealthy particulate emissions. Finally, the project also expects to assist in the regeneration of 478 hectares of *cerrado* and other native vegetation (Ecosecurities and PCF, 2002a).

It is predicted that the Plantar project could generate 12.88 million tons of CO_2 emission-reduction equivalents over a 28-year timeframe, seven years corresponding to the annual reforestation and growth and 21 years corresponding to raw material use in the industry. These carbon credits would be generated through three project components:

- 7.9 million tons CO_2 from industrial activity (based on maintenance of charcoal as a reducer rather than mineral coke);
- 0.44 million tons CO_2 from the improvement of carbonisation kilns (methane-emission reductions); and
- 4.54 million tons CO_2 from reafforesting 23,100 hectares with eucalyptus and assisting in regeneration of 478 hectares of native vegetation (Ecosecurities and PCF, 2002a).

The project is based on four activities: charcoal substitution for coke in pig-iron production; eucalyptus plantations; *cerrado* regeneration; and a reduction in methane emissions from kilns. To calculate the carbon offsets from each of the above components, the project-based outcomes must be compared to a 'baseline' scenario of what would have happened if the project were not undertaken. The baseline scenarios the company developed were reviewed by Ecosecurities on behalf of the PCF, and later examined by an independent certifier, Det Norske Veritas. Their predictions are examined below.

Charcoal substitution by coke in pig-iron production has a baseline scenario which takes into consideration: the pig-iron industry's tendency to concentrate in large-scale integrated coke-based mills;[16] the trend towards conversion from charcoal-based mills to coke-based mills by

[16] Coke use allows construction of much larger blast furnaces in comparison with those used in charcoal, generating the possibility of scale economies. For comparison's sake, while Plantar produces 180,000 tons of pig iron each year, coke-based industries produce an average of 750,000 to 1,000,000 tons.

the few large non-integrated steel mills; responses to the relative decline in coke prices vis à vis charcoal during the Plano Real;[17] the increasing shortage in fuelwood from native forests, besides the need to acquire lands and the necessary time for forest formation;[18] and the extent of familiarity which multinational company headquarters have with coke-based production in their countries of origin. (Ecosecurities and PCF, 2002a; Moura, 2002)

The survival of small- and medium-sized independent charcoal-based mills (a group of which Plantar considers itself a part) is totally reliant on raw material availability in this sector.[19] Charcoal availability in turn depends on the performance of eucalyptus-based reafforestation since charcoal from native vegetation suffers increasing restrictions in terms of availability, and legal constraints (e.g., in Minas Gerais, the government banned the use of native forests as a source of charcoal in the early 1990s).

Through the above-described fiscal incentives programme, Brazil reafforested 6.5 million hectares (in both eucalyptus and pine). In Minas Gerais, approximately 2.6 million hectares were reafforested, corresponding to 40 per cent of national area reafforested with exotic species (Cia. Vale do Rio Doce cited in Ecosecurities and PCF, 2002a). At the end of this programme, the forest sector was left without its main source of financing, relying now on more expensive credit lines with large loan guarantees and thus the area planted annually has drastically declined. With imminent arrival at the third and final harvest rotation in forest plantations established through fiscal incentives, experts foresaw a collapse in the supply availability of raw material from plantations. The baseline scenario assumes that without alternative funding from carbon credits the outcome would be the liquidation of the national charcoal industry, and as a consequence the coke-based mills would absorb the market share of small- and mediumsized charcoal-based pig-iron enterprises.

Following this line of reasoning, the maintenance of charcoal-based production – considered carbon neutral (the carbon emitted in the pig-iron production process is captured from the atmosphere by the reafforestation, and a small amount is fixed to the iron itself) – would be additional to the expected trend of substitution by coke (a fossil fuel). The climate mitigation additionality of continued charcoal use would thus be derived from the difference between the substantial fossil-fuel emissions from coke-based pig-iron manufacture and zero net emissions from charcoal use (estimated on the order of 1.93 tC/t pig iron).

By substituting charcoal for coke in the production process, the reduction of emitted carbon would be: 1,933 tons of CO_2/ton of pig iron produced (coke based) x 180,000 tons of pig iron produced per year by Plantar x 21 years or 7.3 million tons of CO_2. In addition, 0.043 tons of carbon is fixed in each ton of pig iron produced (averting emissions of 0.6 million tons of CO_2) (Ecosecurities and PCF, 2002a).

[17] The 'Plano Real' was a Brazilian monetary stabilisation programme, initiated in 1994, which as one of its consequences, generated an exchange appreciation in the years immediately following its implementation, turning imported products cheaper than domestically produced goods, and thus stimulating coke imports. This situation changed after exchange-rate flexibility was adopted in 1999. In 2002, thanks to macroeconomic pressures, the country suffered a monetary devaluation of about 30 per cent. This depreciation makes Plantar's argument less robust regarding this item, since market terms now favour exports over imports.

[18] According to Moura (2002), the necessity of forest establishment, where the first harvest occurs only seven years after planting and the consequent financial costs incorporated in charcoal production, makes the coke option much more interesting from the financial point of view. Charcoal production only remained competitive thanks to the availability of native fuelwood and/or of eucalyptus planted through fiscal incentives.

[19] The reafforestation of 500,000 hectares of eucalyptus each year over seven years is the estimated requirement to supply the current demand of the sector (Paulino, 2002)

The eucalyptus reafforestation project involves the reforestation of 23,100 hectares of eucalyptus plantations during a seven-year period (3,300ha per year). This will enable the Plantar mill to achieve self-sufficiency with regard to charcoal supply. According to the PCF, the planting should be done in pasture areas converted prior to December 1989, in order to comply with Marrakech rules on forests in the CDM.

Plantar estimates that the forest component of the project will sink 4,464,160 tons of CO_2 in the forest biomass (average stock) during the seven years of the harvest cycle. This amount corresponds to the stored biomass in the new high-yielding cloned varieties minus the average stock found in a plantation at the end of its third harvest cycle. The baseline scenario suggests that after the final harvest cycle of existing eucalyptus, the area would be abandoned or sold and converted to pasture. This component is calculated up to the first harvest (seven years), after which it forms a 'dynamic forest stock', which is regularly replenished by the project (Ecosecurities and PCF, 2002a).

According to the project's logic, plantations of eucalyptus for charcoal-based pig-iron manufacture would be additional to the baseline scenario, because without carbon credits, businesses in the industry would convert to coke-based production. There would be no incentive to reforest additional areas in eucalyptus.[20]

In the regeneration of *cerrado***,** Plantar intends to capture 81,237 tons of CO_2 through another forest component, chiefly directed toward assisted regeneration of 478.3 hectares of abandoned neighbouring *cerrado* areas. The baseline scenario considers pasture maintenance and/or degraded plantations of eucalyptus (Ecosecurities and PCF, 2002a). With regard to this component, it is necessary to verify whether the carbon from assisted regeneration would be additional to that which would have naturally occurred as a result of abandonment of the area. It is apparent from some of our interviews in the region that the *cerrado* could regenerate well without assistance in abandoned areas (Ribeiro, 2002). It is important to stress the pilot character of this experience. The company owns about 50,000 hectares of *cerrado* lands, no longer considered appropriate for eucalyptus planting, that could be included in this component in future projects. According to the director of the company, the World Bank treated this prospect as a valuable learning experience.

The fourth plan is the reduction in methane emissions. To predict this scenario, the proponent took into consideration the low caloric efficiency of the kilns traditionally used in charcoal manufacture. After redesigning the kilns, Plantar intends to reduce methane emissions by up to 70 per cent. From this project activity, the company hopes to issue 437,325 tons in CO_2 credits (Ecosecurities and PCF, 2002a; Goulart, 2002).

4.2 Project funding

The primary Plantar project investor is the PCF, a fund established in July 2000, by the World Bank, with the operational objective of mitigating climate change, aspiring to promote the bank's tenet of sustainable development, to demonstrate the possibilities of public-private partnerships, and to offer a 'learning-by-doing' opportunity to its stakeholders (see Box 4.1).

[20] However, despite Plantar's prediction that wood supply will collapse in the future, data from ABRACAVE (Assis, 2002) indicate there has been an increase in eucalyptus planting in Minas Gerais, even without carbon credits, although the level of activity is substantially less than that required by the industry. This may reflect the shift in foreign-exchange rates militating against importation of coke.

The PCF is intended to invest in projects that could be registered with the UNFCCC for the purposes of the Kyoto Protocol, were the programme to be operational. Both public and private sectors have provided investments to the PCF. Investors include a mix of private companies interested in the commercial and public relations benefits associated with offsetting their emissions (see Box 4.3 below) and public agencies or national governments interested in supporting the emergence of a market that supports sustainable development. Current investors in the PCF are listed in Appendix 1[21]. Contributors, or 'Participants' in the PCF, will receive a pro-rata share of the emission reductions, verified and certified in accordance with agreements reached with the respective countries 'hosting' the projects (see www.prototypercarbonfund.org).

Box 4.3 PCF arrangements

According to Horst Meyrahn (2002) a representative of RWE Rheinbraun AG, a German shareholder company of the PCF, the main motivation for its participation in the fund is threefold. Firstly, there exists a respect for existing regulation; secondly, there exists respect for future expected regulations on greenhouse-gas emissions, which means hedging against future costs, influencing future regulation, learning and strategic positioning. Third, and finally, is the 'green' factor, which can be considered from two points of view: hedging against risk of appearing 'bad' and differentiating products.

According to the information available, the Plantar project was initiated following consultation between the PCF Chief Executive Officer (Kenneth Newcombe), and forest consultant Marco Antônio Fujihara, who designed the project with company executive staff. From the company's perspective, it was clear from the above-described trend of charcoal-based pig-iron production in Brazil, that the maintenance of the sector was a priority.

The agreement between Plantar and PCF includes sale of 1.5 million tons of CO_2 credits, corresponding to about 12 per cent of the total carbon credits expected by the project (the key components of supply were outlined above). The negotiated price was $3.50 per ton of CO_2 (about $12.85/tC),[22] which was set by PCF estimates, resulting in a sum of $5.25 million dollars of PCF financing.

According to the project implementation schedule, these credits will practically all derive from the project's forest component. As a result of this purchase commitment by PCF, Plantar was in negotiation with the Dutch bank Rabobank, trying to obtain financing for an equivalent amount. According to company environment manager, Luis Carlos Goulart (2002), these funds will be used to finance part of initial planting cost (total costs are around $2,600 per hectare through to the final harvest; see details in Appendix 2). The remaining costs will be supported by Plantar.

Of the total CERs, 88 per cent of the credits generated in the project will remain with the company for later commercialisation. They will probably attract a higher price than the credits already sold to PCF, since the carbon market is expected to appreciate as limitations

[21] Available at http://www.iied.org/eep/pubs/MarketsforEnvironmentalServicesseries.html

[22] One ton of carbon dioxide (CO_2) corresponds to 3.67 tons of carbon (tC).

are reached on low-cost emissions reductions in Annex 1 countries. Strategically the agreement signed between Plantar and PCF provides a certificate of credits, which is a rare mechanism for quality control in the carbon market.

According to Plantar's director, the company also negotiated with the PCF that the credits generated by the avoided emissions in the last harvest cycle would be set aside to guarantee that the forest be reformed after the third harvest, thus guaranteeing an additional cycle of 21 years, and so on, assuring permanence of the average forest stock, one of the principal preoccupations in using LULUCF as a means for climate-change mitigation.

The Plantar project was developed in the midst of the establishment of criteria and parameters for the CDM. Sustainability parameters that are requested for projects of this nature have caused a series of critical responses, particularly with regard to the permanence issue, particularly among international NGOs. The baseline assumed by Plantar has also been questioned, particularly when the company suggested that reafforestation would become unviable, because of low returns and the time lag for investment, unless it became possible to finance them through carbon credits. The critics allege that the company would be able to finance the planting without need for carbon credits, illustrated by its recent investments in this activity, financial performance, and future plans (CDM Watch, 2002).

4.3 Sustainability impact assessment of the Plantar project

The assessment presented here was conducted with respect to the project proposals and to the company's current situation rather than actual project impacts, because at the time of fieldwork, the company was in the process of obtaining validation for its proposal with the PCF.

The fundamental criteria for CDM eligibility is that projects bring sustainable development benefits to the host country. We consider here in turn the environmental, social, and economic benefits of the project, based on the outcomes of fieldwork.

4.3.1 Environmental impacts

At the global level there are programmes for the substitution of fossil fuel for carbon neutral. These projects are characterised by the substitution of fossil carbon by biomass carbon, with all the positive impacts on the global environment this process connotes. A sink of 12.9 million tons of CO_2 would provide the project's positive impact on the global environment over a period of 28 years. Because of the project's great potential replicability, given the large number of small and medium-sized charcoal-based pig-iron mills in the same region as Plantar, this may imply a much larger positive impact, besides being a potentially good example of use of the CDM as an additional reinforcement toward biomass use in energy.

Plantar arranged for an environmental impact study, in which is cited the possible biodiversity benefits generated by the project. The study also carried out baseline estimates and suggested some indicators for monitoring and verification protocols (Nepstad and Vale, 2001 cited in Ecosecurities and PCF, 2002a). The baseline scenario assumes that the eucalyptus areas where the project is to take place would probably be transformed into cattle pastures (which customarily occurs at the end of the final cycle of conventional plantations).

Monitoring actions and forest-fire-prevention activity and the remaining preservation activities specified in the annual FSC certification review, would also be interrupted.[23]

When the project is established, the authors suggest that the company go beyond the measures required by FSC certification, taking a more proactive approach to conservation and providing a biodiversity bonus to its investors. Among these additional measures, they suggest: acquisition of new land to bring the total legal reserve up to 20 per cent of the property, including 1,100ha of *cerrado* vegetation in various stages of regeneration; increased investments in fire monitoring and control, including the construction of two additional fire-observation towers; identification and designation of areas within the existing Curvelo property as legal preserve; re-establishment of natural vegetation along the streams that cross the property; re-establishment of natural vegetation in corridors that connect legal reserve fragments; induced restoration of *cerrado* vegetation in areas of intensive use history; and monitoring of water quality, floristic composition, and the diversity of birds, reptiles, and mammals within the legal preserve areas and within the eucalyptus plantations (Nepstad and Vale, 2001 cited in Ecosecurities and PCF, 2002a).

The regeneration of a pilot *cerrado* area will also create an increment in biodiversity and allow return of native species of fauna and flora. It is possible that this experience could then be expanded to other areas belonging to the company (20,000 to 30,000ha).

At regional level, the most significant environmental impact that the Plantar project may have is to stimulate a renewed wave of eucalyptus planting. This region, where the first planting wave occurred thanks to fiscal incentives, may now pass through a new wave created by carbon projects.

Eucalyptus cultivation has been the object of intense debates between scientists, environmentalists, rural producers, and the public. There is a common perception, particularly among the public at large, that eucalyptus 'dries up the land'. According to experts, the technical explanation for this common perception is that eucalyptus exhibits high evapo-transpiration rates (derived from their large leaf area in relation to the area occupied by the plant). This rate is usually greater than that of *cerrado* or native pasture vegetation. This is made worse by the fact that in the dry season, unlike the native plants of the *cerrado* that lose their leaves, eucalyptus trees keep theirs, thus continuing the evapo-transpiration process and consequent absorption of water from the ground. This reduces the available water for percolation into the soil, reducing the available water available to the entire local hydrologic system.

This process, also described by the biodiversity consultant in the Plantar baseline study, must be monitored permanently through mapping of micro-watersheds. The consultant suggests that the company balance its plantings among several micro-watersheds. Among specialists of the sector, there is a consensus regarding the necessity to establish ecological zoning on establishment of eucalyptus plantations, but never its a priori condemnation. NGOs' opinions regarding eucalyptus cultivation have changed over the past few years. According to Maria Dalce Ricas (2002), director of Associação Mineira de Defesa do Ambiente, one of the oldest and most recognised environmental NGOs of Minas Gerais, eucalyptus must be regarded as one would any other agricultural crop. She sees no problem in its being planted, as long as

[23] See Annex 4.3 for the most recent annual summary of FSC stipulations and their response by the company.

the environmental laws are respected and that it not become necessary to open further new areas of *cerrado*, considering that the areas already open are sufficient.

Minas Gerais has already lost about 80 per cent of its forest cover, of which 4 per cent is to be reafforested and a considerably larger area occupied with low-intensity pastures (Ricas, 2002). In some stakeholders' opinion, the fuelwood supply from reafforested eucalyptus areas can be considered as an important factor in reducing pressure on remaining native forests. The company itself still purchases wood from legally authorised deforestation sources, but will stop buying fuelwood from this source when it attains self-sufficiency in its industrial supply.

Bartuíra (2002) shows that protected forest areas (permanent preservation areas and legal preserves) in private hands are more extensive than the federal and state parks in Minas Gerais, many of which in fact only exist on paper (Ricas, 2002). According to environmentalists, it is necessary to consider the role of those forest companies that adopt good environmental practices (among which Plantar is usually included) for biodiversity preservation work.

The introduction of new kilns that are expected to reduce methane and particulate emissions will improve air quality in the charcoal manufacture sites, as well as greenhouse forcing methane emissions. This process appears to still be at an initial stage, not allowing the short-term benefits to be forecast.

The company uses agrochemicals such as Round-Up (Glyphosate) to control weeds. It also controls ants with the fungicide Mirex. The use of Round-Up can be potentially dangerous in plantations adjacent to streams, since its ingredients remain biologically active within a two-month period after application (Nepstad cited in Ecosecurities and PCF, 2002a). In the case of Mirex there is also the risk of contaminating streams that drain these micro-watersheds.

The company uses chemical phosphorus-based fertilisers in planting and nitrogen for cover fertilisation. All chemical fertilisers bring the potential risk of eutrophication, or algal blooms, increase of biological oxygen demand in the drainage system of the areas that are cultivated with them. The consultant suggested that the company develop a monitoring system for soils and water to analyse the effects of agrochemical application, both pesticides and fertilisers (Nepstad, 2001 cited in Ecosecurities and PCF, 2002a).

4.3.2 Social impacts

The project has several lacunae with regard to local sustainable development, particularly to do with small landowners. The Curvelo region, traditionally known for beef cattle production in the past, today contains a large number of small- and medium-sized rural landowners (on average, 80 to 100ha), who face great difficulties managing their properties and are anxiously searching for alternative sources of livelihood (Salvo, 2002). The region is inappropriate for agriculture because of the rainfall, which is very concentrated in four months of the year and therefore offers few options for the rural producer.

There exists in Minas Gerais a programme established by the State Forest Institute (Instituto Estadual de Florestas, or IEF) in partnership with some reafforestation companies, called 'forest farmer', (*fomento florestal*) where the company usually supplies the materials and the

producer the workforce and land for planting. The producer pledges to sell the wood to the company, which agrees to pay the market value at the time of harvest (Eustáquio, 2002).

Given the prevalence of forest-related activity in the region, and Plantar's substantial technical know-how in high technology cloned seedling production, there is considerable potential to secure local development benefits through outgrowing under the forest farmer scheme. This could include the possibility for extending carbon credits to include such farmers, who, like Plantar, emphasise that the main barrier to eucalyptus planting is the length of time needed for initial revenues, as well as the lack of credit for planting.

One of the more problematic matters that remains unresolved thanks to the uncertainty of some rules related to the LULUCF[24] is the fact that the reafforestation must be accomplished in pastures converted before the end of 1989. According to the company, if it had been possible to reafforest areas already planted with eucalyptus nearing the end of a third cycle,[25] there would be less need to purchase land. The environmental benefit would hence be greater since in the past such areas had been abandoned or converted to pastures. Based on our research, there is reason to concur with the company's position, not for environmental reasons, but for social reasons. The purchase of large land areas for forest carbon accumulation would probably encourage a new process of tenure concentration, similar to that which occurred in the region during the first eucalyptus planting wave (because of the fiscal incentives) which brought negative social consequences.

If the project must be undertaken in deforested areas (excluding those areas currently in late-cycle eucalyptus plantations), it would oblige the company, which already owns about 100,000 hectares in Minas Gerais, to buy more land in its Curvelo hub possibly increasing tenure concentration. If we imagine that this project is replicable[26] by other pig-iron mills in the state, this insistence could stimulate a general increase in land concentration, which would work against local sustainable development objectives. The development of the 'forest farmer' programme could fulfil PCF's requirements without the need to purchase new land, and carbon market benefits (derived from the forest component) could be distributed more equitably to a larger number of landowners, without reducing the charcoal supply, the main goal of the project.

The baseline of the project foresees the abandonment of industrial activities and reafforestation by the company, should the project be unsuccessful. The primary social benefit of the project would be the maintenance of 1,270 direct jobs (detailed in Appendix 3), by the project, including: seedling production; forest operations; harvest and charcoal-manufacture operations; and industrial operations. Of these jobs, 76 per cent would be related directly to the forest activity and 24 per cent would be in the related industry. About 10 per cent of these forest jobs would be for women (most of whom are part of the forest nursery main workforce, which has 306 employees) and men occupy the remainder. According to the nursery manager, there are many families who have more than one member working in the

[24] These uncertainties are expected to be resolved at COP9 in Milan, in December 2003.

[25] There exist in Minas Gerais, approximately 2,000,000ha in this condition, that could easily meet all the demand necessary for a large number of projects such as this one (Moura, 2002).

[26] The president of SINDIFER, Afonso Paulino, who also leads a company (SIDERPA) that produces 180,000 tons of pig iron per year, is also initiating the process of starting up a project similar to that of Plantar, using the same consultant. The decision of V&M Tubes to launch a major project along these lines should also be mentioned (see footnote 8).

company, so improving family revenue could be significant (Vinicius, 2002). Most of these workers do not live in rural areas, but rather in the urban area of Curvelo.

Curvelo municipality offers few employment alternatives. According to the Municipal Planning Secretariat, the main activities in the urban area are small textile industries and small retail commerce, and in the rural areas, dairy production. Plantar is one of the main municipal employers and its specialised work such as that generated in the seedling nursery are viewed favourably, because it creates many direct jobs. 'It is like a factory', affirmed the secretary of Municipal Planning (Canabrava, 2002).

Employment generation has also occurred at Plantar linked to changes in planting technology established by the company in 2000. Before then, planting was restricted to the rainy season. To overcome this limitation, Plantar began to irrigate during the dry season, enabling the year-round permanence of the workforce.

In comparison to the coke-based industry, the employment benefits of charcoal production for the region is considerably larger, since the coke is imported from other countries or from the state of Santa Catarina, in the south. Mineral coal extraction and coking are mechanised processes, whereas charcoal production is primarily manual.

From the perspective of the company president and other business stakeholders interviewed regarding the social and environmental criteria to be adopted by CDM, it is not possible to expect much more from market instruments than job generation and consequent regional development, otherwise the business would be made unviable. 'The companies (participants in the PCF) want first the return on their investments. If the return does not exist, the idea could be aborted' (Moura, 2002).

According to the company, verified by the fieldwork, the working conditions are above average within the sector, but this could only be true regarding the company's direct employees. The workers that are subcontracted (in the harvest process, transport, and charcoal manufacture, the heavier activities of the production chain) – according to company data, accounting for 57 per cent of the jobs generated with the project – do not operate under the same working conditions. According to company directors, the company plans to bring subcontracted workers to the same level as those employed in the rest of the company's activities (Moura, 2002). Another trend is the incorporation of these jobs as direct workers receiving the same working conditions.

Regarding charcoal-manufacturing operations, considered among the more harmful jobs to human health, the company has pledged to improve these work conditions by redesign of its kilns, seeking reduction in methane and particulate emissions. This effort is still quite embryonic and its results are not yet visible.

4.3.3 Economic impacts

Brazil is extremely dependent on the flow of external investments to finance its internal and external debt and has made efforts to reduce this dependence one of the central points of its macroeconomic policies. To reach this goal, one of the principal strategies is to stimulate any and all activity that could generate foreign-exchange earnings, despite some posturing over the need to condition private capital flows towards direct employment-inducing investment. Similarly, following the logic behind payments for environmental services, it is important

that the country starts to benefit from its enormous potential exports of global environmental services. Thus, the existence of pioneering projects serves for learning and for developing new opportunities.

The development of a new financing model for the Brazilian forest sector must also be treated as an urgent matter for the country. The productive chain of the Brazilian forest sector is responsible for 5 per cent of the GDP and for 10 per cent of national exports, and also for revenues of $28 billion per year in the domestic and external markets. The sector employs 6.7 million people, or about 8.5 per cent of the economically active population (Bartuíra, 2002).

The fiscal incentives targeted at the sector during the 1960s and 1980s, sparked substantial technological development. Since the end of the programme, the sector lacks credit lines that contemplate the specificities of forest enterprise, worsened by the high current interest rates in the country. New financing options such as that suggested by the carbon market may have an extremely positive impact, particularly for small and medium enterprises. These are different from the big mills, which are often are subsidiaries of international firms, and lack access to international credit lines. According to interviewees (Paulino, Moura, 2002), such enterprises may well close their doors if they are unable to renew their forest assets.

There is also considerable interest in the carbon finance option from the point of view of small and medium landowners. These suffer more from problems of access to credit lines appropriate to the lengthy growing period necessary for a forest harvest. Access to carbon credits, possibly mediated by unions or farmers' associations, could also offer a new opportunity as forest producers. In *cerrado* regions such as Curvelo, this opportunity could perform a strong role in regional development, particularly by increasing the multifunctional aspects of eucalyptus planting.

The total salaries from the project paid by Plantar can be considered significant for the municipalities of Curvelo (around R$350,000/month) and Sete Lagoas (around R$180,000/month), resulting in a positive impact on the local economy.

To negotiate with Plantar, the World Bank conducted a financial analysis with regard to reafforestation for Plantar's own pig-iron production, both with and without the benefits from carbon sales at the agreed price of $3.50 per ton CO_2 (Ecosecurities and PCF, 2002a). The internal rate of return without carbon financing was 3.5 per cent (low rate) mainly caused by high planting costs and the slow generation of cash flow (owing to the seven years required for the first cut), which makes planting operations of little interest to the company. With the introduction of the sale of carbon credits to co-finance plantation establishment, the internal rate of return for the project goes up to 11.9 per cent, a significant increase that may make the business economically sustainable in the long term.

Although not explicitly mentioned on the Plantar baseline studies, it is of interest to demonstrate the increased revenues per hectare as a result of the incorporation of carbon sales in this project. Based on the carbon-accumulation estimates, (Appendix 2, project baseline document), the project estimated a net sequestration of over 2.25m tC and an average stock (remunerable carbon) of over 1.2m tons of carbon in the total area to be planted with eucalyptus (23,100ha). If this average stock is divided by the total area to be planted, the result is an average stock of 52.65 tC/ha. If $3.50/t CO_2 (corresponding to $12.84/tC) is applied to this carbon stock received by Plantar, we find that each planted hectare of eucalyptus will generate $676.03 during its full cycle of 28 years, during establishment and

three cutting cycles, as predicted by the project. This value, when compared with the earnings from extensive livestock grazing on low productivity *cerrado* pastures, represents an added attraction of the activity, especially for small and medium landholders surrounding Curvelo.

Table 4.2. Summary impact assessment of the Plantar project

Sustainability dimensions	*Impact levels*	*Impact description (negative/positive features)*
Environmental impact	Global	Substitution of fossil fuel for carbon neutral charcoal. Biodiversity maintenance.
	Regional/local	Possibility of a new wave of eucalyptus plantings in the region. Reduced pressure on native forest remnants. Maintenance of protected forest areas.
	Local	Expected reduction of methane and particulate emissions. Potential risks from application of agrochemicals. Eutrophication risk by chemical fertiliser use.
Social impact	Regional	Lack of partnership with small landowners. Potential risks of land tenure concentration. Job creation.
	Local	Working conditions above average in the sector except the carbonisation process subcontracted, comprising 57% of the labour, however, with pledges to be incorporated as full-time permanent labourers, and improvement in their working conditions.
Economic impact	National	Foreign capital attraction.
	National/ regional	Development of a new financing model for the forest sector.
	Local level	Income multiplier effect. Increase in gross revenue per hectare reafforested with eucalyptus.
	Microeconomic enterprise	Increased rate of return to the company.

4.4 The Plantar project in the Kyoto context

Of all of the projects reviewed in this study, the Plantar project is that which most explicitly sought to frame itself in the Kyoto context. Following the specific stages in the CDM project cycle, despite having been developed for presentation to the PCF, it has as its principal objective the securing of CERs.

Baseline and additionality

The Plantar project baseline starts from the principle that there is in progress a continuous reduction in plantation establishment for energy purposes, owing to financial difficulties in the sector.[27] For this and other reasons, there has been a decline in use of charcoal as a reducer in pig-iron production, being substituted by mineral coke. As a result, areas that are currently in third-cycle eucalyptus plantations would be increasingly abandoned or turned into pasture.

The project proponents predict that the increased profitability associated with carbon credits will make reafforestation financially remunerative for this purpose, enabling charcoal-based pig-iron manufacture to continue. This process would be carbon neutral, as opposed to its immediate substitute. As a result, average forest biomass would be greater than that found after the third cycle of conventional eucalyptus plantations.

Leakage

Leakage refers to whatever increase in the emission of greenhouse gases occurs beyond the boundaries of the CDM project in analysis, but that can be measurably attributable to the project. In regard to the Plantar project, there exists the possibility of leakage in two of its principal components.

With respect to the energy component, the possible sources of leakage associated with the project are related with the prospect that pig-iron factories currently in the state of Minas Gerais be transferred to the Carajás region, in the states of Pará and Maranhão, a region well endowed with both high-grade iron ore and native forests whose timber residues are increasingly used in the fabrication of pig iron. This was considered probable due to the greater use of charcoal derived from native fuelwood in the Carajás region, and to the lower level of environmental control there in relation to Minas Gerais, as well as to the legal use of fuelwood from authorised deforestation (on small farms, for example).

The monitoring plan anticipates an ongoing assessment of the independent pig-iron segment, to assess the sources of change in its level and location of activity. This is needed to address the baseline assumption that without carbon finance, the sector based in Minas Gerais would interrupt or severely reduce its level of activities.

With respect to the forest component, there are two potential sources of leakage, originating from the need to plant eucalyptus in areas where pastures existed prior to 1989. The first of these regards how the current plantation areas of the company will be used, since carbon forests cannot occupy these for the purposes of the project. These areas, according to project proponents, would probably be abandoned or converted to pastures, following the usual practice in the sector. To reduce the risk of leakage from this source, the company proposed to account for the gain obtained from the difference between the average biomass stocks attained by new cloned varieties, and potentially observed that there could be a fourth growing cycle using conventional varieties. This difference was considered to represent a

[27] In accordance with the regulations of the CDM, the baseline of the project will be re-evaluated every seven years, in order to determine whether the key assumptions used for its formulation are still appropriate (Ecosecurities and PCF, 2002 a).

conservative estimate, since the biomass accumulated even in degraded eucalyptus stands would be greater than that after conversion to pasture or *cerrado* scrub.

A final possible source of leakage is related to the prospect that landowners of pastures acquired by Plantar moving to new areas that they then deforest to establish new pastures. This possibility is always present in the process of acquiring areas for reafforestation in areas currently occupied by pasture. To reduce this risk, the company proposes that formal declarations be obtained from these landowners committing them to avoid changes in land use on their current properties as well as those acquired in the future with the proceeds of sale to Plantar for the purposes of the project (Ecosecurities and PCF, 2002b).

The project proposes that carbon credits generated by the avoided emissions from the substitution of coke by charcoal in the last harvest cycle be set aside to guarantee that the forest be rehabilitated after the third harvest. Under this proposal, this final forest stock could only be commercialised after the total reform of the area, thus guaranteeing an additional cycle of 21 years, and so on into the future, assuring a measure of permanence of the average forest stock.

4.5 Conclusions: lessons learned and recommendations

- The Plantar project represents an interesting approach to generate carbon credits through the CDM because of its various components and the premises involved in the construction of baselines. It involves two major components: the substitution of fossil fuels and sequestration through reafforestation with exotic plantations and the regeneration of native species. The premises used to construct the baselines are widely criticised as regards the sectoral trends projected by the company, thus leading to the need for a rigorous monitoring and validation system.

- The project's local social and environmental impacts are undoubtedly significant, given the jobs that would be generated in several small and medium municipalities (Curvelo, Felixlândia, and Sete Lagoas), where employment opportunities are scarce. The important question, however, is whether local development opportunities arising from actions undertaken in partnership with local farmers have been overlooked, even though they might at first sight be perceived as more difficult to implement.

- Another issue that should be mentioned regarding the eligibility criteria for CDM projects in Brazil is that of tying up large land areas in forest plantations. In the case of Plantar, the company already holds 100,000 hectares in the state of Minas Gerais, although much of the area formerly dedicated to eucalyptus plantations has been abandoned. A more thorough examination of the effects on local sustainable development of further land concentration should be a part of the eligibility analysis for CDM projects.

- A good criterion for indicating forest plantation projects eligible for CDM is to verify the social and environmental certifications already acquired by the enterprise. FSC certification, although not the only standard in existence, and may indeed in some cases be insufficient, would represent a significant departure from current practice, particularly if the criterion regarding promotion of local development is given greater weight. Another recommendation is to adopt instruments to monitor social and environmental impact similar to those undertaken in natural forest management, where the requirements imposed are made progressively more stringent.

- The CDM can and has been used to 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 for CDM.

- The incorporation of local social and environmental development as a criterion in environmental licensing (a legal requirement for enterprises with potential impact such as large forest plantations) is an immediate way to tie existing legal requirements to those facing CDM projects (Ricas, 2002). The licensing process requires public hearings, which allow local stakeholders to participate more effectively.

Annex 4.1 Shareholders of PCF

Governments	Companies
Government of Canada Government of Finland Government of Norway Government of Sweden Government of the Netherlands Japan Bank for International Cooperation	British Petroleum/Amoco Oil: UK Chubu Electric Power Co.: Electricity, Japan Chugoku Electric Power Co.: Electricity, Japan Deutsche Bank: Financial, Germany Electrabel: Energy, Belgium Fortum: Energy, Finland Gaz de France: Energy, France Kyushu Electric Power Co.: Electricity, Japan Mitsubishi Corp.: Trade - Japan Mitsui: Trade, Japan Norsk Hydro: Oil, Norway RaboBank: Financial, The Netherlands RWE: Electricity, Germany Shikoku Electric Power Co.: Electricity, Japan Statoil: Oil, Norway Tohoku Electric Power Co.: Electricity, Japan Tokyo Electric Power Co.: Electricity, Japan

Source: www.prototypecarbonfund.org

Annex 4.2 Production cost elements for eucalyptus reafforestation by Plantar SA

Cost element	*US$/ha*
Land and infrastructure	492.00
Land preparation, seedlings, and planting	854.70
Maintenance, first cycle	427.35
Regrowth	170.94
Maintenance, second cycle	256.41
Regrowth	170.94
Maintenance, third cycle	256.41
TOTAL	2,628.75

Annex 4.3 Estimate of direct labour employed by Plantar

1. Seedling production: 93 (corresponding to 6,091,800 seedlings produced annually by a total of 306 nursery employees, producing 20,000,000 seedlings annually)
2. Soil preparation, planting, regrowth, and maintenance: 149 for 23,100ha of plantation
3. Harvest, transport of wood, and charcoal: 720 for a monthly production of 40,000 cubic metres of charcoal
4. Total number of employees in steel manufacture: 308

Total = 1,270

These jobs would not be generated simultaneously. Items 1 and 2 (except the maintenance) relate to the first seven years of the project, in which the forest would be established. Items 3 and 4 relate to the period of energy substitution, or the 21 years in which the fuelwood is to be used in charcoal manufacture.

Number of functionaries of Plantar Siderúrgica: 308
Average wage: R$575

Social benefits supplied to company employees (Plantar Siderúrgica):
transport to work, health plan, dental plan, basic food basket, loans, life insurance (37.5 x employee salary), funerary assistance for the employee and family, agreements with pharmacies, agreements with stationery stores, complimentary educational scholarship, job qualification and improvement training

Annex 4.4 Summary of the conditions proposed year by year in the forest certification of Plantar SA according to FSC norms and company responses (Scientific Certification Systems, 2001)

- **Condition 1998/ 1:** Immediate implementation of a programme for monitoring of natural resources and environmental quality – *Condition complied.*
- Sub-Program for Reserve Area Management – *Subprogramme complied*
- Sub-Program Characterization and Monitoring of Flora and Fauna – *Subprogramme complied*
- Environmental Education – *Subprogramme complied*
- **Condition 1998/ 2:** Elaboration and implementation of a programme for site monitoring of soil and water– *Condition complied.*
- **Condition 1998/ 3:** Elaboration and implementation of a multi-annual programme of forest research, principally in areas of management, agrochemicals, native species, and environmental factors – *Condition complied.*
- **Condition 1998/ 4:** Elaboration and Implementation of a Corporate Environmental Policy – *Condition complied.*
- **Condition 1998/ 5:** Compose the functional structure of the company, with the definition of responsible party for Environmental Planning and Management – *Condition complied*.
- **Condition 1998/ 6:** Revision of the Internal Operational Instructions of the company, so as to assure normative instructions of environmental character in all stages of planning and execution of forestry activity – *Condition complied.*
- **Condition 1998/ 7:** Consolidation of data obtained by the Programme of Monitoring of Natural Resources and Environmental Quality – *Condition complied.*
- **Condition 1998/ 8:** Define a strategy for the company in research and development, considering the minimal environmental requisites in relation to forestry activity – *Condition complied*.
- **Condition 1999/ 1**: Present an updated map and term of commitment to maintain and integrally protect conservation areas – *Condition complied.*
- **Condition 1999/ 2:** Present a plan for regularising and title of the legal reserve areas **–** *Condition complied.*
- **Condition 1999/ 3:** Present a plan for rehabilitation of the areas of permanent preservation occupied marginally by the installations of packaging and a plan for disposal of charcoal residues – *Condition complied.*
- **Condition 2000/ 1:** Immediate implementation of norms for control and return of pesticide containers – *Condition complied.*
- **Condition 2000/ 2:** Immediate implementation of norms for control and return of radio batteries – *Condition complied.*
- **Condition 2000/ 3:** Immediate review of operational norms including monitoring and conservation of works for control of soil erosion, such as contour planting, containment boxes and slope retention – *Condition fulfilled by Condition 2001/ 1.*
- **Condition 2000/ 4:** Present a plan and schedule for implementation of the proposals presented in the report 'Characterisation of areas of reserve and permanent preservation' – *Condition complied.*
- **Condition 2000/ 5:** Definition of a plan for management for the conservation areas with old abandoned plantings of eucalyptus – *Condition complied.*
- **Condition 2000/ 6:** Improvement of the conditions of bathrooms and canteens of employees that work in nurseries, including a crèche service for female workers – *Condition partially complied.*
- **Condition 2000/ 7:** Establish a programme of monitoring of gullies existing in the company's areas – *Condition complied.*
- **Condition 2000/ 8:** Complete the report 'Characterisation of the areas of reserve and permanent protection', with the characterisation of new forest fragments incorporated – *Condition complied.*
- **Condition 2000/ 9:** Definition of a management plan of the conservation areas specific for large forest fragments – *Condition complied.*
- **Condition 2000/ 10:** Complete the soils map of new areas acquired – *Condition complied.*

5. Description and analysis of the Peugeot project

The Peugeot project originated with objectives for the investor that were predominantly commercial, although no carbon credits are sought. The project seeks to counteract the negative environmental image of the automotive manufacturing industry, one of the most intense CO_2-emitting sectors. Under the Kyoto Protocol, once in force, these industries will be called upon to reduce their emissions whether at the source or by compensating partly for these emissions through one of the Kyoto flexibility mechanisms. By starting early in forest carbon investment, PSA Peugeot-Citröen hoped both to learn about the process and improve its image in the consumer market.

Although the investor has publicly declared no intention to claim CERs for the carbon accrued through reafforestation, the present research sees it as a valuable experience to test the role of forest carbon projects in the emerging global carbon market. This chapter will, therefore, focus attention on the project's contribution to local sustainable development while also examining important issues relevant to the Kyoto context, such as baseline and additionality, permanence and leakage. The concluding remarks highlight some weak points that arose in project implementation, and offers recommendations that may render greater benefits to the primary stakeholders in Brazil – the local communities.

5.1 Project background

Peugeot's investment in reafforestation may be compared to an investment in advertisement made by a publicity agency. It is a self-fulfilling investment that allows great margin of freedom to the developer. Since it does not depend on external donors and suffers no restriction from the carbon market, the investor is free to make significant decisions regarding project activities. The concept and functioning of the project depends on the company's perception of what will achieve the maximum impact in terms of increased public awareness and enhancement to its environmental profile, specifically towards shareholders and consumers.

The implementation of the Peugeot project is characterised by two defining features. One is the impressively large figures used in promoting the project so as to match, in grand style, the image of environmental protection and enhancement. The media widely publicised, 'Peugeot intends to combat global warming with the creation of a carbon sink. It will invest $12 million[28] in planting 10 million native trees in an area of 5,000ha of degraded pastureland. The target is, in three year's time, to sequester 50,000 tons of carbon (tC) per year from 2003 to 2043, totalling 2 million tC' (ONF, 2000; *Le Monde*, 13 August 1999).

The second important feature is that of timing: haste is needed to implement the reafforestation. Reafforestation was expected to be thoroughly accomplished in three years, accompanying the installation of an industrial facility in Rio de Janeiro, in the south-east of the country, whose inauguration was scheduled for the year 2000. Hence, reafforestation in the Amazon region was planned to begin sooner, to promote the industry's green image in a country where it was expanding its automotive production capacity and market.

[28] Among the projects analysed, the Peugeot project represents the highest amount proposed for investment, at the time of its launch. These figures were revised sharply downwards with experience in its implementation.

In 1998, PSA Peugeot-Citröen, Europe's second-largest car manufacturer, entered into contract with the French National Forest Service (Office National des Forêts, or ONF), which in turn entered into separate partnership with Pro-Natura International (PNI), a Franco-Brazilian NGO, with the objective of establishing a carbon-sink project in north-west Mato Grosso, in Brazil's Amazon region.

The ONF is a national organisation that tends to state forests in France and its outlying territories. ONF International (ONFI) is a direct and private corporate affiliate of ONF, which manages its interests outside of France. ONFI, in partnership with PNI, established ONF Brasil Ltda., a private Brazilian enterprise, which serves as the official developer of the Peugeot project.

The project location was chosen based on PNI's extensive (over ten years) local experience with agroforestry extension projects in Juruena in Mato Grosso, undertaken by the organisation's national affiliate, Instituto Pró-Natura (IPN).

In 1999, ONF Brasil acquired the São Nicolau Ranch in the municipality of Cotriguaçu, neighbouring Juruena. The land was acquired after a review of available properties by IPN personnel familiar with the region, and after a title search to determine the potential for unimpeded purchase. The selection criteria required that the property or properties to be purchased be accessible to Juruena, selected as a centre of operations, and contain a relatively large area in degraded pastures. Of the 10,000ha acquired, 7,000ha were in native Amazon forest, 500ha in permanent protection areas along the Juruena River, 500ha of fallow land and 2,000ha converted to pasture by the former landowner. A second property in the municipality of Juruena with approximately 2,500ha of pasture land was also considered for acquisition. As broadcast by *Le Monde*, ONF initially anticipated that 5,000ha of degraded pasture land would be planted with native forest species to sequester carbon over a 40-year period, with the average of 10 tC/ha, parameters specified in its contract with Peugeot.

The principal innovation of the project was to seek to re-establish, to whatever extent possible, a forest resembling the rich regional biodiversity of the Amazon region, recovering lands degraded by pasture establishment – the region's principal substitute land use. Once mature, such forests could be managed sustainably for timber and non-timber forest products. Over 30 regional forest species and the exotic teak, widely used in reafforestation activities in the region, were initially selected as candidates for planting.

Figure 5.1 Map of the ranch

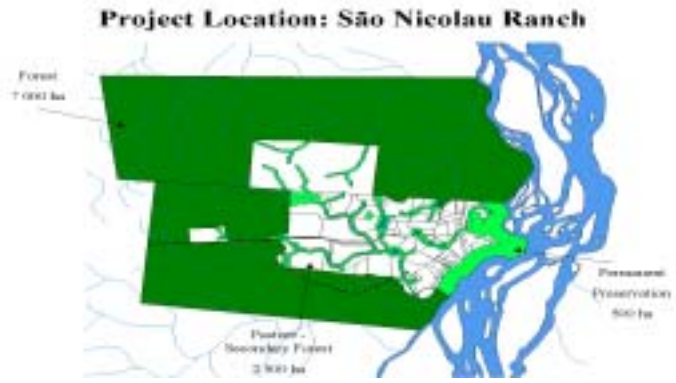


Figure 5.2 Project municipalities

The establishment of the nursery, the production of seedlings and land preparation for planting were undertaken in 1999, and followed by the first planting in November of the same year. The area planted per year was distributed as follows:

Planting 1999–2000: 747ha
Planting 2000–2001: 66ha
Planting 2001–2002: 384ha
Planting 2002–2003: 515ha
Control planting: 250ha
Total area planted: 1,712ha

Note: includes replanting in areas previously planted, exhibiting high failure rates.

ONF subcontracted its plantation operation services to two French companies: EDEA SA, represented by its Brazilian affiliate Terra e Floresta Ltda., responsible for land preparation,

construction and maintenance of roads, and other mechanised operations and NAUDET SA, a traditional French company in nursery and seedling production, represented by its Brazilian affiliate Floresta Viva Ltda. The latter was responsible for the installation of the nursery, production and planting of the seedlings and post-plantation maintenance.

A baseline study was carried out in July 2001 by a technician affiliated with the French agricultural research organisation CIRAD, to serve as the underpinning for monitoring of carbon sequestration in the reafforested area on the ranch (Locatelli, 2002).

The project also involves a forestry-extension component targeted to small-scale farmers that live near the ranch in both Juruena and Cotriguaçu, originating from a need to dispose of excess seedlings leftover from the reafforestation project. This activity is undertaken by IPN technicians in line with the organisation's historical role in the region, with the aim to promote integration of the project with members of the local community. The underlying idea is to promote a culture of planting multi-functional trees and to create synergy with a regional GEF-financed project (Promotion of Conservation and Sustainable Use of Biodiversity in the Frontier Forests of North-western Mato Grosso, Brazil) executed by the State Foundation for the Environment (FEMA), in partnership with NGOs, local governments, and producer organisations in the region.

Owing to the project's ambitious aims and the company's sense of urgency, activities began prior to approval of environmental licensing[29] and indeed prior to application for such a license at FEMA, as required for agricultural enterprises over 1,000ha in size.

The project faced a number of obstacles in its first year, ranging from natural conditions to human and institutional factors, which limited its successful implementation. The resistant and aggressive brachiaria grass (*Brachiaria decumbens*), of African origin, one of the most common fodder grasses used in Brazil, posed a great danger for the survival of seedlings planted in the previously established pastures. In addition, the lack of knowledge regarding local forest species, change in the technical team fielded by ONF to the region, bureaucratic delays affecting importation of some equipment, all contributed to unsatisfactory initial results. This is partly reflected in a low survival rate of 60 per cent of the seedlings in the first planting cycle. This led to a decision to pause in the second year, limiting planting to 66ha primarily for research purposes (ONF, 2000; Graffin, 2002).

As a result of the pressures for rapid implementation, and of arrogance expressed by some of the foreign personnel, causing latent antagonism from government institutions, the project became the brunt of regional criticism. Accusations were made linking use of herbicide by the project to unexplained death of wild turtles and cranes found along the Juruena River, as well as of smuggling of native tree seeds to France. The case received national media attention in November 1999, and the Land and Environment Committee of the State Assembly with the participation of the Public Prosecutor's Office mounted an official investigation commission to verify the facts (Viana, 1999).

[29] One year after the Peugeot project began, FEMA began to institutionalise Single Environmental Licensing (LAU) – *Licenciamento Ambiental Único* for rural properties requesting deforestation approvals throughout Mato Grosso. The licence was applied first to holdings above 1,000ha, then reduced gradually to include smaller rural enterprises. The São Nicolau ranch became one of the test cases for the LAU.

The project had indeed sprayed 5,000 litres of glyphosate (Roundup) by air for weed control in July 1999 over an area of 1,500ha of pasture land, in a volume within the herbicide's legal prescription. In April of the same year, the project applied to export 5t of native tree seeds for analysis in the ONF headquarters laboratory in Paris, a request denied by the State Agriculture Sanitary Service (Maekawa, 2002). The result of the official investigation concluded that no environmental damage could be traced to the project (Viana, 1999), but lingering doubts remained.

With regard to the use of glyphosate herbicide, its demonstrable efficacy is unquestionable when compared with mechanical interventions or use of fire, and it is legal when applied within recommended parameters. Such herbicides are thus frequently used to prepare the soil for reafforestation and establishment of other crops. However, despite these facts, they are widely condemned as 'anti-environmental' due to their risks when poorly handled. In the case of the Peugeot project the use of herbicide reverberated badly despite the lack of any demonstrable link between its usage and the death of animals. It is flagged as contradictory to the entire point of the project, which is to protect and promote sound environmental practice (Viana, 1999).

The episode had a profound impact on the project, forcing its implementers to rethink its focus and the process underway, resulting in a number of changes. A sharp reduction in plantation activity in the following year was followed by a gradual increase over the following two planting seasons. It appears likely that ONF will restrict the plantation to the 2,000ha of pasture land at the São Nicolau Ranch to be completed by 2004, rather than seeking additional area to expand reafforestation to its original objective of 5,000ha (Graffin, 2002).

The process of internal re-evaluation, resulted in the following seven changes (Graffin, 2002):

- Reduced reforestation area: Because of the difficulties encountered in controlling the brachiaria grass without herbicide, and the need to understand and experiment with native species the project reduced the area planted in the second year (2000/2001) to 66 hectares, which effectively stymied the originally planned three-year planting schedule. In addition, greater care was taken to choose plots to test different tree species, and these were demarcated and incorporated within a geographic information system to facilitate the monitoring of future carbon balance. In the words of the project coordinator they have replaced quantity with quality[30] (Graffin, 2002).
- Creation of a Scientific Advisory Committee: In response to domestic criticism of the developer's inadequate technical knowledge of reafforestation with tropical rainforest species under the stress conditions of open pasture, a scientific advisory committee was formed in 2000, including researchers, professionals, government institutions, and NGOs from both Brazil and France. The project relates its activities to the committee, whose role is to assist, advise, improve, and divulge project activities to the wider scientific community. In addition to the scientific advisory committee, the project also broadened its involvement with local scientists by signing an umbrella technical cooperation agreement with the Federal University of Mato Grosso, and involving faculty from

[30] Quality refers to both more meticulous plantation and to increased integration with local communities (Moraes, 2002), the latter to be analysed more fully in a later section on social impacts.

several of its departments in ongoing monitoring and assessment of faunal biodiversity, carbon flux, reafforestation technology, and pest occurrence.

- Substituting foreign equipment and expertise with local inputs: At the technical level the project substituted the sophisticated Australian Rotree equipment brought by the French subcontractors with manual planting, which has proved to have the same efficiency in local conditions and to be far more cost effective. Pastures are leased to neighbouring ranchers prior to the seedling plantation and cattle grazing is used to weaken grass rigour as a first stage of control of plant competition.
- Abandoning the use of herbicides for manual weeding: Following the controversy over the use of herbicides, the project decided to discontinue the use of chemicals for weed control. Instead, ONF switched initially to using other means, such as a whip cutter, complemented with manual weeding in the area surrounding each seedling. Despite this method being more costly and less efficient (as well as generating some initial carbon emissions after planting), its adoption was a political decision made to rescue the project's environmental image. Nevertheless, further experimentation with localised use of small amounts of herbicide led to its being partially incorporated in the project once more in the final planting stage, after experimentation showed its efficacy when compared with alternatives such as establishment of leguminous cover.
- Adopting more realistic objectives: The goal to reafforest 5,000ha was reduced to 2,000ha, and as a consequence, the total amount of carbon to be sequestered was also adjusted significantly downwards. In August 2002 the project completed its baseline survey, which estimated generously that the initial stock of carbon in pasture was 50 tC/ha, (including soil carbon; an estimate derived from the literature). It also estimated that the carbon stock of the future mature forest, also based on literature on existing forest areas and limited tree measurements in the forest reserve on the property, is between 250 and 300 tC/ha, including 100t of estimated soil carbon. The estimated time period necessary for the reafforestation to reach maturity was also extended from 40 to 100 years. Hence, the estimated annual amount of carbon sequestered was revised from 10 tC/ha/year to 4–5 tC/ha/yr over an adjusted time frame of approximately 70 years (Locatelli, 2002). According to the project manager at the time, the project adopted a precautionary approach, based on the assumption that it is better to provide estimates of project achievements rather than definitive figures, remarking that this denotes part of the project's learning process. The executors have also learned that numbers of variables may affect achievement of the originally declared values.
- Enhance local integration with environmental education: In 2001 a Brazilian forest engineer was hired to introduce an environmental education programme into the project. The programme consisted of organising opportunities for school students from the region to visit the project area in order to acquaint members of the local communities with the project.
- Cancelling contracts with French contractors: Local government officials viewed the subcontracting of French companies by ONF for plantation services from the outset with reserve. The cost charged for the service of the French companies was comparatively higher than that of local firms. It was decided that the two contracts with the French companies, Terra e Floresta (Naudet SA) for land and soil preparation and Floresta Viva (EDEA SA) for the production and planting of seedlings, would be discontinued in mid-2002, and substituted with local service providers. According to ONF Brasil, the main

reason for this change is to strengthen the relationship with the local communities, and to ensure greater local dissemination of nursery and seedling production knowledge.[31]

5.2 Peugeot project sustainability impact assessment

5.2.1 Environmental impacts

At a global level, the amount of CO_2 to be sequestered was reduced because of project hurdles. During the initial years of project implementation, the developers expect to reduce the total area of reafforestation from 5,000 to 2,000 hectares, confined to the São Nicolau Ranch. Consequently, the net carbon to be sequestered would be reduced significantly from an estimated 2,000,000 tC to 500,000 tC (2,000ha x 250 tC/ha).[32] With this adjustment the cost per ton of carbon, if the total initial budget were spent, rose from the initial estimate of $6 to $24.[33]

At the regional and local level there has been a net contribution to the awareness of forest conservation in an area of agricultural frontier. The area of direct influence of the Peugeot project includes parts of the municipalities of Juruena and Cotriguaçu where the nursery and São Nicolau Ranch are located. The two municipalities lie in north-west Mato Grosso, a region that encompasses a total of seven municipalities[34] with similar patterns of land occupation. Located in the Amazonian 'arc of deforestation' the region has experienced very active recent expansion of its agricultural frontier.[35]

Both subsistence farmers and large cattle ranchers base their livelihoods on extensive practices, such as slash-and-burn, shifting cultivation, and pasture burning. The area deforested in Juruena and particularly Cotriguaçu has increased dramatically since the early 1990s. By 2002, at a rate of about 1 per cent annually, nearly 20 per cent of Juruena's area had been deforested, while Cotriguaçu (part of whose area is devoted to Indian reservations) is only 7 per cent deforested, but has recently been at the receiving end of a migratory wave of failed settlers from neighbouring Rondônia. Once soil fertility is exhausted the degraded land is left behind and forested areas are opened farther along the arc of deforestation (UNDP, 2001). According to Instituto de Pesquisas da Amazônia, Brazil would rank fifth in carbon emissions if deforestation and biomass combustion were taken into account. This activity takes place primarily in the Amazon. Carbon-dioxide emission resulting from deforestation and burning is of great concern not only in Brazil but worldwide because of its influence on global warming (Carvalho et al., 2001).

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[31] It is also fairly clear that this decision was made as a substantial cost-cutting measure, in line with the overall project strategy to retreat from original over-optimistic projections of the reafforested area and carbon sequestration.

[32] 250 tC/ha=300 tC/ha of forest=50 tC/ha of pasture land. See discussion on baseline survey in earlier section.

[33] $12,000,000/2,000,000 tC=$6/tC, whereas 12,000,000/500,000 tC=$24/tC. These cost estimates are based on projected rather than actual expenditure. There is little doubt that Peugeot significantly reduced its initial proposed expenditures on the project. However, no actual cost data have been made available to the participants in this study.

[34] Corresponds to 108,000km^2, representing 2 per cent of the Brazilian Amazon (UNDP, 2001).

[35] Clearing and biomass burning are part of the land-conversion process that follows the colonisation of the Amazon region. Every year, the land preparation process for farming in the Amazon begins in the dry season during June and July, when the felling starts. Fires are initiated two or three months later, prior to the rainy season, after the biomass has dried out enough to sustain combustion. An increasing number of clearing fires have been observed in recent years (Cunha, 1989; Martinelli et al., 1996 citing Carvalho et al., 2001).

In this realm of intense deforestation, a large reafforestation project involving substantial investment attracts the attention of farmers and is hoped to set a good example. At first, it provoked curiosity, doubt, distrust, but gradually there were changes in the settlers' attitudes towards forest conservation. According to state deputy Gilney Viana: 'The project illustrates the value of forest, be it standing, reforested, or rehabilitated. This value is not measured in monetary terms but is important in the agricultural frontier where the custom of land clearing is intense' (Viana, 2002).

The reafforestation itself stands as a static symbol. Its potential impact would only be effective when combined with other social integration efforts such as extension assistance, environmental education and investment support. The distribution of seedlings to small farmers by the project for the establishment of agroforestry is complementary as a switch to the necessarily concerted effort toward more sustainable land uses in the region.

At the local level there is a research effort in faunal biodiversity. In April 2002, the project signed an additional term to its technical cooperation agreement with the Federal University of Mato Grosso to carry out fauna and insect monitoring with installation of insect traps in the reafforested area. The specialists carried out several field surveys, which indicated the reappearance of species in the newly reafforested area, rarely encountered in pastures.

Also at the local level, there has been donation of seedlings for rehabilitation a local park. The project donated 10,000 seedlings of native tree species for the recuperation of 15 hectares of degraded area in the 36 hectares Araras Park in the city of Juruena (May, 2002).

At local level there has been loss of potential native species diversity in reafforestation. Although in many cases, technical obstacles served as a source of reflection for improvement, one of the original benefits envisaged by the project: to restore native biodiversity, was only partly accomplished. Along with the shift from chemical weed control to manual weeding, there was a simultaneous contraction to six selected native species (apart from teak, which is an exotic species) from an original mix that came to include 45 native species. The selection is based on the species' ability to coppice under competition with the brachiaria grass, thus reducing the need for manual weed control (Graffin, 2002). The trade-off between successful reafforestation and re-establishment of original forest biodiversity was paramount in this decision. Over the long run, however, it is expected that regeneration of other species will occur by dispersion from neighbouring forest reserves, and the recovered forest will closely resemble the one which originally existed in the area.

5.2.2 Social impacts

The project's priority is to provide an environmental image to the investing company, and to capture carbon, while social benefits to local communities appeared initially to be a secondary concern to the investor. Originally social integration was focused primarily on seedling distribution to some neighbouring small farmers in partnership with IPN.[36] This partnership led to efforts to convince managers that the Peugeot project bring greater benefits to the local communities, so as to better complement the mission of this NGO to promote social and environmental sustainability in the region.

[36] This programme arose out of accidental overproduction of seedlings in the first planting period. Rather than destroying them, project management decided to donate them to local farmers.

This pressure was reinforced by the difficulties of the first year, which brought to the implementers' attention the need to internalise better social and environmental concerns associated with the project. In consequence, the project made efforts towards integration with the regional scientific community and to promote closer acquaintance with the local population. Project executors remain uncertain as to how to go about ensuring continued local benefits. Encouragement of local people's involvement in spin-off carbon schemes has been proposed by IPN managers, and would benefit by the experience of the Peugeot project as well as involve a technical partnership with ONF. Some of the social benefits described below (research, extension, and environmental education) are rather ad hoc efforts adopted by an innovative and open-minded project manager, not yet internalised in the overall project commitment, although all decisions have been taken with the knowledge and approval of ONF leadership in France (Graffin, 2002).

At regional level there has been a convergence of discussion on carbon sequestration services in the region. Given the notoriety of the investor and the significance of its investment in reafforestation, the project has created an opportunity for bringing together diverse stakeholders, scientists, academics, government officials, and NGOs in the region to discuss the potential of global environmental-service markets, in particular the carbon market.

At regional level there has also been generation of scientific knowledge on native forest species, carbon monitoring, and faunal biodiversity. The resources brought by the project worked as a catalyst to regional and local research initiatives on native forest species, fauna, and insect biodiversity and methods for carbon monitoring. Because there is a lack of financial support from state research institutions and because forestry research need to be done over such a long time, many of the local research initiatives have not had the opportunity to become consolidated. The resources invested by the Peugeot project provided structure and area for the establishment of trial research plots for the generation of knowledge on regional eco-systems and their restoration. The creation of the scientific advisory committee in 2000 and the establishment of the collaborative research agreement with the Federal University of Mato Grosso and other regional research partners facilitated the foundation of this structure.

In regard to carbon monitoring, two methods are being applied in the project. A tower was installed in March 2002 in pastures targeted for reafforestation, to measure atmospheric gas fluxes, through research integrated with the Large-scale Biosphere Atmosphere Experiment in Amazonia (LBA programme); and regular measurement of net biomass accumulation in predefined plots.

At the local level there has been significant employment generation. In terms of direct social and economic impacts, employment creation is the most visible and brings the highest direct benefit to the local communities in the two municipalities where the project is located, particularly when compared to former cattle ranching. The former beef-cattle-raising activities on the São Nicolau Ranch had employed only two permanent workers. During the first three years of implementation (1999–2002) the reafforestation project employed, through its two subcontractors, approximately 100 workers in the rainy season (November to March), of which an average of 20 positions are kept throughout the year for seedling maintenance in the dry season (April to October). Besides the plantation operations, ONF Brasil supports eight administrative and technical workers from three families who live on the ranch.

All temporary and permanent staff are registered employees, according to the national labour codes, and both working conditions and the salary rates range approximately 15 per cent above the regional average. Subcontracted temporary workers are lodged at the ranch with provision of transport, board, and some recreational facilities.[37] Workers hired directly by ONF Brasil receive a house for each family unit and free canteen service (Moraes, 2002).

However, it is necessary to recognise that the employment generated in reafforestation enterprises is often limited primarily to the establishment of planting and to the initial maintenance of the seedlings. With completion of 2,000 hectares of reforestation on the São Nicolau ranch, these labour requirements will decline rapidly. During the peak plantation period in 2002/3 ONF Brasil expected to hire-in 60 temporarily workers of which 15 would be retained until 2005 (Moraes, 2002). ONF registered an average of 23 employees for 2003 (through September), including the peak planting period, evidencing a decline in the level of employment with the reduced planting effort as the project's target is neared (ONF Brasil, 2003).

At the local level, seed collection has generated income for residents. There is no precise register of the total number of families who have benefited or how much of their income derived from seed collection because of the project. It is roughly estimated that 500 people benefited from seed collection. Different stakeholders interviewed (Almeida, 2002; Maekawa, 2002; Marcório, 2002; Chazeaux, 2002) concur with the idea that sale of native tree seeds to the Peugeot project played a role in income generation,[38] particularly in the case of those newly arrived to agrarian reform resettlements. In addition to the financial benefit, this activity contributes to environmental consciousness regarding the value of native trees, as a potential income source (Almeida, 2002). However, this benefit was also short term since the supply was mainly intended only to fulfil the project's nursery demands. The volume of seed demanded by the project boomed in the first year with decreasing amounts in the following seasons, when the reafforestation targets were reduced.

The reduction of total reafforested area to 2,000ha allowed a budget readjustment to increase modestly social-integration activities. In late 2001, a forester was hired to develop an environmental-education programme to enable the project to become better known to members of local communities. The programme's target group is primary schoolchildren, as these youngsters are the most open-minded recipients and advocates of new ideas to adult members in their family. The programme works in partnership with the municipal Departments of Education of Juruena and Cotriguaçu who select the students to visit the project. In 2002, 400 students visited the project site during a one-and-a-half-day visit (Moraes, 2001). The resources destined to this programme in 2002 amounted to R$16,800.[39] In 2003, a total of 282 schoolchildren from the two municipalities visited the project for one week each, and showed considerable learning achievements (Assumpção, 2003).

The initial social-integration activity planned was the distribution of seedlings of native species to farmers neighbouring the project plantation. This extension effort was carried out

[37] Soccerfield, TV, table tennis, snooker, and 'pebolim'.

[38] Some families made from R$1,200 to R$1,600 (US$520 to US$700) in one week from seed collection. (This amount is equivalent to six to eight minimum wages.) A kilogram of cashew seed fetches R$5, while the more scarce and preferred 'caxeta' and 'angelim' seed can fetch R$15 (Almeida, 2002). It should also be noted that this activity is highly seasonal, but constitutes an important supplemental source of income in forest communities.

[39] Approximately $7,000 at an exchange rate of R$2.30 to US$1.

jointly by ONF Brasil and IPN aimed at encouraging small farmers to plant native fruit and timber-tree species together with teak within their farming systems for conservation and productive purposes. During the first year, seedling distribution was further accompanied with fertiliser as an extra incentive. The follow-up report to this initial effort (Ryn Von, 2000) shows that the seedlings are used as live fencing for demarcating property, rehabilitating degraded permanent preservation areas, providing shade in pasture land, and mostly for the establishing agroforestry systems, such as shading existing coffee trees, and inter-planting with annual crops.

The total number of seedling distributed during the first four years of the project up to 2003 was 68,266, reaching 83 small farmers (some of whom repeated planting in successive years) (Assumpção, 2003). On average each farmer had established 2ha of plantation with a density of 385 trees/hectare with varying survival rates (May, 2002; Sell, 2002).[40] In a survey of beneficiaries in 2003, 44 per cent responded that they had planted all seedlings provided, while an additional 37 per cent planted only part of these. The remaining 19 per cent either planted none or had moved on, illustrating the lack of permanence in such systems. Furthermore, since many of these plantings had been established in areas close to or integrated with crop cultivation (agroforestry systems), they were frequently subject to risk of fire. The fact that many small farmers do not live on their own land also was considered a cause for concern, as was the lack of technical assistance and of time available for maintenance (Assumpção, 2003).

5.2.3 Economic impacts

There were economic multiplier effects noted on the local economy. Terra e Floresta and Floresta Viva, the two French subcontractors that performed most of the reafforestation services, purchased most of their equipment in the regional and local market; even leaving aside the cost factor the importation process is lengthy and bureaucratic. Terra e Floresta alone bought over R$1,000,000 in heavy equipment for land preparation in the regional market (Chaseaux, 2002).

The levy of service tax by the municipality of Juruena, employment creation and seed collection brought about by the project have raised the purchasing power of the local population as well as the investment capacity of the local government. This has had a corresponding multiplier effect, contributing to enhance local commerce, particularly during the first two years of project implementation (Marcório, 2002).

It is commonly voiced among local authorities and economic representatives that benefits to the local economy would have been more substantial had the services been carried out by local enterprises instead of subcontracting to French companies (Siebert, 2002). Yet the fact that much of the equipment, and both supplies and manual services were purchased or contracted locally suggests that this would not have made a major difference.

Data presented on the total outlays of the project in 2003 indicate that two-thirds of a total of approximately R$1 million was spent in the project region (47 per cent in Juruena alone),

[40] On average, the seedlings planted in farmers' properties exhibited survival rates similar to those planted under better conditions through reafforestation at the São Nicolau ranch. This was due to the fact that they were typically planted in agricultural plots rather than in pastures, and were cared for by farm households rather than employees.

while 90 per cent of expenditures were made in the state of Mato Grosso. Only 7 per cent was spent on imported goods or services. On the other hand, of total expenditures, only 8.6 per cent went towards the cost of project integration with the local community (Gardette, 2003).

As the subcontractors' offices are located in Juruena, the service tax levied on plantation services was received by this municipality, although there was a dispute over this between the municipalities of Juruena and Cotriguaçu. The total amount levied during the first three years of implementation added up to R$190,000, of which, according to Brazilian federal law, 25 per cent went to education and 13 per cent to health. The remaining amount, in accordance with the mayor's office, was channelled to the municipality's Department of Agriculture, and as such as been used particularly for fixing trucks and tractors, purchasing motorcycles, paying debts of the local farmer's cooperative, and other purposes (Maekawa, 2002).

Overall the project is perceived as having a good environmental image. Although the investor's image was partly tarnished by the herbicide incident, it has fulfilled its objective to strengthen the 'greenness' of its image and has portray itself as an enterprise with an environmental conscience to the general public and its shareholders.

Regarding the project's cost effectiveness, it is unlikely that a project of this type could be replicated commercially owing to the low pricing of transactions in the carbon market, high initial costs due to imported technology and technical delays, and the absence of forest or agricultural by-products to offset the cost of carbon sequestration. It is characteristically a pilot project with high-cost transactions and learning by doing.

Table 5.1 below provides a summary overview of the impact assessment of the Peugeot project as discussed in this section.

5.3 The Peugeot project in the Kyoto context

The Peugeot project has no intention to claim Certified Emission Reductions (CERs) generated by the reforestation. The investor's main interest is to convey an environmental image for the company. Although the project stands outside the carbon market, it has gone to some lengths to show how it responds to Kyoto and later COP rulings regarding project-eligibility criteria. In the Brazilian context, in which the inclusion of reafforestation in the CDM has met with official approval after some initial resistance, the lessons learned are important and may provide directions for the establishment of project criteria and future projects taking part in the global carbon market. The following section attempts to analyse briefly four important aspects related to forest carbon projects in the Kyoto protocol context, namely baseline and additionality, leakage, permanence, as relates to the Peugeot project.

The contribution of projects to local sustainable development is also an important condition in the Kyoto context and as the central theme in this research, is analysed separately in the concluding section below.

The baseline of the Peugeot project is quite simple: it is the pasture land on which reafforestation takes place. In the absence of the project, it is expected that the pasture land would have remained as it was. In terms of additionality, the Peugeot project changed the land use by adding forest coverage through reafforestation in an area previously used as pasture. However, additionality may be questionable in view of potential leakage.

In this project the risk of leakage is latent as at any time the former owner of the São Nicolau Ranch may purchase a forested area in the region or elsewhere in the Amazon, and establish a new ranch, a practice very common in the region. The project does not present specific leakage-mitigation efforts. However, by contributing its learning and demonstration effects to regional sustainable development efforts under way, and by co-financing the GEF sustainable biodiversity use project, the project may thereby mitigate the potential for leakage.

The reafforestation established is composed 85 per cent native species and 15 per cent exotic teak (*Tectona grandis*). There is a possibility that mature trees will be harvested in 40 years or longer. According to the project, reafforestation requires management (i.e., partial thinning) throughout growth to maturity, in particular in plantations with stand densities as high as 3m x 5m, which may otherwise bring the risk of tree fall. Since the project aims to sequester carbon, eventual harvesting will be based on sustainable forest management so that a sustainable carbon stock will be secure (Griffin, 2002; Assumpção, 2002).

5.4 Conclusions: lessons learned and policy recommendations

The section above screened the overall positive contributions of the Peugeot project to sustainable development. It is expected that the investment contributed some positive impact. In the concluding section, some project weaknesses are examined as a learning opportunity to see how potential benefits accrued to local communities could be enhanced and focused.

The case study shows that limitations may be expected for a purely commercial project to contribute to local sustainable development, owing to the priority interests held by investors, which may not coincide or may be perceived as exclusive from local interests and needs.

Peugeot has not been able to capitalise fully on its image prospects from the project. It appears that project implementers are now moving in the direction of a project that exhibits a stronger orientation towards replicability and community integration as well as engagement of the broader scientific community.

The weak points identified below are those that have hindered greater social achievements:

- Decision-making is centralised in hands of the project developer limiting participation of other stakeholders (beneficiaries, local authorities, environmental agencies, and partners). Decisions taken by the board of the French company do not reflect local realities, leading to conflicting perceptions of project benefit.
- In general, local authorities lack information regarding carbon projects. As a result they do not know how to participate, suggest, or cooperate so that carbon projects could incorporate more local social demand.
- No social assets have been incorporated to benefit local communities. The only productive asset envisaged of possible incorporation to the municipality was the project nursery, after conclusion of the plantation, yet even this was not assured.[41]
- Lack of involvement of farmers in the carbon scheme. No efforts were made to involve local communities, particularly small farmers adjacent to the project in generating carbon credits, although project management now concedes that measurement of carbon

[41] On severing its subcontract with Floresta Viva in 2002, ONF Brasil has determined to maintain a minimal nursery structure at the São Nicolau ranch. The owner of the land leased for Floresta Viva's nursery in Juruena does not plan to keep the nursery in operation.

sequestration in reafforested areas on small farms should be accommodated, and information shared with those seeking to organise such projects.

- Some positive impacts are not secured as they depend on the profile of the project developer in charge. The Peugeot project was a learning-by-doing experience and as such project implementers have learned from its initial inadequacies. This learning is realised in an ad hoc fashion yet offers the opportunity for lessons learned to be incorporated into the project.

Table 5.1. Summary impact assessment of the Peugeot project

Sustainability dimensions	*Impact levels*	*Impact description (positive features)*	*Limitations*
Environmental impact	Global	Initial goal proposed would sequester significant amount of CO_2 contributing to mitigation of global warming.	Amount of CO_2 to be sequestered reduced due to project hurdles.
	Regional/local	Contribution to the awareness of forest conservation in an agricultural frontier area. Contribution to the establishment of agroforestry.	Requires complementary financial and technical support to be effective.
	Local	Research demonstrates improvement in faunal biodiversity in reafforested pastures. Donation of seedlings for rehabilitation of local park and to small farmers.	Use of herbicide contradictory to main project objective of environmental protection. Loss of diversity in reafforestation due to restricted use of native species.
Social impact	Regional	Convergence of discussion on carbon sequestration service in the region. Inclusion of wider scientific community. Generation of scientific knowledge on native forest species, carbon monitoring, and faunal biodiversity.	Initial barriers to information exchange. Lack of guidelines on monitoring.
	Local	Employment generation to local communities. Seed collection as source of income generation for local population. Environmental education. Forestry extension.	Employment primarily seasonal and restricted to plantation period; Short-term seed demand for project nursery. Decision-making centralised with project developer. No participation of local authority in project design. No involvement of small farmers in carbon schemes. No physical asset gained besides seedlings donated.
Economic impact	Macroeconomic regional/local	Economic multiplier effect on local economy. Service tax levied to Juruena invested in education, health and agriculture.	Multiplier effect limited by use of French subcontractor.
	Microeconomic enterprise	Good environmental image of the investing enterprise.	Not cost effective due to high transaction costs and learning by doing. Environmental image tarnished by the herbicide incident.

Based on the lessons drawn from the Peugeot carbon sequestration project some policy recommendations addressed to governments, NGOs, developers, and investors are indicated bellow to assist the design of future carbon projects to enhance benefits to local communities.

- It is fundamental that the project concept be transparent to other stakeholders from its inception.
- A workshop on carbon services and markets in the proposed project area addressed to all residents before project definition would help the project to reflect local social demands and facilitate participation.
- Project assets may be better transferred to the benefit of the communities if there is higher participation and shared decision-making in aspects of the project that have an impact on the local population and regional institutions.
- A robust institutionalisation of instruments to transfer social benefits of the project is necessary to secure social gains.
- It is not a requirement that carbon project investors or developers acquire land for reafforestation. Doing so raises the cost of carbon sequestered and may contribute to land concentration. Additionally, it also works against the opportunity of broadening participation of other landowners in the carbon schemes.
- It is important to build up experiences of carbon projects with the participation of small farmers in carbon schemes. There is insufficient credit in Brazilian capital markets, and when there is, it rarely reaches small farmers. Carbon credits could be used to finance initial investment in establishment of plantations for small farmers, both for production and conservation. Although the Peugeot project does not intend to claim carbon credits, it could very well, with little additional cost, assist the small farmers with inputs such as seedlings and technical knowledge to enable them to take part in the carbon market.[42]
- Participation of small farmers in carbon schemes seems to be more appropriate under the auspices of programmes such as Proambiente[43]. Such programmes could benefit from synergy and proximity to the Peugeot project in terms of technology transfer and extension assistance. Alternatively, expansion in the Peugeot project area could be accomplished under contract with such programmes, which could add considerable visibility to the investor as a social and environmentally responsible corporation.

[42] As a result of continual prodding on the part of IPN and the scientific advisory committee, it now appears that ONF Brasil has conceded technical assistance toward carbon measurement in small farmers' plantations accomplished with seedlings donated by the project.

[43] Proambiente is a sustainable social and environmental development programme based on environmental service generation and the multi-functional features of family farming in rural Amazonia. It promotes environmentally sustainable production systems, with integrated management of natural resources. Carbon sequestration services provided by rehabilitation of degraded farmland, permanent protection, and legal preserve areas could represent considerable local and global benefits.

6. Description and analysis of the Ilha do Bananal project

The first carbon project initiated in Brazil, the Ilha do Bananal project can be treated as one having a more experimental than commercial characteristics. The project does not envisage obtaining credits that could be traded in the carbon market. It is financed by the AES Barry Foundation, based in Wales, and implemented by the NGO Instituto Ecológica and its partners. The project has an emphasis on the social component linked to the CDM, and to scientific issues regarding carbon monitoring. Located in an ecological transition zone, the project aimed to open up a series of possibilities for future projects,[44] which would have a more competitive character in the developing market. As one of its clear merits, the project introduced so-called 'social carbon' in Brazil – projects that have in their conception a priority focus on aspects that stimulate local development, for which reason we situate this project as developmental in character, according to the previously presented typology.

In accordance with this typology, carbon projects having this characteristic tend to seek resources from financial sources concerned not only with an image of environmental responsibility, but rather with having as a priority social responsibility. Having the focus of work concentrated on social questions and on knowledge generation, rather than on carbon-credit generation, permitted great liberty to the project's executors, with respect to attainment of carbon sequestration objectives proposed to the investors at the outset.

6.1 Project background

6.1.1 Project location

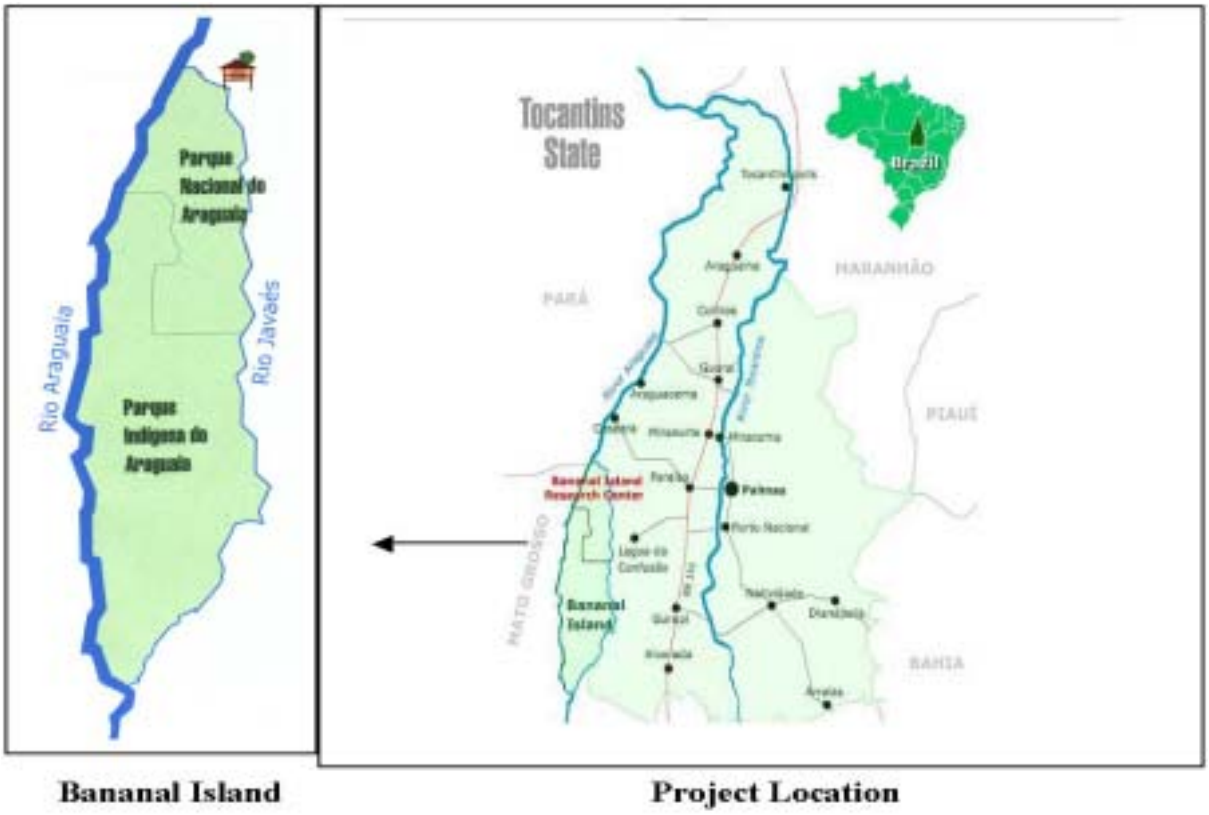
The Carbon sequestration project of Bananal Island (CSPBI)[45] is centred in south-west Tocantins, a relatively young state that is treated as part of the Brazilian Amazon. It comprises Bananal Island itself, with an area of approximately 2,100,000ha – and its surroundings to the north and east of the island and part of the Environmental Protection Area of Cantão (APAC) (see map below).[46]

Bananal Island is divided into two parts: the National Park of Araguaia (PNA)[47] of 562,000ha in the north and Araguaia Indian Reserve (PIA)[48] of approximately 1,528,000ha in the south. The three areas (PEC, PNA, and PIA) are all protected areas of restricted access under the guardianship of NATURATINS, IBAMA, and FUNAI,[49] respectively.

[44] The project was initially conceived in 1997 and initiated in 1998, in a period when most of the rules regarding implementation of the Kyoto Protocol and the carbon market were still in a very embryonic stage.
[45] The Portuguese name and acronym are Projeto de Seqüestro de Carbono da Ilha do Bananal (PSCIB).
[46] APAC is a recently designated conservation area created by the Tocantins state government in May 1997. It extends over 16.8m hectares, covering a total of 15 municipalities on the north-east of the park and includes the Parque Estadual do Cantão (PEC), itself of 90,000ha. It is rich in *cerrado* habitat, which shares much of the island's biodiversity. Its designation is intended to preserve the natural beauty of the area while facilitating the development of ecotourism and related services in the region.
[47] Parque Nacional do Araguaia (PNA)
[48] Parque Indígena do Araguaia (PIA)
[49] Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) is the Brazilian federal environment agency; Instituto Natureza do Tocantins (NATURATINS) is the environmental institute of the state of Tocantins; and Fundação Nacional do Índio (FUNAI) is the National Indian Foundation that oversees indian lands and indigenous people's welfare.

The region is considered to be an ecotone of great ecological importance, since it is an area of transition of three important Brazilian biomes: the *cerrado* (savannah bush land), the Amazon forest and the *pantanal* (marshlands).

Figure 6.1 Maps of Bananal Island and project location



6.1.2 Project objective

The project was prepared to take part in an international tender organised by Natural Resources International on behalf of the AES Barry Foundation. The tender specified that AES Barry, a gas-energy facility, was seeking a project to offset 6m tC, the estimated emissions throughout the company's expected lifetime. The tender also required that the focus of the project be put on the social component. The investor did not intend to claim the eventual carbon credits accrued to the project, which gave great margin of freedom to the developer to adapt its activities.

The ultimate aim of the Bananal project is to develop and implement an innovative, equitable and sustainable system to offset greenhouse-gas emission through the sequestration of CO_2 in terrestrial ecosystems on Bananal Island (Rezende, 2001).

The project's specific objectives are: to establish an international and interdisciplinary research programme related to carbon sequestration in the vicinity of Bananal Island, with the support of the Canguçu Centre; to generate scientific information and appropriate technology for the carbon project; and at the same time to improve the living standards of the population

in the project's area of influence thorough environmental education and support to sustainable income-generating activities (Rezende, 2001).

The original technical proposal presented in December 1997 estimated that the amount of carbon to be sequestered in 30 years would be around 65 million tons. This amount was revised downwards later to 25 million tons in 25 years to adjust the expected lifetime of the AES Barry power plant. Carbon sequestration is based primarily on forest preservation and regeneration in protected areas and to a lesser extent on the establishment of agroforestry, complemented with environmental-awareness activities (Ecológica, 1997).

6.1.3 Project components

The project is grounded in three principal components: forest; environmental research and carbon monitoring; and the social component, as described below.

Forest component
The forest component is that responsible for generating carbon, and was divided into three lines of action. First, the permanent preservation of 200,000ha of existing old-growth forest (including upland and inundated forests) located in the Araguaia National Park (PNA) and the Cantão Environmental Protection Area (APAC). This item would be responsible for generating 21 million tons[50] of carbon. The preservation activity remained the role of IBAMA[51] regarding the former area and of NATURATINS[52] the latter. Second, reafforestation and regeneration of 60,000ha of degraded forest and *cerrado* areas in the PNA, predominantly gallery forests, bordering water courses in the region. The project expected to sequester through this action about 3.9 million tons of carbon.[53] This line of action was also placed under the auspices of IBAMA, since it was all to be accomplished within the PNA. Third, implementation of 3,000ha (1,500ha, in the initial proposal) of agroforestry systems in the municipalities located in the area of influence of the Ilha do Bananal project. This line of action, the only that remained the responsibility of the NGOs involved in the project (initially Gaia and later the Instituto Ecológica itself), expected to sequester about 210,000 tons[54] of carbon during the project's lifetime of 25 years.

Research component
The central objective of the research component is to develop methodologies for carbon monitoring. For this purpose, the project constructed the Canguçu Research Centre, situated adjacent to the PNA and PEC. The centre is capable of receiving visiting researchers, and is equipped with environmental-monitoring systems, capable of supporting local research. The centre also has been used in programs for training of professors and in ecotourism activities (Rezende, 2001).

[50] 200,000ha x 105 tC/ha, the average value of forests found in studies of biomass measurement carried out in the area (Rezende, 2001).
[51] Federal agency responsible for administration, maintenance, and control of federal conservation units in Brazil.
[52] State agency responsible for administration, maintenance and control of conservation units in the state of Tocantins.
[53] 60,000ha x 65 tC/ha, the average weighted value used by project executors for the transition zone between forest and *cerrado*, based on biomass measurement data collected (Rezende, 2001).
[54] 3,000ha x 70 tC/ha (Rezende, 2001).

With progress in its activities, the project has developed partnerships with a large number of national and international research institutions, in hopes of becoming a centre of reference in the area of carbon monitoring and sustainable development.

Social component
In the original proposal, the social component of the project was focused basically on environmental education through two main channels: first, that pertaining to the existing schools network in the region; and second, activities directed to the entire community. Through the execution of the project, and in agreement with efforts foreseen in the initial proposal, the project appealed to new sources of financing to incorporate additional resources in the social component, particularly those more related to the generation of alternative sources of income.

The main actions undertaken under this component are the training and qualification of teachers of the agricultural and urban schools through the joint elaboration of an environmental education handbook; the distribution of seedlings in the schools in conjunction with lectures on environment; the plantation of nurseries for the production of seedlings (one of which having been passed directly to administration by the community), and the distribution of these seedlings among the agricultural and urban communities.

After additional financing was obtained for the social component from the cosmetics company Natura, the environmental-education effort with distribution of seedlings was strengthened, and incorporated activities of women's qualification for health care, and the fortification of productive activities. The latter included establishment of agroforestry systems and experiences in support of income-generating projects in agrarian reform settlements in which the project is active.

In relation to the indigenous groups resident on Bananal Island, the project worked with two villages with the objective of introduction of beekeeping, and in one of them, Boto Velho village, the project also introduced a pioneering experience in indigenous ecotourism.

6.1.4 Project partnerships

The project was built on a partnership between four institutions, under the leadership of Ecológica Advisors, a private consulting company that would have the function to coordinate the actions of the partners. The other partners of the project would be: IBAMA as the federal agency responsible for the PNA, responsible for the preservation of the existing forests in the park, as well as for the regeneration and reafforestation of 60,000ha within the PNA; NATURATINS, responsible state agency for the APAC and PEC, and for preservation of existing forests in these areas. The fourth partner is the NGO, Gaia, an organization with experience in environmental education and promotion of sustainable alternatives in agricultural and urban communities.

In the course of the project, some roles were inverted and others had not been consolidated institutionally. In relation to the activities that were to be developed by Gaia, these were gradually assumed by Ecológica, which created in turn the Ecológica Institute, which took over the social actions of the project. On the other hand, the partnerships of the project executors with the involved governmental institutions did not materialise. Difficulties arose involving the substitution of those responsible for these institutions, and the more personal rather than institutional character of the relations previously established, did not allow the

initially idealised partnerships to move forward, particularly in relation to IBAMA.[55] This restricted the targets of the project to the social and research components, with the exception of the plantation of agroforestry systems, which today continue to be developed through the social component supported by Natura.

Actually, the fragility of the partnerships with official agencies was foreseen in the original proposal presented to the investors. Furthermore, the executors carried out one of the commitments of the project with regard to these partners, providing them with the information generated in the construction of the baseline with the intention of supporting management plans.

6.1.5 Project phases and intervention areas

The revised project duration of 25 years is divided into two phases. The two phases concern primarily Ecológica's intervention toward agroforestry establishment and environmental education. For the first phase (initially projected for three years, then revised to five) the area subject to Ecológica's intervention encompasses five municipalities[56] located in the buffer zone in the northern and eastern part of the island, totalling an area of 1.7 million hectares. For the second phase, Ecológica will extend its activities to the indigenous land of the Araguaia Park (PIA), on the southern part of Bananal Island. This would require discussions and negotiations with the National Indian Foundation and indigenous communities on the island (Rezende, 2001).

Throughout the project period the intervention of IBAMA and NATURATINS would consist of continuous efforts to protect and regenerate forestlands within their respective areas of responsibility: the Araguaia National Park, and the Cantão State Park, and Cantão Environmental Protection Area.[57]

6.1.6 Project funding

Project phase I is financed by the AES Barry Foundation, a non-profit foundation associated with a British natural gas company. For the first five-year period £650,000 (approximately US$1 million) was secured. For phase II, the subsequent five-year period, another £600,000 had been negotiated with the same institution. It is foreseen in the original project proposal that the project developers will be seeking alternative funding sources to support project activities after the first funding phase.

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[55] The formal partnership proposal between the institutions was submitted to the central directorate of the agency in the national capital, and no response was received. According to the directors of Ecológica, the local superintendent had an important role in the initial construction of the proposal, but then received no continuation after her substitution. As regards the state agency, a protocol of common actions was signed, but this was also not implemented. In both cases, funds were reserved in the project to match with governmental facilities, personnel and equipment in the execution of these actions, which were conceived as the central components of the project (avoided deforestation and reforestation). However, the long-term commitment by the agencies over the 25-year project period, to maintain and protect forest resources, could not be ascertained except insofar as their charters provided for these responsibilities with regard to the parks in question.

[56] Caseara, Pium, Lagoa da Confusão, Cristalândia and Dueré. All the five municipalities lie in the north and east of the Bananal Island and all have territory that is incorporated in the APAC and/or the PNA. According to the Tocantins Atlas the municipality of Dueré is rather disconnected as it is not part of the APAC nor of the PNC adjacent to it (SEPLAN, 2001).

[57] See section on forest component for specific targets.

A strategy considered by the project developers to complement funding is the creation of project income generating activities for self-financing by the end of the project's term. Organic fruit production in agroforestry systems and ecotourism in the Canguçu Centre are ancillary activities proposed by the project to respond to this demand (Rezende, 2002). Unfortunately both activities were not very profitable financially. Carmo Hill ranch was acquired by the project for organic fruit production. It appears however that organic fruit production in this region still requires considerable research before it can deliver economic returns. Furthermore, the revenues charged for accommodation to tourists and researchers hosted by the centre during the dry season do not cover the management costs of the Canguçu Centre (Rezende, 2002; Merlin, 2002).[58]

In 2001 the insolvency of AES Barry anticipated and intensified the urge for diversity in financial backers. AES Barry Foundation did not honour the full second tranche of £650,000, of which only £100,000 was disbursed. In order to bypass the financial crisis, the project had recourse to other investors and redefined some research and social-component activities. It succeeded in bringing in $300,000 from the Natura Foundation for the continuity of environmental education and distribution of seedlings, and adapted two of the ongoing capacity-building programmes to: 'Health through Women' and 'Support to Production', in particular the establishment of agroforestry.

Another grant of $120,000 from the municipality of Bolzano in Italy was added to the project for the building of a training centre in Caseara to support its capacity-building activities within the social component. It also managed to incorporate $90,000 from the World Bank Millennium LBA programme, *Large Scale Biosphere-Atmosphere Experiment in the Amazon,* of which, $80,000 is destined for the installation of a tower to measure the eddy correlation and $10,000 for research expenses of the centre. Finally, the project incorporated funds derived from environmental compensation for damages arising from the construction of the airport at Palmas, the state capital. $300,000 is earmarked for activities for indigenous groups in two villages (Boto Velho and Macaúba)[59] in the project area.

6.1.7 Project beneficiaries

As previously noted, this project has as one of its pillars, local development work with the communities in the buffer zone of the Araguaia National Park and of the Cantão State Park, located in the five municipalities in the area of influence of the project. The project executors chose agrarian reform settlers within a stratified universe of rural producers, to participate in the project, as these were at the same time the most destitute and the most organised (Santos and Santos, 2002).

6.2 Bananal project sustainability impact assessment

6.2.1 Environmental impacts

As presented in the initial proposal (Ecológica, 1997), the project had an ambitious goal of carbon sequestration: approximately 65 million tons of carbon, a goal that was later reduced

[58] According to Stéfano Merlin, the executive director of Ecológica, the revenue from ecoturism, which includes the visits of researchers for scientific purpose, amounts to approximately 50 per cent of the total cost of running the Canguçu Centre (Merlin, 2002).

[59] These two indigenous villages are located at the contentious zone between the National Park of Araguaia and the Indigenous Park of Araguaia claimed by the Karajás and Javaés indigenous groups as their ancestors' land.

to approximately 25 million tons, based on biomass measurement studies. Of this amount, 83.6 per cent would be derived from the preservation of seasonally flooded and existing upland forests in the protected areas, 15.6 per cent from regeneration and recovery of areas of forest and cerrado in the PNA, and only 0.8 per cent from the planting of agroforestry systems.

The first point to be analysed in relation to the expectation of future carbon sequestration is with respect to the approach used. The project was conceived primarily (83.6 per cent deriving from preservation) from the standpoint of avoided deforestation, a concept not contemplated in the LULUCF regulations of the Kyoto Protocol, but that in any case continues to be discussed as being potentially acceptable as a component in carbon markets not regulated by Kyoto. Another issue that also is insufficiently clear in discussion on the carbon market is whether carbon credits may be generated in areas where environmental regulatory instruments would already compel protection, such as in conservation units of restricted use.

The most important question in relation to carbon in the project is that of the defection of the partners responsible for the majority of the carbon that would be generated or stored by the project. In this regard, the carbon project, as such, has been substantially reduced in scale. The fact that the partners responsible for most of the carbon to be generated have not fulfilled their responsibilities for the project, and in fact do not perceive themselves to be participants (Gobira and Mendes, 2001) greatly reduces the importance of the project as a means of capturing carbon from the atmosphere.

Another point that deserves prominence in regard to carbon sequestration volume is the still considerably incipient stage in establishment of agroforestry systems. According to the project's technician, only during the 2002/3 rainy season will the first agroforestry system modules be established in three selected agrarian reform settlements. These modules will contemplate five producers in each settlement and each will have a size of one hectare. The expectation is that these modules will serve as experiments, and will stimulate other agriculturists to adopt them later. It is also important to mention the positive effect of the distribution of 168,565 seedlings (out of 232,086 produced), since the beginning of the project (Merlin, 2002). The biggest problem in relation to the amount of carbon sequestered by these seedlings is the absence of data referring to their distribution, seedling survival, growth, and other silvicultural information.

As its executive coordinator admits (Rezende, 2001), the project cannot be termed a carbon project according to a simple reading of the expression, but should rather be treated as an experimental carbon project, in which research and support to local development are the most important concerns.

One of the most interesting aspects of this project was the search for market instruments, in this case the carbon market, that could support the activities of state and federal conservation units, historically limited with regard to technical staffing and resources. Although the project itself was not effective in achieving this, the concept could be taken up by other projects, since it was strategically well defined. Moreover, the work of the Ecológica Institute in the buffer zone contributes to reduce the human-induced pressures on the parks.

The construction of the Canguçu Centre provided an excellent base of operations for undertaking research, notably those studies related with local biodiversity, the flows of

carbon and other gases. Particularly noteworthy, are the works carried in partnership with IBAMA and support from the Earthwatch Institute on Amazonian turtles, in which a series of studies are under way (sand grain texture and turtle sexing, contamination of turtle eggs by Salmonella, reproduction of turtles) with the presence of researchers form the State University of Tocantins. Other studies include measurement of methane emission in wetland (University of New Hampshire/LBA), and geomorphologic parameters (cooperation with the University of Ouro Preto).

The social component of the project incorporates environmental consciousness raising in greater or lesser extent in the communities surrounding the conservation units. This process, besides possibly generating alternative and more sustainable sources of income, could in the medium and long term lead to the reduction in the human-induced pressures on legal reserves,[60] and serve as a major argument for the partnership established by the project with the state Public Ministry.[61]

6.2.2 Social impacts

As the project is still young and most of the social activities entail capacity building for the improvement of living conditions of local communities, and hence have indirect effects, the assessment of social benefits is based on the results achieved during the process to date, rather than end results.

One aspect of the Bananal project that stands out among the four case studies and merits attention is the deliberate effort to involve local communities in discussion and participation in project activities. This effort is reflected in the innumerable meetings with local authorities, potential collaborators, and target groups, and in the diagnostic studies carried out prior to the elaboration and implementation of the project activities. It is also reflected in the level of engagement of some participants with project activities, such as the voluntary collection and donation of native seeds to the project nursery and the fact that seedlings are fetched by farmers at nurseries instead of delivered to farmers' plots (Auriman, 2002).

The research networking established between the project and other national and international research institutions and universities is a remarkable feature of the Bananal project, possibly ensured by the international academic, research, and business experience of Ecológica's president. Undoubtedly such networking has leveraged the research capacity of all involved parties, and was benefited by the project's investment in the Canguçu Centre.

The project not only carried out its own original carbon research, but the Canguçu Centre also served as a physical and financial base supporting other researchers, contributing to the generation of information on the regional ecosystem and on land-use patterns in the region and in the tropics in general.

[60] In the ecosystem in which the project region is located, the Legal Reserve proportion – area of private properties on which alteration of vegetation is permitted – is 50 per cent.

[61] The state Public Ministry entered into a partnership with the Ecológica Institute, through which it cedes an employee, Marli Santos, who was responsible for monitoring of the social component of the project, and been in charge of this component for two years. In return, the ministry receives updated information regarding the project as well as training for its staff, in the belief that the project has potential to reduce the incidence of environmental crime.

The project carried out a detailed baseline study on land-use change from 1986 to 1998 on Bananal Island and its extended buffer zone covering a total area of 5.1 million hectares. The study showed that the average annual deforestation rate[62] in the region is 0.8 per cent. Apparently this study is the most detailed one on land-use patterns on the island and surrounding region. Ongoing PhD research in cooperation with the University of Hohenheim on 'Comparative Land Use Pattern of Different Sizes of Land Holdings in the Bananal Region' will provide further data on land-use trends.

Regarding carbon research, the project baseline study has contributed to the measurement of carbon content in relation to biomass weight and carbon stock of different forest types in the local ecosystems (see baseline details in Annex 6.1. below). As the three biomes are very representative in the Brazilian context, the baseline study on carbon measurement may be a valuable reference for carbon monitoring. In line with its carbon research, the Canguçu Centre is collaborating with an LBA project in cooperation with the universities of Goiás and Santa Barbara (USA) and is hosting a NASA-funded LBA/ECO research site on methane emissions from inundated forests.

The project pioneered introduction of the Sustainable Livelihood Approach (SLA)[63] to assess the social impact of interventions on local communities. The approach is based on a holistic concept aimed at alleviating poverty and promoting development. Livelihood is understood as the access to resources necessary for a sustainable living, which is translated into five capital asset sources: human, social, physical, natural, and financial. The main feature that differs from other approaches is that the assessment is based upon the communities' perceptions of the changes in their access to these capitals (Santos and Santos, 2002). Although this perception is restricted by the limited information horizon of poor communities, the approach does add to an overall assessment of activities with social impact. In particular, the pentagon shape used to represent the five capitals in this approach allows a clear visual representation of the changing process. The project is discussing and disseminating this approach to other development NGOs and project staff in the region.

The Bananal project built and inaugurated the Canguçu Research Centre on 5 August 1999 equipped with a complete meteorological station and facilities to host 15 guests. It is located at the embankment of the Javaés River bordering Bananal Island in order to facilitate field research on the local ecosystem. The centre is a pioneer in attracting physical and financial support to research projects related to carbon and local ecosystems. It serves not only research by the carbon project itself but also other research themes approved by the centre's research directives. The centre was set up with a research committee including recognised researchers at regional and national universities and experienced officials of the government environmental agencies, such as IBAMA and NATURATINS.

[62] The baseline survey used satellite images of four periods to identify deforestation rates. The periods are: before 1986: 5.28 per cent; 1986–91: 4.3 per cent; 1991–1995: 3.53 per cent; and 1995–98: 2.21 per cent. The average is 0.8 per cent per year, which is twice the deforestation rate in Brazil as a whole for the same period (Rezende, 2001).

[63] In Portuguese Meio de Vida Sustentável.

Figure 6.2 The Canguçu Centre

The Canguçu Centre (see Figure 6.2) is in the process of consolidation and is gaining recognition as a centre of reference for ecological and carbon research nationwide, leading to its consideration as a centre of excellence.

The project itself does not have a substantial demand for labour. Among the activities initially planned, those related to the forest component on protected areas probably would be those which would have had greatest direct employment impact, such as preserving 200,000ha, and particularly in the reafforestation of 60,000ha.

Of the activities that have been actually carried out, the construction of the Canguçu Centre probably had only minor local impact at the time. Today, the centre employs about four people in its routine activities, primarily during the dry season when the area is accessible. The other permanent activity that generates employment is the maintenance of nurseries, that currently occupies five employees and one technician (Maria, 2002), but will reach seven employees and a manager when the nurseries are at full capacity. Training activities are conducted by the permanent team of Instituto Ecológica involved with the project that includes about three people, with support from specialised professionals for specific courses.

To generate income, the path chosen is to stimulate planting at and collect seed, as well as incentives for small income-generating projects, such as the financing of a sweets factory (see below). These have the great merit of generating more desirable social and environmental alternatives. However, in terms of income generation per se, there is a long road ahead.[64]

The project provided financial, technical, and organisational support to the Women's Association in the agrarian reform settlement União II to establish a small sweet factory (called Delícias do Cerrado), which uses native fruits as the main ingredient. The major objective is to generate income through using native tree species, showing the local population the economic potential of this fruit.

[64] To cite one example, the sweet factory financed by the project in the União II settlement inaugurated in June 2001, has monthly revenues of about R$200, that serve to leverage the purchase of ingredients and equipment, and for one retreat during the entire period, at a cost of R$30 for each woman belonging to the association.

The project established four nurseries with a total production capacity of 700,000 seedlings per year in Caseara, União II, Cristalândia, and Pium. Since the project's start, approximately 90,000 seedlings have been distributed to communities in the five selected municipalities. Seedlings were distributed freely during environmental-awareness sessions to communities, schoolchildren, and teachers. Unfortunately, no records have been kept on the distribution or follow up on their survival rate (Auriman, 2002; Maria Clóvis, 2002). The nursery in União II was transferred to the control of the resettlement association in 2002 for the farmer's own management and benefit.

The project is in the process of establishing agroforestry demonstration units among 15 small farmer volunteers in three selected agrarian reform settlements. Training courses in agroforestry have already been carried out in all settlements and seedlings are to be planted in the rainy season of 2002/3. According to interviews carried out during field research in October 2002 the reasons for their participation in agroforestry are threefold: alternative crop production, income generation, and conservation. The experience of these 15 farmers should inspire other farmers for a second stage.

In 1999 Gaia involved schoolteachers from the five municipalities in the elaboration of an environmental education handbook entitled *Aprendendo com a Natureza* (*Learning with Nature*) as an educational tool, that they would then use for teaching. This handbook was used in 15 capacity-building sessions carried out with the participation of 245 schoolteachers in the Canguçu Centre. The project has also carried out environmental education training sessions at schools in local communities.

As an attempt to build confidence and bring the target groups closer to the project, it supported a visit by four community members to the donor institution, AES Barry Foundation in Wales.

A diagnostic study has been carried out by a project consultant and published by Ecológica on the Karajá and Javaés indigenous groups in the region entitled 'Social Environmental Diagnostic on Karajá and Javaés Communities on Bananal Island'. This study may serve as a guideline for future activities with these and other indigenous groups.

Resources from the Bananal Island project in phase II financed the introduction of beekeeping techniques to São João, one of two villages targeted by the project. After the interruption of the second tranche of financial support of £600,000 from AES Barry Foundation, in view of insolvency of AES Fifoot, only one village received assistance and no follow up of the application of this new technique has been carried out.

In return, money from environmental compensation for airport construction in Palmas launched ecotourism and handicraft activities in two other villages located in the area. The money was obtained by litigation between the PNA and the PIA. A local cultural exhibition centre and an historical house have been built respectively in Boto Velho and Macaúba villages. The furnishing of the historical house has been suspended with the interruption of funds, but was resumed in April 2002 (Merlin, 2002).

6.2.3 Economic impacts

At national level, the principal impact of carbon projects has been to show Brazil's potential in this area. There has been considerable discussion regarding diverse alternatives for

occupation of land, at a time in which the country is seeking to increase its exports, and when the primary agricultural export products, such as soybean, can be devastating in their impact on occupation of territory, particularly in the Amazon basin.

It is important that projects such as this and the Peugeot project, both situated in the 'Arc of Deforestation', point to other alternatives for generation of foreign exchange, even if these may not be as profitable on a per hectare basis. They possess a series of benefits that could potentially compete with export agriculture and particularly with cattle ranching: the two dominant land uses.

The principal macroeconomic impact at a regional level derives because the project's has attracted international credits through new environmental-compensation mechanisms.[65] This experience, in an area for which Brazil has few human resources, will be valuable in attracting further such investments. After successfully initiating this project, Instituto Ecológica with its private offshoots, Ecológica Advisors and a more recently created firm Ecológica CO_2, have initiated a number of new projects, including a first proposal for urban carbon sequestration in the capital of Tocantins, Palmas. Partnership with urban interests has resulted in the elaboration of a municipal environmental law with actions to combat global warming, one of the first such laws in existence at municipal level in Brazil, denoting environmental awareness on the local agenda.

At the level of the investing firm, a positive impact that could arrive is the image of socially responsible enterprise. This possesses a strong and growing appeal with the company's stakeholder community in Europe and the US, derived from its support for sustainable local development among rural settlers on the fringes of the Amazon forest, while at the same time combating global warming.

For the Brazilian company Natura, a leader in the cosmetics industry, the rationale is similar. This company's support resulted in adding lines of work to the social component of the project, such as training in family health through women, and through use of phyto-therapeutic medicines.

[65] The state of Tocantins was created under the Brazilian Constitution of 1988. Although located in the northern region, it can be considered transitional between the two principal Brazilian biomes: *cerrado* and Amazon rainforest. Its capital, Palmas, was built from scratch after the creation of the state, which can still be treated as a state in formation, attracting numerous migrants from all parts of the country.

Table 6.1 Summary impact assessment of the Bananal Island project

Sustainability dimensions	*Impact levels*	*Impact description (positive features)*	*Limitations*
	Global		Not effective in terms of additional of carbon stocks
Environmental impact	National/ regional	Use of market instruments to support federal and state protected areas. Avoided deforestation in region of high deforestation rate.	Lack of more robust institutionalisation of partnership with government environmental agencies.
	Regional/local	Development of research in ecotone for environment conservation.	
	Local	Contribution to environmental awareness, which may lead to reduction in the human-induced pressure on legal reserves and buffer zone in the medium and long terms.	Difficult to account for deforestation avoided as a result of project's environmental awareness effort. Monitoring needed to capture results and source of change.
Social impact	National	Research dissemination through networking. Contribution to generation of scientific information on local ecosystem. Introduction of 'sustainable livelihood' approach in social assessment.	
	Regional	Provision of support by the Canguçu research centre to other researchers.	
	Local	Financial support to community income-generation micro-projects. Establishment of 4 nurseries with 5 staff. Distribution of seedlings to community; Support of establishment of agroforestry. Capacity building and environmental education to school teachers and community in general. Job creation during building of the research centre. Assistance to indigenous groups in beekeeping and ecotourism.	No registry of distribution and follow up. Due to start in the 2002/3 rainy season. Insignificant employment generation in the research centre (4 staff). Temporary employment during building period. Activity suspended due to interruption of funding.
Economic impact	Macroeconomic national/ regional	Carbon projects as alternatives to degrading agricultural systems in the region.	
	Macroeconomic regional/local	Project contributes to attract other carbon investments in the region.	
	Microeconomic enterprise	Social responsibility image to AES Barry and Natura.	Insolvency of investor AES Barry interrupted funding.

6.3 Bananal project in the Kyoto context

The reduction of the observable deforestation rate in the area of project intervention could be roughly considered as a result of the activities of the project, allowing the accounting of this reduction as a carbon benefit. However, this is complicated because of two factors. First, is

the guarantee that any reduction was in fact caused by the actions of the project and not another cause, such as a change in the macroeconomic context? Second, is the complication of determining the net carbon emissions avoided through change in forest stocks? It is necessary to predict deforestation trends and to determine the loss of carbon that would have resulted, had these trends continued as before the project and required complex modelling.

A baseline study was carried out on an extended area of 5 million hectares, which covers the whole Bananal Island itself of 2.1 million hectares, composed of two protected areas, and an extended buffer zone, stretching 60km on either side of the island. The overall average annual deforestation rate of the extended area is 0.8 per cent from 1986 to 1998, with a cumulative rate of 15.15 per cent during the entire period. Inside the greater buffer zone itself, within the outreach of Ecológica, the annual deforestation rate is 1.35 per cent, with a cumulative rate of 24.86 per cent over the same period (Merlin, 2002). The core question of the baseline is to use the deforestation rate not to preserve a piece of forest but as a reference to reduce the deforestation rate itself in subsequent years. This rationale is determinant in the polemic discussion on leakage of forest carbon (see leakage section below).

As the island is a protected area and already enjoys special protection measures, additionality could only be considered if the protective measures are strengthened by the project with corresponding budget with monitorable and measurable results, such as the reduction of degradation or deforestation rate inside the parks. In the case of the Bananal project it does not seem to be reasonable to claim additionality in the protected parks as the expected project activities inside them failed to materialise through the proposed partnerships.

Similarly, additionality in the buffer zone only takes place if the deforestation rate is reduced outside the parks due to project intervention. This assessment is dependent on the follow up of the deforestation rate in the subsequent years of the project intervention, and a link back to project-related interventions, yet to be carried out.

The carbon stock baseline showed that there are differences in carbon stocks in different types of forest stands (on dry land, periodically flooded land, and seldom-flooded land). These baseline data would be useful for the monitoring of avoided emissions.[66] Baseline data also showed that the carbon-biomass ratio is under 50 per cent. This information is also useful for the calculation of avoided carbon emissions, and will doubtless serve of value for future projects in this region.

Carbon stock measurement in agroforestry has yet to start. This is however the main activity in the project that has the prospect to generate measurable carbon sequestration applicable under CDM rules, and will be of great value to other projects in the region as well.

Whenever land is purchased for protection or reafforestation, it is difficult to follow up on initially identified leakage risks. Besides, such efforts are limited to the boundaries of the reforested and/or protected areas. In return, intervention is direct and under the control of the project. Indirect actions, such as awareness building, technical support, and assistance, education, and control measures, may cover a broader area and ensure that risk of leakage is likely to be lower.

[66] See Annex 6.1. Detailed information on these data is available in the book published on the project (Instituto Ecológica, 2000, 2001)

In the case of the Bananal project, had the partnership with the government environmental agencies been successfully brought to fruition, the risk of leakage would be within the control of the developers and their partners. In other words, it would depend mainly on their will and ability to impose control measures and protective interventions. In the case of carbon sequestration through change of production systems by farmers or ranchers adopting agroforestry or reafforesting their mandatory legal reserve, once well established such practices may be assured of permanence in the long term.

Regarding protection of national and state parks, permanence is fairly well assured as these are designated by law as protected areas. However, permanence of forest carbon in the buffer zone is a totally different matter. Permanence of the forestry projects in the buffer zone going on in small farmers' plots is affected by the permanence of the farmers themselves, which in turn is dependent on the sustainability of their production system in the region. In this regard, the lower income strata tend to exhibit a higher degree of rotation among holdings, which greatly limits the permanence of carbon stocks. Therefore, selection criteria for farmer participants in the carbon schemes should consider the stability of the candidate farmers in the region.

If small farmers are involved in carbon schemes additional economic and environmental benefit is likely to accrue to them. Carbon credits may be used as an upfront investment for the establishment of productive buffer area forest projects or protective reafforestation in degraded areas. There may be a trade-off between the amount of carbon sequestered and the social benefits generated when small farmers in agrarian reform settlements are involved, such as appears to be the case for future projects in the Bananal Island region. A handicap may be necessary to compensate for the transactions costs of smallholder carbon generation. The Community and BioCarbon Funds institutionalised by the World Bank in 2002 are designed to accommodate this social additionality.

6.4 Conclusions: lessons learned and policy recommendations

As the Bananal project stands primarily as a learning experience to format future competitive carbon projects the lessons distilled from it are to be incorporated in the projects in negotiation by the developer. Five aspects of carbon projects are suggested by the developers so that they be manageable: less comprehensive in terms of number and scope of components with realistic and achievable results; forest conservation should not be greater than 5,000ha; project income-generation activities are helpful to reduce the investment cost; small farmers should be involved in carbon schemes to enhance social benefits; partnership with government institutions needs to be well defined and localised. These recommendations are in line with those observed by the research team and are listed as follows.

Lessons learned from project's weaknesses

- Fragility in the establishment of partnership with government environmental agencies based on personal contacts without institutionalised binding contracts. Hence change of leadership in the government agency obstructed verbal commitment. According to project proposal documents (Ecológica, 1997) the budget counterpart related to duties that were to be shared by official agencies was not clearly identified.
- The project indicates that there is a trade off between the amount of carbon sequestered and the prioritisation of social-development activities. The project has chosen to target small farmers, particularly those in agrarian reform resettlements as a political

commitment, whereas big ranchers generate greater sheer pressure on deforestation. Hence, the project intervention is not very effective to avoid deforestation or reafforest degraded areas, rendering limited potential for carbon sequestration.

- Distribution of seedlings can serve two rather distinct purposes. In general, it supports environmental education and can fortify discourse on the importance of planting shade trees, as a source of food within communities and particularly with children. But if the objective goes beyond this, to become a reafforestation with the objective of carbon sequestration or establishment of forest projects, it is necessary to ally this with the production of seedlings, training in planting besides permanent technical assistance and monitoring of silvicultural operations (survival rates, plant development, biomass accumulation, etc.).
- From the point of view of maintenance or restoration of biodiversity, distribution of seedlings can be very efficient in regard to establishment of useful trees, avoiding or reducing demand for native timbers, but does not guarantee the repair of damaged ecosystems, since often the demand is greater for exotic plants or traditional fruit trees.

Lessons learned from the project's strong points

- The level of receptivity to new agricultural practices on the part of rural settlers or small producers in this region is quite great. This can be explained by two reasons. First is the fact that the state of Tocantins has received large numbers of migrants from all over Brazil, unfamiliar with the land they currently occupy, and thus lacking a strongly established tradition in the locale. Second, the quality of technical-assistance services offered by the state to settlers and small farmers is very low. These two factors result in considerable receptivity for quality technical assistance that respects the producer, both in terms of a personal relationship, as well as in terms of the search for alternatives.
- Payment for seed collected could be an instrument for complementary income generation allied with community consciousness raising. Payment for seeds is also perhaps one of the most practical means to demonstrate to the small farmer the value of standing trees. To be effective, it is necessary that seed collection be accompanied by work on environmental education in rural and urban communities, creating by this means a greater demand for native seedlings, as the responsible technician for the project nurseries suggests (Maria, 2002).
- This project does not involve land acquisition or the commitment to generate carbon credits for the investor, since the funding comes from a non-profit foundation. According to the implementers, the project's social and scientific profile is meant to offer a learning opportunity to manage a social carbon sequestration project. The learning about the limitations, vulnerabilities, potential leakage, project methodologies, carbon measurement parameters, carbon monitoring, and working with communities are indisputable benefits of this experience.

According to Ecológica's director, what singles out their project from others is the concept of social carbon, in the sense that the carbon credit is generated with social responsibility (Rezende, 2002). Whether the Bananal Island carbon project fulfils the proposed carbon goal or not is seen of minor importance since the project is experimental. The important thing is that the learning resulting from the project made it possible to formulate new projects focused on marketable social carbon. These projects are currently being negotiated.

Recommendations

Partnership with government institutions in carbon projects needs to be formalised, with activities and budgets clearly defined throughout the course of the project to minimise political interference. It is also important that financiers understand that the possibility always exists that public-private partnerships may be fragile, and therefore charge their partners to define this institutional commitment at the moment at which contracts are closed.

It is important that government agencies, be they state or federal, awaken to the possibility of utilisation of economic or market instruments, such as the carbon or water markets, as new possibilities for generation of revenue to support their responsibility to protect conservation units. Rural development agencies should also take proactive roles in developing projects jointly with rural producer organisations, who stand to benefit from the potential market for carbon, and avoid limiting discussion on such instruments only to environmental forums.

As far as avoided deforestation is concerned, this is particularly justifiable in an agricultural frontier such as the Amazon region. The experience from the Bananal Island carbon project suggests that if protection actions are carried out within a defined and realistically workably sized buffer zone, additionality becomes defendable and measurable.

The deforestation trend of a georeferenced area could be used as project baseline. The area under intervention would be monitored and compared periodically to verify reduction in deforestation rate along the project period. It is recommended that a similar area without intervention be georeferenced as a control to contrast possible non-project interference.

Carbon credits may be used in part to finance extension, education, and control activities of government agencies and NGO developers and partly to finance the establishment of plantations on farmers' properties either for the restoration of the mandatory permanent reserve areas, or for sustainable production purposes.

It is likely that avoided deforestation and reafforestation activities in the Amazon region will include medium and large ranchers as they are the principal parties responsible for deforestation and own large areas of degraded pasture land. Their inclusion may be effective both in avoided deforestation and in carbon sequestration. It is important to stress, however, that their inclusion must not be exclusive or diminish the social-carbon priority (Instituto Ecológica is in the process of incorporating large ranchers in future carbon projects.)

Carbon projects that seek to incorporate social aspects as a relevant component should have in their conception, strategies for training and technical assistance as pillars, with the objective of creating new alternatives for income generation. Such alternatives must be identified in line with beneficiaries' expectations, and developed preferentially on the basis of their demands. It is also necessary to define indicators of effectiveness for such actions to measure their real benefits.

Considering the importance of sustainability for CDM projects, it is recommended that the national institution responsible for their clearance (a designated national authority) oblige proponents to specify the proportion of their budgets destined to social components, if possible establishing a minimum proportion to be applied, with an explanation of project operation along these lines.

Annex 6.1 Baseline study carried out on carbon content of different forest types in the ecotone region of Bananal Island: index of carbon content in percentage in four ecosystems of the project area

Ecosystem	Arboreal Vegetation – Average				Understory – Average			Litter
	Tronco	Galho	Folha	Casca	Tronco	Galho	Folha	
Flood forest	46.28	45.19	46.91	43.20	45.30	44.51	43.28	25.58
Highland	43.63	45.17	47.06	43.58	46.21	44.43	47.36	34.64
Cerrado	46.01	42.62	47.85	44.91	45.52	41.06	45.50	36.36
Floodplain fields	**Grass**				**Bushy vegetation**			
	Grass	Grass litter			Branch (*murici*)		Leaf (*murici*)	
	40.09	36.24			42.46		43.45	

Source: Instituto Ecológica, 2002

Annex 6.2 Baseline study on carbon stock of plant biomass in different phyto-physiognomies

CARBON STOCK		VEGETATION TYPOLOGY (ton/ha)			
		Upland Forest	Flooded Forest	Cerrados	Floodplain fields
Total		111.65	98.58	31.46	6.84
Dead OM		6.55	7.61	3.57	1.82
Carbon in Trees	Trunk	44.17	33.91	3.99	*
	Branch	29.37	24.98	4.05	*
	Leaves	3.56	3.88	0.94	*
	Bark	5.25	4.62	0.69	*
	Roots	*	*	2.43	*
	Total	82.66	67.40	12.10	*
Carbon in Bushes	Trunk	7.98	7.27	4.71	*
	Branch	11.97	14.66	8.16	0.47
	Leaves	2.54	1.63	2.96	0.03
	Grass	*	*	*	4.70
	Total	22.45	23.56	15.78	5.02

Source: Instituto Ecológica, 2002

7. Description and analysis of the Noel Kempff Mercado Climate Action project

Under the Framework Climate Convention, pilot projects called Activities Implemented Jointly (AIJ) were established to test carbon-mitigation projects and gain insight for future mitigation strategies. There exist two main approaches to reducing carbon-dioxide levels in the atmosphere through forest-related mitigation activities. First, sequestration of carbon through afforestation, reafforestation and rehabilitation of degraded lands which leads to an increase in terrestrial carbon stored in land and forests, absorbed from the atmosphere; and second, emissions avoidance, where the release of additional carbon to the atmosphere is prevented, through forest conservation or so-called 'avoided deforestation'.

The NKMCAP may be described as a carbon emissions and leakage avoidance project with a community-development component. The project seeks to avoid the release of carbon-dioxide emissions from deforestation and forest harvesting through conserving forests, in addition to combining this with leakage avoidance using two key complementary activities: monitoring of indemnified logging companies and assisting communities to enhance local sustainable agriculture, forest management, and provision of social development benefits.

In 2001 the NKMCAP completed its first five-year project cycle. The project had been at the centre of much international debate on the inclusion of land-use activities in international climate agreements and whether these schemes could provide livelihood benefits. Although largely technical in scope, these projects have claimed to be win-win endeavours, seeking to provide local sustainable development benefits to local forest-dependent people as well as reduce greenhouse-gas emissions of global impact. In 2001 it was time to undertake an assessment of what the expansion of the Noel Kempff Mercado National Park and the NKMCAP had meant for the local communities, including local entitlements to land, political and institutional strengthening, and the generation of alternative incomes.

This case is based on an assessment of the local development benefits of the NKMCAP and the outcomes of the community development programme APOCOM (1997–2001). It is important to keen in mind that projects are a vehicle to bringing about changes in structure (institutions) through processes. These changes can result in both positive and negative manifestations at the local level. In this case we address these manifestations, as articulated by the local communities and perceived by the NGOs and wider project stakeholders.

7.1 Project background [67]

The NKMCAP in Bolivia is one of the largest pilot projects ever undertaken globally. It is an emissions avoidance (avoided deforestation) project where TNC, and a consortium of companies including AEP, together with the Bolivian government, have indemnified logging concessions. The project was established in the Noel Kempff Mercado National Park, situated in north-eastern Bolivia, bounded by the Paragua, Tarvo and Itenez rivers to the west and north, and Bolivia's border with Brazil to the east.

[67] This case study draws on field research conducted in Bolivia covering the period from 1997 to 2001. A participatory evaluation brought together a range of actors during a two-week workshop in five communities in Bajo Paragua to review the project experience in September 2001.

The park itself has almost doubled in size since the inception of the project, now comprising 1,523,446 hectares of diverse lowland and upland forests.[68] By avoiding and reducing greenhouse-gas emissions from logging and agriculture it is expected to protect up to 3.59m metric tons of carbon over 30 years.[69] The volumes of carbon sequestered in the park expansion area are monitored and compared with carbon stocks outside the park, still subject to harvesting. The difference between the baseline and new stocks is the amount of carbon the project assumes will be sequestered.

The NKMCAP was established as part of the United State Initiative on Joint Implementation pilot phase.[70] The project developed an offset sharing system that provides 49 per cent of the offset credits to the government of Bolivia of which 20 per cent are shared with the project implementers a national NGO Fundación Amigos de la Naturaleza (FAN), 49 per cent to the industry contributors and 2 per cent to AEP, the lead investor, as a project development 'bonus'. The government of Bolivia is required by contract to spend the proceeds from the sale of offset credits on park-management activities in Noel Kempff and throughout Bolivia, and on other biodiversity-preservation activities. Central to the project design is the history of the park and the local communities.

7.1.1 History of the Park

The park was first declared the Huanchaca National Park of Flora and Fauna in 1979. Later its name was changed to Noel Kempff Mercado National Park. In 1988 the park had its first expansion. In 1996 a second expansion brought the park to 1.5m hectares.

Tracing back, in 1990, Flor de Oro, the centre of the park administration was established. To expand the park, FAN bought a 10,000ha cattle ranch adjacent to the park boundaries. Immediately after the purchase cattle were sold and the infrastructure reorganised to make way for four main programmes. These included: protecting the northern part of the park and establishing an administrative base; scientific investigating of the natural resources; looking into ecotourism to generate resources for the management of the park; and a habitat-restoration programme. In 1995 an agreement for the joint administration of the NKMCAP was signed between FAN and the Bolivian government. For ten years (1995–2005), the park administration was placed under a joint consortium of FAN with the government. Between 1995 and 1996 The Nature Conservancy brokered a debt-for-nature-swap between Bolivia and the JP Morgan Bank. TNC worked with FAN to obtain $0.16 for each US dollar and an additional contribution of 0.8 Bolivian centavos. With these funds FAN partially financed protection activities in the PNNKM and the Amboro National Park as well as the organisation's headquarters in Santa Cruz.

Also, between 1995 and 1996 the Bolivian government, with TNC and FAN undertook a national park management plan. Spearheaded by one of the founders and then director of FAN, forest concessions were indemnified in 1996 after significant political lobbying. The NKMCAP was promoted as a 'carbon sink', primarily to secure long-term funding for park. After signing a Participation Accord with the US Department of Energy in 1995 the TNC came to the AEP with an idea for a carbon sequestration project in Bolivia, with which they could approach the USIJI. AEP had become involved in carbon sequestration activities via

[68] The project is protecting an additional 634,000ha of biologically diverse lowland forest.
[69] Previous estimates were valued at between 7–14 million tC) over 30 years.
[70] The US Initiative on Joint Implementation was established in 1993 and further supported by 1995 with the adoption of AIJ at the first COP in Berlin.

the US Climate Challenge Programme, under a voluntary partnership between the electric utility industry and the US Department of Energy.

In 1998 the project implementation agreement was signed by notable political figures, including the Minister of Sustainable Development Erick Reyes Villa, the Vice Minister Neyza Roca and the US Ambassador Donna Hrinak Also present at the signing were representatives of the principal co-investors including TNC, AEP, Pacificorps and British Petroleum.

The project was designed to fulfil three key objectives: promotion of carbon benefits; biodiversity benefits; and local sustainable development benefits. The carbon benefits would result primarily through two leakage-compensation activities at project level: prevention of carbon-dioxide emissions and forest harvesting. First, they would avert logging which includes halting the removal of commercial timber and elimination of damage to unharvested trees; and second, averted conversion of forested lands to agricultural uses, which includes halting the loss of carbon in forest biomass and from soil (Powell, 1999). The project's primary investment was to indemnify logging companies, which had obtained concessions to the timber in the park area. This enabled the Bolivian government to then increase park area to its current 1.5m hectares. Pressures for conversion of forests in the buffer zone to agriculture have led to distinct project investments affecting local communities, as described in detail in this case study.

Box 7.1 Principal actors

Private sector investors
American Electric Power (AEP) is the top power generator in the US and a leading marketer of power, natural gas, and related products and services. With the completion in June 2000 of its merger with Central and SouthWest Corporation, AEP owns and operates more than 38,000 megawatts of generating capacity, making it America's largest electricity generator. Revenue in 2001 increased 67 per cent to $61.3 billion. The AEP voluntarily participates in the US Department of Energy's Climate Challenge programme focused on CO_2 and has a mission to plant 15 million trees in five years, improve generating and energy delivery efficiency, use more nuclear power, and implement energy-conservation programmes at AEP facilities and for customers. It claims that approximately 17.5 million tons of carbon dioxide have been avoided or sequestered since 1991 (see http://www.aep.com/investors/financialreleases).

BP is the holding company of one of the world's largest petroleum and petro-chemical groups. Its main activities include exploration and production of crude oil and natural gas; refining, marketing, supply, and transport; and manufacturing and marketing of petro-chemicals. BP has worldwide operations with revenues of up to $148 billion in 2001. BP became part of the Climate Action Project in NKMNP in Bolivia in 1997. Its aim is to mitigate the effects of global climate change through two areas of special interest: biodiversity and sustainable development (see www.bpamaco.com/index.asp).

Pacificorp is one of the lowest-cost electricity producers in the US, Pacificorp generates about 8,000 megawatts of energy from coal, hydro, gas-fired combustion turbines, geothermal, co-generation and renewable wind power. (www.pacificorp.com)

Government
The National Climate Change Programme (PNCC) was created in 1995 to undertake the first national communication to the UNFCCC with the assistance of the US Country Study Management Team. The mandate of the PNCC in relation to the CAP is to monitor, verify, and certify the conservation and sequestration of carbon and other greenhouse gases under the flexible mechanisms of the UNFCCC and Kyoto Protocol.

The National Service for Protected Areas (SERNAP) was created in 1999 to coordinate the functioning of the National System of Protected Areas (SNAP), and guarantee the management of protected areas in the national interest to conserve biodiversity, within its ability. Its mandate is to oversee protected areas and therefore as well the management of the NKMCAP.

International and local NGOs
The Nature Conservancy (TNC) is a US conservation organisation, and the broker in the indemnification of logging concessions and raised donor interest in the project. It is a non-governmental conservation and development organisation with a mission to 'preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive'. The TNC views the project objectives as net carbon benefits; forest conservation and prevention of deforestation; and assurance of future forest conservation through the establishment of income-generating activities.

Fundación Amigos de la Naturaleza (FAN) is a Bolivian conservation NGO and serves as project administrator. Its mission is to conserve biodiversity by protecting the sustainable and equitable use of natural resources in Bolivia. Its project objectives are to conserve natural areas and to achieve rational management of natural resources under the principle of sustainable development.

Local government and communities
Municipality of San Ignacio de Velasco is a counterpart for some project activities and the park management. Municipal officials have an interest in the devolution of the management of the national park to the region.

Central Indigena de Bajo Paragua (CIBAPA) is a group that represents the local communities, created during the project process. CIBAPA was created to represent four key communities, Floride, Porvenir, Piso Firme, and Cachuela and among its objectives is using the land-title process to ensure that proceeds from future forestry activities are disbursed at community level. It consists of a president and a vice-president elected by the communities every five years.

The National Park Management Committee contains elected community members who participate in the quarterly park management meetings. It is a forum for community leaders, municipality, and park, where project representatives discuss and decide on issues relating to the park. The committee is the representative body of the local community, which participates in the planning and enforcement of the management of the area. The central objective of the committee is to strengthen park management through its participation in planning and enforcement. Also, it aims to ensure that the management of the park is undertaken in keeping with biodiversity conservation, guaranteeing the participation of the region and local populations.

7.1.2 Characteristics of the region

The climate in the project region is humid tropical with an annual average precipitation of 1,500mm, with a humidity gradient from south to north. The area encompasses five important ecosystems ranging from Amazonian rainforest, gallery forest, and semi-deciduous tropical forest to flooded savannah and *cerrado*. A rich variety of grasses, orchids (110 different species), and tree species bloom throughout the year. There are 2,700 registered species of higher plants, and there could exist up to 4,000. Tree species include mahogany (*Swietenia macrophylla*), oak (*Amburana caearensis*), cedar (*Cedrela odorata*), and rubber (*Hevea brasiliensis*). A variety of economically useful palms exist including asaí (*Euterpe precatoria*), ariri (*Syagrus petrea*), motacusillo (*Maximiliana maripa*), pachiuva (*Socratea exorrhiza*), and carandai-guazú (*Mauritia flexuosa*). The park is biologically diverse lowland forest with a bird list of over 630 species, and approximately 130 mammals, including abundant populations of giant otter (*Pteronura brasiliensis)*, Amazon River dolphin (*Inia geoffrensis)*, various jaguar species, Giant Anteater (*Myrmecophaga tridactyla)*, and the very rare and endangered maned wolf (*Chrysocyon brachyurus)*.

Figure 7.1 Map of Bolivia in South America and (inset) project area

A buffer zone has been created on the western side of the park extending into the Bajo Paragua river basin. Three communities: Florida, Porvenir, and Piso Firme were settled adjacent to the river in the municipality of San Ignacio de Velasco, within the department of Santa Cruz. To the north-west of the Park lies Cachuela, bordering the municipality of Beni and within the park boundaries to the north is Bella Vista.

7.1.3 Role of the local population in the project

Prior to the park expansion the communities did not have legal access to its territory but accessed the forest concessions through informal usufruct rights.

The population in this region is estimated at approximately 2,000 people, divided between three main indigenous communities. Porvenir is the largest with 466 inhabitants and about 94 families, Piso Firme with 452 people and 105 families, and Florida has 144 inhabitants and 27 families. Cachuela and Bella Vista only have only a few families (six and five, respectively). Many families live under the same roof, so the number of households found in each community is fewer than the number of families as described here. The populations are thought to be quite stable in the region, and there has been an encouraging increase in the number of young families. This is particularly noticeable in Florida, which has seen an increase in young families since the inception of the project owing to an initial out-migration with the termination of logging activities. Several families have parents or relatives in San Ignacio de Velasco who left at one point and they themselves had chosen to return,

Figure 7.2 Noel Kempff Mercado National Park and surrounding areas

Source: NKMCAP 2001

tempted by the opportunities that the region holds. Most families have links with the urban areas, especially those with children studying in the city, who often choose to stay there once their studies are completed.

Historically, the dispersed communities[71] of the Bajo Paragua region have relied on the forest that is now part of the expanded national park. They are descendants of the earliest recorded inhabitants of the forest.[72] The Europeans arrived in the late 1800s to exploit rubber, and as

[71] Population of communities quoted as 2,366 people, in USIJI Proposal, 1996.

[72] These included the ethnic groups Guarasug'we, Paucerna, and Tavareka people in the latter part of the eighteenth century and the Chiquitanos. The remaining ethnic groups consist of traditional Guarayo Paucerna, and *mestizo campesinos* (mixed-race peasantry). Until the 1970s there still existed Guarasug'we o Pauserna, but

commercial exploitation expanded, Chiquitanos from the south of the Park began to displace and assimilate the original native inhabitants. The rubber era, which led to the cultural extinction of the Guarasug'we and Tavreka, declined in the 1940s and the region's populations switched to commercial exploitation of other wildlife resources, to fur and trade in crocodile skins. The most recent economic activities include timber and heart-of-palm (palmito from *asaí*) concessions. Logging activities peaked in the 1980s when the government established the Bajo Paragua Production Forest Preserve, and granted large timber concessions, which allowed selective logging of species such as mahogany, cedar, and oak for periods of 20–25 years (USIJI, 1996).

Box 7.2 Summary of project history

- 1901: Chiquitano Indians are brought to the region of the Bajo Paragua as peons of landowners to work on rubber-tapping estates.
- 1940s: Residents become independent from landowners and establish themselves in independent communities, some requiring schools.
- 1970s: The fur trade is going strong and the communities live from their exploitation. There is no road into the region.
- 1980s: Logging comes to the region, bringing with it roads and more people (both temporarily and permanently). Links with the towns and cities are strong. The companies employ many men in the communities.
- 1988: First part of the park is established as a debt-for-nature swap. Two big events in mid-1990s, the new forestry law and the first carbon sequestration initiative.
- 1996: Design of the Noel Kempff Mercado Climate Action Project.
- 1996: New forestry law passed (after project design and launch).
- 1997: Start of the NKMCAP and community development.
- 1998: The project starts supporting the land-titling process with the communities.
- 2000: In the land-titling process elaboration of a forest management plan of 94,000ha of community forests.
- 2001: The extended national park has become the world's largest carbon-sink project.
- 2002 Second phase of project financing for NKMCAP. Re-naming of community-development programme as *Programa de Desarrollo Comunitario del Parque*.

Today, the communities in the region are reclaiming their entitlements as indigenous people. This involves a lengthy formal legal process, as well as internal reflection on the importance of culture and tradition. The traditional language, Chiquitano, is spoken by few of the elders in the communities and traditional music is played only by a limited number of older men. In Bella Vista it is possible to come across some of the last remaining Paucerna people, but tradition is dying fast with few people to continue traditional skills such as pottery making. The assimilation of traditional culture has also taken place through the historical presence of the Jesuits in the region, evidenced in celebrated traditions such as walking on hot ashes (*pisa fuego)*, and the Easter celebrations of Judas where male community members dress up as Judas and get up to mischievous games. The reminders of Jesuit influence are illustrated by missionary churches in the communities and in the region in the municipalities of San Ignacio de Velasco, San Francisco Javier, Concepción, Santa Ana, San Miguel, San Rafael, and San José. There are also emerging contemporary religions, including Evangelism, with new forms of ceremony such as the annual visit of the *Spiritu santu* from Brazil.

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their descendants have been assimilated by the current communities of *mestizos chiquitanos* (Government of Bolivia http://www.snids.gov.bo).

Aspects of the Noel Kempff Mercado Climate Action Project (NKMCAP) directly related to the local communities include primarily the forestry programme and a community-development programme called Community Assistance (Apoyo Comunitario, or APOCOM), which was re-named Programa del Desarrollo Comunitario del Parque (PRODECOM) in March 2002. In addition, the CAP forestry programme also oversees the carbon-monitoring programme, including measuring and monitoring of carbon at the ground level (inventories and establishment of plots) and tracking of logging activities of the indemnified companies. The forestry programme is supportive of the local development benefits through a land-titling process and has been involved in undertaking a forest-management plan, capacity building of the technical team members in the communities, and provided technical support to the Central Indigena de Bajo Paragua (CIBAPA). Personnel of this programme have also been involved in internal-negotiation processes between community leaders.

APOCOM (now PRODECOM) aimed to improve quality of life by providing benefits through improved development and production activities in the communities. In 2001 the programme was supporting four full-time extension workers. Three extension technicians provided agricultural and/or forestry assistance. One extension worker supported a micro-credit programme and the co-ordinator of the APOCOM oversaw the programme. The community-development programme reflected a mixture of charity, compensation, and development (Peacock, 2001).

Initially the communities were opposed to the park expansion. There was resistance from the local communities regarding the intentions of the park despite the fact that there was no threat of displacing local people. Led by one particularly strong community, residents consulted with the municipality on the issue and wrote a letter of opposition. The municipality finally expedited its agreement to the project, and these issues were set aside as being of internal concern between the local government and community representatives (Moreno, 2001). Thus, although the project was started in 1998 it only began to be accepted by the communities from 2000. From interviews with community leaders it transpires that opposition of some groups over the decision to expand the park was over fears that access to traditional lands would be prohibited. However, the real problem has been cited as arising over subsistence rights. At the local level it was voiced that poor communication between the park/project and the community led to resistance.[73]

From the project's perspective, one of the key challenges faced at the design stage was the absence of organised local representation. Reportedly, by 1996 community organisation, such as the village council, already existed, but was not functioning adequately. This is in contrast with the situation in the more recent past, for today if a project is brought to communities they would be more able to participate in its design and execution.[74] The communities recognised that this 'late start' on their part limited the extent to which community-development activities could be implemented. A second major focus of resistance emerged in 2001 between communities in the region based on a power struggle between local elites over

[73] "[Well] we can say that they arrived and said we are going to do this and that. I have to say that with the expansion of the park, I was opposed to it … I didn't know what it meant, what were the advantages and disadvantages, because they informed us badly. [When] they communicated that they were going to expand the park and that we (the communities) … were not going to be allowed to fish then we reacted against it" (key informant and member of CIBAPA, personal communication, 19 August, 2001).

[74] Since this assessment the communities have signed two new project agreements and in 2003 the communities, SERNAP, and FAN signed a contract for co-implementation of the community-development programme PRODECOM.

resource control (personal observation). Underlying this resistance was a concern that local institutional rules and norms were in some way challenged by new rules introduced by the project and park, such as the 1996 forestry law which redefined forest access and use rights. Decisions relating to the management of forest resources in the new indigenous territory were seen by some elites as representing an outside intervention arising from alliances between the project, CIBAPA and the park as well as based on personal politics (personal observation). In the process the project may have challenged existing power struggles and acted as a catalyst for divergences to become exaggerated.

7.1.4 Project design

The project experience highlights the distinction between participation and consultation. By all accounts, the initial approach to the communities was in the form of a consultation and a 'wish list' was drawn up. The perspective portrayed by one key community informant was that it was like 'money falling from the sky'. A number of weaknesses existed in the design, including unclear common objectives over the use of project resources and little sense of responsibility on the part of the park and NGO regarding compensation. In retrospect, the list that the communities provided was beyond the realities of the project, in terms of both transaction costs and time.[75] The communities lie far from the project headquarters and decision-making was centralised due to pressure from higher levels for the project's success. It also reiterates the issue of absent organisation at the onset of the project and the challenges that face developers and designers. Promises made early on in the project, and not kept, such as fixing the roads, were perceived as failures by local community members and contributed to their frustrations. Looking closer, blame was centred on the project when it was actually the responsibility of the local government to provide road maintenance. What this illustrates is the challenge that communities face in ensuring that the municipality fulfils its development obligations to them. Another significant issue raised is that of ensuring that community members understand which organisations are responsible for which tasks and how to ensure accountability. At that time it was also clear that the representation of park and project was not connected in peoples' minds; they associated the park with the state and the control of the resources while the project was associated particularly with microcredit and other social benefits. Little association was made between the project, national park, and the local leakage compensation activities that were part of the original project objectives.

7.2 Sustainability impact assessment of the Climate Action project

As seen in the other case studies, the impact of the CAP is set within the three pillars of sustainable development: social, economic, and environmental. The assumption underlying the assessment framework is similarly that all three are necessary to achieve sustainable development. Each of these pillars is framed within different levels: global, national, and local.

7.2.1 Environmental impacts

Projected carbon sequestration levels were initially estimated at 14 million tons of carbon over thirty years (El Deber, 1998; TNC factsheet, 2000). The projected net sequestration was later reduced to 7m tons of carbon owing to high initial estimates revised after the 1996 forestry law and other improvements to the baseline (Winrock, 2002). Deforestation data in

[75] This has since been taken into consideration by the project in the planning of new community-development activities.

the project area were based on the best available information and methods for calculating baselines at the time with substantial effort to re-evaluate before claim of any offsets (TNC, 2003). The adjustment results in the cost per ton of carbon to rise from the initial estimate of $0.50/tC to $1/tC.[76]

Forests cover around 53 million hectares of Bolivia, mainly in the Departments of Santa Cruz, Beni, La Paz, Pando, and Cochabamba. Deforestation in the department of Santa Cruz has risen since the mid-1980s due to substantial agricultural settlement under the Tierras Bajas Initiative, soya bean production, and resettlement of people from the Altiplano (the Andean high plains). Soybean production began in the early 1970s following a substantial increase in the world price of the crop. By the late 1980s, soybeans represented the country's most important oilseed crop. NASA Landsat images in 1984 to 1998 show a significant rise in settlement of soybean farms owned by Mennonites and Japanese farmers.[77] It is thus argued that the project will contribute to a reduction in the pace of deforestation in this frontier area.

The leakage compensation activities laid out by the international scientists and project designers included:

- Planting of economically useful palm species;
- Agroforestry model farming (with credit);
- Substitution of beef cattle to include dairy cows;
- Forest management;
- Organization; and
- Land tenure.

Changes in land use towards more sustainable agricultural practices were impeded for a number of reasons. The extent of technology transfer was limited and understanding of the link between concepts of leakage and conservation were not deep enough. The importance of this link is significant in terms of complementing extension (seeds and technical equipment) with environmental education, discussion, and awareness. Some of the poorer families were involved in experimenting with planting trees on their plots of land. Yet, the extent of such planting was limited to a small number of families. One of the technicians noted that the uptake was poor, and that the link between credit and agricultural practice had significant implications for the perceptions of the farmers, their confidence, and interest in the long-term efforts.

The direct contribution of establishing forest-management plans and agricultural land-use maps has been proven to be useful for the organisation and articulation of the importance of land as seen through the national and global framework. It is early days to consider whether the management of the forests will be better undertaken than it would have been by the previous logging concessionaires, because it represents a new process and will take a level of clear, transparent governance that has yet to be tested. In addition, the agricultural plans have been confined to the local level and being established in one community at a time. These

[76] According to project design documents, the NKMCAP is a demonstration project with no provision of credit guaranteed, but with high investment costs. However, at the current market price of $10/ton this cost signifies that if the park were ever to become credit-worthy, it would bring great benefits to stakeholders. On the other hand, such projects, including both the NKMCAP and Ilha do Bananal may be accused by other promoters of more costly ventures of depressing the carbon market, hence harming others' viability.

[77] See http://svs.gsfc.nasa.gov/imagewall/LandSat/santa_cruz.html Last accessed 30/08/03.

expressed pride in the plans that each family had established with crop rotations. However, the establishment of 50-hectare plots for each community in Florida contributed high initial levels of carbon emissions.

The uptake of alternative and better land-use practices, such as the agroforestry model plots with the incentive of credit for a cow or bull on rotation, was limited. During the five years of the project a small number (1–10)[78] of men (out of a total population of 2,000, of which men comprise at least 50 per cent) participated in this activity. There were several reasons identified for the lack of interest in the model farms, including insufficient time available, and too many criteria set by the project for credit approval. A number of young men (not necessarily farmers) expressed an interest in having cattle because they generate cash and status, but did not want to invest time in setting up agroforestry systems that would only provide one bull or cow on credit, while some men over 40 years of age (about 20 of these) had made attempts to set up the new systems.

Efforts to improve forest management, local organisation and secure land tenure have proved to be the most successful project contributions to local livelihoods. Before the project the communities were employed by the logging companies, while in the process of participation in the project, have become owners of their own forests and responsible for their management. For example, the community-based organisation CIBAPA has established a heart-of-palm business and is in the process of negotiating the sale of its own timber (Vaca, 2003). In terms of organisation, compared to the past when no legal representation existed and the village councils did not function, the communities now have legal status as indigenous territories, and functioning village councils with statutes and rules, and community representation on CIBAPA, which has legal standing.

The TCO process, which refers to the right of return to original indigenous territories and their titling as the principal community priority, is the most important aspect of the project's local impact. Prior to the project the communities resided within the forest concessions. Now, they are in the process of gaining title to nearly 400,000ha of communal land (see Figure 7.2, showing TCO area adjacent to the park, above).

In 2003, two significant developments illustrate how communities' roles have evolved since the initiation of the project: first, was the elaboration of long-term plan for the TCO; and second, the prioritisation of environmental education. The elaboration of an integrated management plan covering all TCO represents an important step, considering that such a long-term vision would not have been possible several years ago. This observation also applies to environmental education, which has in the process become one of four strategic pillars of the PRODECOM plan (2003–07) (Powers, 2003).

7.2.2 Social and political impacts

The project has been at the centre of international debate on the impact of carbon sequestration and biodiversity projects under the Kyoto Protocol. Its effect at the global level has been considered primarily to generate 'know-how' and learning by doing. From the perspective of international policymakers, scientists, and NGOs, the greatest interest and impact of the project has been within the context of discussion of leakage and the types of projects that should be included in the CDM. NKMCAP has been depicted as one of the

[78] Source: NKMCAP community monitoring data, 2001.

largest formal forest carbon projects and is also cited in the IPCC/LULUCF Special Report (2000) to illustrate carbon projects. It has received international media coverage, both positive and negative, and in the process has sparked considerable debate regarding the impact of these types of schemes on local livelihoods, the use of incentives, and the potential for inequities between global priorities and local realities. It has also contributed to the dissemination of scientific findings and information.

There is one key global contribution, which is the scientific research and provision of data to the international NGO and wider research community (primarily carried out by Winrock International).

The socio-economic and political reality of Bolivia dictates that biodiversity conservation is not an immediate political priority. Although Bolivia possesses some of the most advanced legislation in the world regarding forestry and people's rights, and despite the rhetoric contained in its national sustainable development plans, other pressing issues such as poverty alleviation, development of infrastructure such as roads and transport, and stimulating the mining industry take precedence. It is within this context that the project was established with the aim of raising the conservation and sustainable forestry profile of Bolivia.

In a national policy setting, the project has primarily contributed to the discussions and interaction between the government JI programme and other institutions both national and international such as the global JI office, FAO, UNDP, universities, and NGOs regarding climate-change mitigation and forestry. However, in the light of the US withdrawal from the Kyoto Protocol and the exclusion of avoided deforestation from the CDM, the initial enthusiasm has waned somewhat.

There are three key contributions of the project at the national level.

- National to international dissemination of information on carbon pilot projects at the UNFCCC. One of the key features of the project is its wider dissemination to the international community to share technical design. This has shown initiative to the international community, and raises the profile of Bolivia in international negotiations.
- Increased generation of scientific 'know-how' on monitoring of carbon and biodiversity.
- Dissemination of carbon awareness nationally (media coverage) raising profile of the JI office among bilateral organisations in Bolivia.

In Bolivia's current context there exist conflicting objectives between policies such as credit for soybean production, and stimulation of migration from the highlands to the lowlands with the conservation of forests. In 2001 a threat arose when 300 families from the highlands had been granted rights to settle in the buffer zone around the park. There was great concern among the local municipality, local community leaders, and the NGO that decisions had been made at the national level and for political reasons without consultation with the municipality. The pressing issue of migration remains a key concern to be addressed, since the conflicting objectives of conservation (preserving forest) and converting land to agriculture (rights to land) bring to light distinct positions that pitch the land-rights movement against both national and international conservationists.

The project has been widely publicised regionally and nationally by the media, by FAN, and the SERNAP. Posters can be seen in many locations, depicting pop stars enjoying the beauty of the park's famous waterfalls. Yet the number of visitors to the park is quite small, as it

remains remote and costly to reach. To reach the area by plane from the regional capital, Santa Cruz, costs around $400, while the journey by local bus is long and hard on poor roads. The major market for tourists still lies with the international community (carbon tourism).

In accordance with Asquith et al. (2002) the links between the concepts of biodiversity conservation, carbon sequestration, and local development benefits were not wholly clear at the time of the initial project assessment. Local concerns were largely about the implications of new rules associated with conservation, such as fishing, hunting, and extraction of hearts-of-palm. Before the 1990s, conservation was not a term known in the communities, due to their remoteness and isolation. The creation of protected areas and conservation activities implied substantial changes for the communities. In their own words, they were not ready to take on the norms and rules that the state was imposing (and, above all, without consultation about how the new system would function). With the passing of time the project brought both positive and negative changes.[79] The threats of overlapping institutions and contesting rights to resource use arose as particular local concerns.

It is useful here to summarise eight social and political impacts.

- Change was brought to the local community via the project and the park. These include changes in rules and local practices over the management of natural resources. The project acted as a vehicle for change and in some instances this resulted in resistance from the community.
- New conservation or resource-management rules are not always clearly understood or accepted by those they affect, such as restrictions on fishing, hunting, or harvesting.
- Asymmetries of information exist and these can contribute to myths and misinformation regarding benefits and access to resources.
- Dialogue and mechanisms for initial equitable partnerships were absent in the design phase. These partnerships have grown over time between the NGO and the local communities.
- Equitable benefit distribution was advocated by the project, yet the inclusion of more marginal community members remains a challenge.
- Capacity building is one of the most important contributions of the project to the communities, including the training of local leaders to disseminate information to all levels, while keeping gender balance in mind.
- Local people were unaccustomed to some of the project activities, such as the model farms (*potreros modelos*), resulting in only limited acceptance.
- The most successful project outcomes are process related. These include the land-titling process, building organisational capacity, and sustainable forest management.

7.2.3 Economic (developmental) impacts

The project provided funds and support to the JI office by funding for technical capacity building. The plan also called for carbon credits to accrue to the national government. A long-term strategy for future park administration was that of establishing an endowment fund administered by the TNC, perceived by stakeholders as beneficial to regional development and park management. The immediate economic impacts of the carbon sink notion initially created a great sense of enthusiasm for environmental services and biodiversity at the state

[79] Village headman, personal communication. 13 February 2003.

level, yet in recent years this has waned in the light of the direction taken by international FCCC negotiations. New project-related efforts are emerging in response to project rules and the limitation of potential CDM projects to afforestation and reafforestation. The impact of the withdrawal of the concessions and the windfall gains by the timber companies may be cited as a source of contention. Yet, it is difficult to discern the impacts of the project per se (purchase of concession rights) from the impacts of the national forestry legislation, which in itself has contributed to a decline in regional income from the timber industry of up to 65 per cent (*El Deber*, 1997). Reportedly, the 1996 forestry law has impeded profit margins for logging concessions in the region and in due course these companies could have naturally ceased to exercise their logging rights.

In 1998 a credit and rotating fund for production incentives was set up as part of the project. At the local level the plan was to provide alternative income-generating activities through the establishment of revolving funds to give credit to productive activities undertaken by community members. These activities predominantly included: agriculture, livestock, ecotourism, and small businesses. The average amount of credit provided was under $200, with terms of repayment at 20 per cent interest per annum, and two years to repay the principal – hardly generous or concessional terms. The outcomes of the credit and revolving funds was raised by community members during household visits and informal discussions as something that they were generally concerned about and considered one of the least successful project outcomes. At that time, many loans were delinquent and a sense of widespread indebtedness prevailed.

Table 7.1. Community rotating funds: 1998–2001

Communities	*No. of micro projects*	*Loans (US$)*	*Balance in fund (US$)*
Piso Firme	34	20,100	552
Porvenir	34	20,200	549
Florida	25 [a]	9,176	0

Source: Milne (2001) from FAN (2000); six projects were actually functioning in 2001.

Milne (2001) suggests that 20 agriculture and livestock, three agroforestry nurseries, and four agricultural support loans were taken during 1998–2001. Yet, project data show that by 2001 no agroforestry plots had been fully established. Those loans related to conservation practices included a number of family ecotourism lodges, two small family restaurants, and an inn.

Anecdotal evidence illustrates a general concern that microcredit activities were not finding success, and an apprehension with regard to indebtedness. Some of the key reasons identified for poor repayment were linked to limited use of cash in the communities, lack of employment and income generation at particular moments in the project cycle. People noted that they had spent what they considered 'their own money' on basic needs (*viveres*) such as sugar and oil at a time when money was scarce in the early days of the project. Other reasons included the lack of capacity, understanding, and reflection on repayment of project money, and the lack of enforcement (sanctions) for repayment. The poorer members of the communities were those who benefited the least. The organisation of the credit committee

and the management of funds proved difficult with corruption occurring in at least one of the communities. Restructuring of the credit committees has since taken place.[80]

The provision of incentives is not necessarily best done in the form of cash, since the community functions by barter and trade in informal goods and services, such as washing, cleaning, and rice. Cash is most needed for oil, sugar, medicines, petrol, and transport costs. Thus there has always been a limited amount of cash flowing among community members. Besides the fundamental problems of introducing credit into a barter economy, the incentives were focused on agricultural activities which affected the poorest members, yet the richer community members, who could take larger loans chose to invest in activities unrelated to agriculture, such as shops, bakeries, hens, a petrol pump, and so on. Other reasons for the lack of success concur with Milne (2001) that these include the following:

- High loan default;
- Limited alternative employment generation;
- Limited uptake of technology transfer;
- Perception that the project caused job loss by removing timber activity;
- Lack of financial resources due to agreed period of abstention from fishing as part of a fisheries management plan;
- Loss of roads formerly well kept by logging companies, leading to increased transport expenses; and
- Lack of enforcement of sanctions due to cultural traditions or reciprocity, social obligation, and resource sharing in the communities.

7.2.4 Equity impacts: carbon benefit distribution

This section reflects on the equity implications of carbon trade and forest carbon projects, as a new dimension in project impact assessment.

At the global level, credits are accrued to the international (or in this case, bilateral) players. The investors accrue the carbon credits for the avoided carbon-dioxide emissions. The global benefits are thus associated with the emissions offset to the global atmosphere, while the proceeds from the credits generated are distributed among the Bolivian government (49 per cent of all carbon credits generated, of which 20 per cent accrues to FAN), and the remainder are divided among the private-sector investors. The question arises as to the legitimacy of this division and to what extent direct benefits accrue to the local users and managers of the resources from which this new wealth springs. We shall first look at the national impact of carbon rights and their significance.

Carbon emissions reductions were to be obtained from buying and retiring logging concessions on state land and supporting the management and protection of these lands now part of a national park. Carbon rights were negotiated between the government, investors, and NGOs. Exactly whose rights should prevail over carbon credits becomes a cloudy issue when the land that accrues these credits belongs to the state. On the one hand, one might argue that the state has acted in the interest of local communities, to avoid introducing carbon credits, which may only raise expectations that cannot be fulfilled, given uncertainties in the market.

[80] Since the time these data were collected, changes in microcredit personnel and assumption of command over credit committees by the communities themselves, putting them in change of debt collection, instead of project technicians. According to PRODECOM repayment of funds has remained limited, but it is advancing.

On the other hand, the restriction of local usufruct rights to the park by community members also raises thorny issues.

The local benefits include investment in health care, education, jobs, and other development activities sponsored by the project. Part of the project's predicted carbon credit entitlement would entail local communities changing their land-use practices. In the short term, incentives were provided in the form of credit (loans for agriculture) but once project money ran dry, it was expected that carbon credits would contribute to support the park, and through the park, provide financial assistance to the communities for leakage avoidance. Indeed, the issue of direct-credit distribution at the community level was not considered in the formal project design (project technician, 2001).

- At the municipal level, a key representative indicated that the project had the potential to sequester vast quantities of carbon and to generate credits for the region, illustrating that expectations can be raised at a local government level.
- At the community level, the concept of carbon was grasped by the local elite: some people explored the concept through discourse, describing that here were the lungs of the earth and the west has polluted its own world to destruction and is in need of these lungs. The president of the CBO articulated interest in trading carbon from the new indigenous territory.

These perceptions indicate that expectations were raised regarding the return to the local level of at least part of the carbon benefits being generated to the investors, the state, and FAN. If they were not part of the project design, it would appear that this may become a source of additional friction in relations with the community as time goes by.

7.3 Noel Kempff project in the Kyoto context

The project represents an additional activity in the spirit of Kyoto since the Bolivian government – although it had adopted a policy to end timber concessions and expand the park – did not have access to the resources necessary to accomplish this objective. Without the project, logging concessionaires would have continued harvesting timber on the property and, it is argued, much of the forest in the project site would have been cleared or degraded. Reductions of 75 per cent in concession holdings (a result of the 1996 forestry law) had led to only marginal improvement in harvest efficiency, from a national level before 1996 of 0.02m^3 to 0.09 m^3/ha from 1996 to 2000. The project assumed a harvest rate avoided of 0.1 m^3/ha for areas of the park that would have been happened had the project not intervened, for a total volume of 2.2 million m^3 over the area accessible for harvesting (521,000ha) in the 30-year project horizon (Winrock, 2002).

Displacement activity (leakage) is dealt with in the project through an agreement with the former timber concessionaires under which they are obligated to report on the compensatory funds they received to cease operations and to cooperate by adopting sustainable forestry practices in their logging activities outside the project area. Besides these agreements, possibly of questionable observance by private timber firms, Winrock (2002) assessed the potential price effects on output of the windfall indemnification of the firms operating in the NKM area. Leakage was estimated on this basis to represent an additional 14 per cent of timber volume, assuming that international prices would not rise with a decline in the Bolivian concession area. (If prices were to adjust to the decreased output, assuming inelastic export demand, there could be an increase in leakage of up to 44 per cent.)

Leakage is also a concern associated with slash-and-burn activity, and hence was addressed through the promotion of alternative production activities with local communities to create economic opportunities, so as to provide an alternative to encroaching on other forest lands. We have already addressed the relative success of these endeavours, which are ongoing.

The project's carbon benefits are expected to last in perpetuity as the site lies within the newly expanded national park. Besides protected-area status, a permanent endowment has been established to fund protection activities throughout the 30-year life of the project and beyond.

Table 7.2. Impact assessment summary table of the Noel Kempff project

Sustainability dimensions	*Impact levels*	*Impact description (positive)*	*Limitations*
	Global	Initial targets proposed sequestration of 14 million tons of CO_2 over 30 years.	Amount halved after initial over-estimations of baselines and leakage.
Environmental impact	Regional	Expansion and protection of the national park to approximately 1,500,000ha. Hopes to contribute to the decrease of deforestation in the region.	The national policy context is still conducive to conflicting conservation and development policies. Risk still exists, although possibly diminished, of forest fires in the dry season.
	Local	Improved agricultural and livelihood systems. Sustainable forest-management plans.	Slow/resistant uptake of technology. Link between project's leakage potential and local development needs to be clear. Better dialogue on conservation between project and wider community members is needed (particularly with women).
Social impact	Global and national Regional	Technical 'know how'. Capacity building among key stakeholders. Dissemination of scientific information. Awareness of the park's importance to the region.	Institutional weaknesses: distance (both physical and cultural) between stakeholders. Global and national priorities to illustrate project potential can impede the local priorities, or the time it takes to reach compromise.
	Local	Contributions to capacity building among local organisation. Institutional strengthening.	Change and resistance at local level towards intervention design and priorities. Conflicting priorities due to unclear rules and introduction of new norms.
Economic impact	Macroeconomic regional/local	Incentive carbon credits and endowment funds for conservation. Entry of resources into region for purchasing concessions.	No carbon credits accrued to date and not likely to by Kyoto criteria. Returns from logging at regional and local level perceived as diminished. Regional and local priorities for employment.
	Microeconomic enterprise	Provision of credit incentives and rotating funds.	Distance and location of communities in relation to markets. Maintenance of road and other transport links limits opportunities. Perception of loss of jobs/income. Historical and cultural context are an important to consider in design.

7.4 Lessons learned and policy recommendations

The reflections of project stakeholders voiced in interviews, workshops, and meetings undertaken in 2001 show that the overall contributions of the NKMCAP to sustainable development have been both positive and negative. There are many positive outcomes of the experience of the NKMCAP and the case reflects specific challenges of management decisions and implementation that have arisen in the process. The project process itself perhaps opened up new directions for dialogue between project and local people, which lead to new understanding and possible avenues for participation. On the other hand, in accordance with Asquith et al. (2002), there exist challenges of participation in such intervention, which indicates there is a need to tackle the issue of design, risks, and benefits sharing early on in the project. It is also important to keep in mind that the NKMCAP started at a time of high political tension in the UNFCCC negotiations, which resulted in significant pressures for implementing agencies to live up to expectations. Now that pressure has subsided and the project stakeholders have settled into an established relationship with clearer community-development objectives, the project has ample opportunity to evolve into an important example of joint management.

In the following section some of the key project weaknesses are examined as a learning opportunity for future understanding of the role of environmental services, biodiversity, and communities.

The case study illustrates that multiple-level projects might encounter barriers due to the complexity of bringing together numerous often competing interests, held by investors, government and NGOs, which may not coincide or may be perceived as distant from local realities.

The project has now taken a turn towards capitalising on the social dimension and in the process has contributed a number of extremely important lessons to a wide audience. The key to remember is that the local communities are likely to remain in the zone for an indefinite period with the establishment of the indigenous land title, while the project's lifetime is limited.

Preliminary lessons and recommendations
Lesson: The project reflects a new type of partnership that is legitimised by the international community, but requires legitimation among multiple stakeholders.
Recommendation: Project development principles should ensure that the process of framing objectives and targets offers transparency and equitable definition of common objectives to these multiple stakeholders, enabling criteria and results to be assessed in a participatory fashion.

Lesson: The project design was not sufficiently clear and inclusive of local partners.
Recommendation: A clear set of guidelines/criteria for evaluating social impacts of carbon projects needs to be devised or adapted to the specific context by civil society, communities and national government.

Lesson: The project design attempted to assume responsibility for too many activities not directly related to project objectives.

Recommendation: The number of activities should be limited[81] and have clear carbon, social and conservation links/benefits.

Lesson: The project had unclear links among carbon, conservation, and development objectives.
Recommendation: Clarify how activities will contribute to carbon sequestration and the realistic opportunities for associated development benefits, based on an in-depth knowledge of community livelihood strategies.

Lesson: The rights and responsibilities of communities and their leaders in relation to the rules for usufruct, management and protection established by park authorities and by the project were not clear.
Recommendation: It is recommended that a clear understanding of local community rules and dynamics be incorporated into the prioritisation of project activities and that project expectations regarding local land use and other objects of intervention be conveyed and negotiated through community outreach for information and awareness raising.

[81] PRODECOM's revised community development plan (2003–2007) considers a smaller number of project activities, one of which is environmental education.

8. Overall conclusions

In this final chapter, we synthesise the key impacts, lessons learned, and policy recommendations for actions that could be taken by policymakers, investors, project managers and other stakeholders, to fortify local sustainability in connection with forest carbon projects.

Consistent with the structure of the report and the presentation of the four case studies, the conclusions are set out according to the three pillars of sustainability: social, economic, and environmental. Each of these will be considered in turn, starting with the general consideration of the social aspects of carbon forest projects, followed by general environmental aspects, economic considerations and finally some general conclusions and recommendations. This chapter also proposes evaluation criteria that will be of importance to future forest carbon projects, as the climate convention moves toward implementation.

8.1 Social-assessment considerations: local benefits and poverty alleviation

8.1.1 Project design and social impact assessment

According to the Project Document Design (PDD) text, set out in the Marrakech Accords (2001), CDM project review appears primarily concerned with environmental and social impacts, mentioned in two items therein. Firstly, one item (2-e) requires that projects include documentation on the analysis of environmental impacts, which, if considered significant, should lead to the preparation of an environmental impact assessment, according to procedures required in the host country. The second item (2-g) regards social impact. This item makes reference to the inclusion of stakeholders' comments, including a brief description of the process, a summary of the comments received, and a report on the account taken of any comments received.

The overall ambiguity of this formulation suggests that the social and economic criteria necessary for impact assessment has deliberately been left vague in acquiescence to resistance expressed by a number of G77 host countries towards the notion that a standardised social and economic criteria be pinned to the PDD. In their view, host countries should determine the social and economic criteria to be used in screening projects. However, this ambiguity leaves the door open to interpretations of levels of commitment to social and economic development priorities, and the transparency of the process of project impact assessment.

It became clear from this study that stakeholder participation should be enhanced when designing, implementing, and evaluating outcomes of projects. In the four projects reviewed, participation of local community members was found to be limited, even when stakeholders (such as local elected officials) are articulate, and capable of communicating and imposing demands on project proponents. Because the subject of carbon sequestration is still rather obscure, local actors have rarely been engaged in discussion about the nature of these projects. When debate does occur, the population or communities affected are historically absent, since a local elite usually dominates. As a consequence, it is necessary to seek objectively 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 is generated by CDM projects. Discussion of projects should rely on such participatory methods as those widely used in Rapid Rural Appraisal or in the Sustainable Livelihood Approach rather than solicitation of comments via the internet such as those aired in the Plantar case, following PCF procedures. If designed appropriately, a workshop on the meaning of carbon services in the proposed project area addressed to all citizens prior to project definition would undoubtedly help the project to reflect local social demands and facilitate a realistic degree of stakeholder engagement toward the project's goals.

8.1.2 Partnership with small landowners

A key issue regarding social inclusion is the degree of participation by surrounding residents in the 'core business' of commercial projects, i.e., in generation of carbon credits. Even should such participation be marginal, it will in all probability have a more significant effect on local development than that resulting from indirect economic spin-offs of project actions. For local communities, taking part more effectively as a project partner can bring lasting socio-economic benefits, not least of which being income generation or access to credit from the direct sale of environmental services as well as the stimulation of local capacity to undertake new projects.

Inclusion of communities affected by a project should be explicitly incorporated in the project scope. In those projects where the main focus is on local development, such inclusion would assume a central role. In the more commercial projects involving large-scale central plantations, small farmers can be included as partner 'out-growers', distributing benefits of eventual carbon credits among local actors.

The case studies introduced in this study suggest potential avenues for this kind of participation. In the case of Plantar, for example, the extraordinary forest technology developed by the company enabled additional income to be generated from sequestered carbon ($676.03/ha during each 21-year cycle). This could be a strong stimulus to the participation of small and medium producers of the Curvelo region, who are in serious need of alternative land-use options. Such an approach would probably reduce the company's need to purchase new areas, shown in this study to represent an additional source of already skewed land tenure. It could also be widely replicated through similar projects in the same region, spreading socio-economic benefits.

The Peugeot project created an embryo for action along this line, when in partnership with Instituto Pró-Natura it began a programme to distribute native seedlings to small producers in the area surrounding the core reafforestation project. Local organisations then initiated viability studies with the help of researchers and NGOs to develop carbon project models for small landowners based on agroforestry systems, grounded in this experience. A similar project model, based on small-scale agroforestry systems and organic orchards, has also been addressed by directors of Ecológica, as one of the principal outputs of the Ilha do Bananal 'social-carbon' scheme.

To exemplify the implications of this element for the small landowner, the table below shows the additional per hectare revenues that a producer could receive from carbon credits, according to the growth estimates used by project executors.

Table 8.1. Revenue potential from smallholder carbon sequestration

Project	*Crop/system*	*Carbon*	*Average annual incremental revenue/ hectare generated by carbon sales*
Plantar	Eucalyptus	Average stock of 52.65 tC/ha	$32.19 (21-year cycle of 3 cuttings) (halved if pledge of 2 cycles is required)
Bananal	Agroforestry	70.0 tC /ha at end of period	$ 35.95 (25-year accumulation)[82]

Source: Project data.

From the point of view of social impact, these annual incremental returns are by no means negligible in underdeveloped tropical areas, particularly if summed to the revenues obtained from other annual/perennial crops and animals in the agroforestry systems adopted. Certainly, direct payments to small producers represent a significant potential benefit of the carbon market to induce local development for poor communities.

8.1.3 Concentration of land tenure

Forest carbon projects, like some other agricultural commodities, depend on a reasonable minimum area to guarantee profitability. Because there are considerable transaction costs, particularly those incurred in negotiation of contracts, carbon monitoring, carbon-credit commercialisation, and technical assistance for the implantation of technical operations, large areas[83] are typically necessary to amortise these costs.

In the Plantar case, uncertainties relative to LULUCF project criteria led the project to establish forests on pasture land converted before 1989. If it had been possible to reafforest areas already planted with eucalyptus nearing the end of their third cycle, based on the original project proposal,[84] there would be less need to purchase additional land for plantations.

From a social perspective, expansion in area dedicated to eucalyptus reforestation, allied with the need for large areas to reduce per hectare transaction costs associated with carbon finance, 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 commodities in Brazil, such as coffee, sugarcane, and eucalyptus itself in the era of fiscal incentives. This process is repeating itself today notably with soybean cultivation and beef cattle ranching at the Amazon frontier.

This process, extremely harmful for local social development, not to mention loss in biodiversity values, could be counteracted through inclusion of small and medium producers in the projects' core business. This could be achieved either through direct partnerships (farmer forest programmes, or *fomento florestal*) in large-scale commercial projects, or with such farmers assuming the role of primary actors in local development projects based on payments for ecosystem services. Such options would reduce the need to acquire land and the

[82] Considering the same value assured by PCF to Plantar: $3.50/t CO_2 (or $12.84/ tC).

[83] The sheer scale of the areas involved in each project is remarkable. The smallest one reviewed is that of Peugeot, whose initial project foresaw the reafforestation of 5,000ha of degraded areas, for which it initially bought a ranch totalling 10,000ha, of which only 2,000 could be reafforested from originally degraded pastures. The remaining reforestation area would have to be obtained by purchase of additional property.

[84] According to Plantar's managing director, there exist in Minas Gerais approximately 2,000,000ha of ageing unproductive eucalyptus stands, that could easily meet all demand for reafforestation, and serve the needs of a large number of similar projects in the pig-iron industry (Moura, 2002).

potential to exacerbate an already highly skewed land-tenure structure. Besides the social gain, this partnership can reduce the final costs of carbon sequestration, because investors would not need to incorporate land-acquisition costs, and could rely on household labour – typically valued at less than rural wages – as a partial contribution to plantation establishment. These cost reductions would help to cover the additional transactions and validation costs.

The issue of maintaining large land areas tied up in forest plantations remains a pertinent issue in CDM project eligibility. A more-thorough examination of the effects on local sustainable development of further land concentration should be a part of eligibility analysis for CDM projects. Such examination should not necessarily serve as a justification for refusing carbon finance, but rather suggest means for integrating the local population and existing low productivity agropastoral lands into project benefits.

8.1.4 Job creation

In terms of direct socio-economic impacts, employment creation is the most visible and most immediate benefit to local communities, besides that of producers' direct participation in carbon-credit generation. Analysis of both the quantity and quality of jobs generated, is fundamental for evaluating a project's socio-economic stimulus.

Projects that manage to generate income and jobs from the sale of global environmental services may provide evidence to the local community of the potential to unite environment and development goals. The educational and behavioural impact of such demonstration can eventually stimulate a transition towards local sustainable development. A relationship may be discerned between employment generation in the projects visited, and a shift in local perception of the link between environmental services and local development. In the case of the Peugeot project, for example, it was noted that the emergence of a market for native forest seed and the mere existence of a reafforestation project at large scale financed by a major multinational corporation led to an incipient shift in local views on the value of the standing forest and appropriate local land uses. Even small farmers demonstrated their appreciation of the relationship between such land uses and the global environment. These results may be partially traced to complementary environmental education activities under way in the region, indicating that employment must be matched by efforts to fortify local understanding.[85]

Another matter of potential concern in forest carbon projects is that regarding temporal and seasonal labour requirements of afforestation and reforestation projects. Temporal concerns relate to the greater labour requirements at the time of forest establishment and lesser demands throughout the growth and maintenance period. Seasonal effects include the greater need for labour in the rainy (planting) season than in the dry (maintenance and harvest) season. Projects with these profiles should expect investments in capacity building and training in alternative income-generating activities for periods of low employment.

There is some potential to overcome some of these labour discontinuities by linking forest carbon with renewable energy generation, such as in the case of Plantar, which offers additional employment generation in charcoal manufacture during the dry season. Designing

[85] It is important that project proponents have a clear understanding about actions additional to those considered normally associated with social benefits. From some managers' point of view, social sustainability of a commercial project must be restricted to job creation, to preserve financial competitiveness (Moura, 2002).

planting systems in cycles so there is always new planting in progress is one way to reduce temporal discontinuity.

8.1.5 Income generation

Additional social benefits may be created by projects through income generation from local initiatives or by introducing new land-use options. Some of the initiatives undertaken in this regard by the projects reviewed include the following.

Forestry and agroforestry support
Agroforestry systems (AFS) have been promoted as one of the most promising means for sustainable use of tropical ecosystems as well as carbon sequestration, particularly for projects involving small landowners. Among their main advantages we can point to higher diversity and corresponding risk reduction, utilisation of perennial forest species in association with annual crops for production system longevity, etc. Although they offer many advantages, the process of implementing AFS is still in its infancy in the majority of the South American contexts (Smith et al., 1998). Some main reasons for this is difficulty in access to long-term credit, unavailability of technical assistance to small farmers and problems related to marketing for some agroforestry products, such as access to urban markets, absence of roads, etc.

Nursery construction and subsequent distribution of seedlings to small farmers and community members in general is a fundamental activity in the Ilha do Bananal project and is also important in the Peugeot project (in partnership with IPN and local governments). This distribution has an educational character, which aims to contribute to the wider appreciation of planting native species.

In urban areas, seedlings have been used to create small orchards and forest lots, as a source of food and as shade trees. In the rural zones the seedlings have been used to create live fencing for demarcation of properties, to recuperate degraded permanent preservation areas, provide shade in pastureland, and for establishment of agroforestry systems, being used to shade existing coffee trees, and to interplant with annual crops. In association with this distribution, project implementers offer technical or educational lectures to local community members about the importance and use of the seedlings.

But this is not sufficient if the project's social objectives are to go beyond environmental education, and include reafforestation with the objective of carbon sequestration or to establish AFS. In these cases, it is necessary to ally seedling distribution with other aspects. These include the identification of mother trees in the wild, gathering of seed and production of seedlings, training in planting practices besides permanent technical assistance and monitoring of silvicultural operations (survival rates, plant development, biomass accumulation, etc.). Low survival indexes, caused by inadequate local species choice, planting time, pest attack and other agronomic problems (weeds, diseases, etc.) mean that only a very small percentage of seedlings will survive to be trees. Together with these technical matters, it is fundamental that the projects seek support to commercialise the products produced in AFS, as well as the carbon itself, one of the largest bottlenecks for this kind of land use.

In this process it is fundamental to identify and apply existing local experience with the goal of reducing resistance and to incorporate local knowledge. The lack of qualified technical

assistance is so great that there is often substantial receptivity to new techniques. This was found, for example, in the case of the Bananal project, where the acceptance of new technology was a function of the provision of quality technical assistance, and respect for the producer.

Seed collection

Forest carbon and AFS projects encourage the creation of a new regional market for forest seeds. This can generate substantial dividends to local community development in projects that make use of native species plantings, since the absence of official nurseries to supply them leads to stimulus for small and medium forest enterprise. The exact size of this market and its potential income-generation capacity to the local communities can only be roughly estimated. However, its potential economic importance can serve an immediate educational function, since the seed market shows community members the value of a standing seed-bearing tree that may be many times higher than the price obtained by cutting it down for wood, so contributing to environmental awareness of non-timber forest values (Almeida, 2002).

However, this benefit is only of fairly short duration since the supply goes mainly to fulfil the project's nursery demands. Once the project's needs are met, this demand declines. The volume of seed usually demanded by the projects boomed in the beginning years with decreasing amounts in the following seasons, owing to the reduced reafforestation targets. To counteract this problem, it is necessary that seed collection be accompanied by work on environmental education in rural and urban communities, creating through this means a greater demand for native seedlings for long-term benefit. Project developers should be encouraged to perceive the synergies obtained from investment in a cluster of similar projects in a single region, relying on seed collection and other technical capacity generated by projects to develop spin-off projects and services to restore degraded lands and to establish new forest carbon plantations and AFS.

Financial support to income generating micro projects

The funding of small income-generation projects can also be an important lever to stimulate local initiatives, particularly those related to the utilisation of local products, aggregating income to traditional uses, such as support for a native fruit sweet factory by the Bananal project. A clear point in the NKMCAP project experience with micro-lending is that it is necessary to take the local cultural context into consideration, and ensure local organisations assume control over micro projects. External factors that affect success in such ventures include the lack of infrastructure, access to markets and conflicting interpretations of financial ownership ('project money' versus 'community money'), and the implications of this interpretation for stewardship and repayment.

A number of lessons have emerged regarding use of credit or other financial incentives with local stakeholders. These include: the necessity to recognise clear links between project objectives and local development targets; realistic parameters linking incentives with opportunities for local income generation; simplified design processes; avoidance of approaches that override existing procedures or priorities; support for people to develop a sense of ownership and confidence in conforming with contracts; clear development targets discussed and developed in partnership, and linked to incentives (educational aspect); project incentives appropriate to local institutional arrangements such as rules of money distribution, customs of lending, and repayment. In other words, concerns broadly associated with micro-credit schemes in developing countries need to be recognised and observed if such elements

are to become part of CDM projects. These are not always clear and need to be well understood and clear between project developers and borrowers. It may be more appropriate that such project elements be channelled through existing national micro-credit structures than seek to develop parallel schemes.

Based on these related experiences, it is fundamental that projects ally enterprise funding to actions directed to enhance local technical and commercial capacity, to increase the chances for enterprise success and to avoid frustrating communities' expectations. If these areas of expertise do not lie with the project executors, they should secure assistance from the increasing number of successful non-governmental organisations engaged in chanelling micro-credit, with excellent loan repayment rates and social benefits.

8.1.6 Generation of scientific knowledge

All of the projects analysed are characterised by a pioneering and learning-by-doing approach. In this pioneering process, the projects played a fundamental role in generation of scientific knowledge, as well as support to discussions regarding development of criteria for the CDM, particularly with regard to LULUCF projects and related activities.

From the international policy perspective, and among scientists and NGOs, the greatest interest and impact of these projects has been within the context of discussion of leakage and of the types of projects to include in the CDM.

Resources brought by the projects have worked as a catalyst to regional and local research initiatives on native forest species, agroforestry, floral and faunal biodiversity, and methods for carbon monitoring. Owing to the lack of financial support from state research institutions and the long-term nature of forestry research, many local research initiatives have not had the opportunity to become consolidated. The resources invested by the implementers of the projects have provided structure and area for the establishment of trial research plots for the generation of knowledge on regional ecosystems and their restoration, agroforestry, and carbon monitoring.

The partnership with regional research centres and local universities assists in information exchange and applies quality controls to research and monitoring, driven by these institutions. Also, the participation of these institutions brings the potential to produce new scientific information and knowledge, as they are often closely linked with international research networks. Such links are further facilitated by partnerships forged in sponsors' host countries.

Although in the first instance, this kind of impact does not bring direct benefits to the local population, it can support complementary locally sustainable development initiatives, pointing toward new land-use options as well as encouraging training for local people who participate in research activities.

8.1.7 Environmental education, capacity building and indigenous groups

Environmental education has been adopted as one of the main community-oriented activities in all studied projects, it being a particular emphasis in the Ilha do Bananal project. These environmental education programmes aim to reach primarily public schoolteachers and students, assuming that the children would be the principal multipliers to their parents and family. The programmes' goals seek to clarify the projects' objectives and climate-change

issues to community members, as well as to offer general information about the importance of the environment – with the aim to change unsustainable behaviour patterns, particularly in rural production areas. These project elements should be reinforced, by integrating them with existing teacher-training programmes under way in rural areas, to which they provide important opportunities for field visits and hands-on dynamic educational experience, memorable to the young.

Besides environmental education per se, the projects offer two other kinds of capacity-building activities. The first is focused on local communities involved with the projects. Education and human-capital development in countries such as Brazil and Bolivia register the highest deficits in rural areas and in villages far from principal urban centres. Carbon projects that seek to incorporate the social aspect as a relevant component should incorporate strategies for training and technical assistance as pillars, with the objective of creating new alternatives for income generation. Such alternatives must be identified in line with beneficiaries' expectations, and developed preferentially on the basis of their demands. It is also necessary to define indicators of effectiveness and monitoring of the results of such actions, to measure their real benefits, rather than simply tabulating number of participants as a project result.

The second kind of capacity building concerns reinforcement in understanding of climate-change issues, such as awareness of the existence of a carbon market and technical issues associated with carbon measurement and rural land use. In the case of NKMCAP, technical training has been provided for community leaders, for people in different levels of government (municipal, state and federal), and NGOs. Such capacity building is fundamental for the country to prepare itself to take part in the carbon market.

Projects located near indigenous areas should include in their social component actions targeted to these communities. Given developing countries' historical negligence regarding indigenous people, projects should seek to establish partnerships with such groups, to reinforce their traditional activities, as well as to stimulate new alternatives for their survival. In the case of the Peugeot project, for example, initial seed supplies were stimulated among local indigenous groups whose reserves lie near the project site, thus generating a new source of income, based on their knowledge of seed-bearing trees.

Ideally, projects should seek approval from local partners, through local decision-making mechanisms and collaborate with those people who are affected by the project towards a common goal. This could mean supporting communities' efforts to attain land title, as in the case of NKMCAP, or assisting the development of indigenous or local institutions. However, ensuring land titles for indigenous communities requires a considerable amount of technical and conflict-resolution skill, which need to be accounted for in project design and budgeting. Linking processes of carbon mitigation with local land titling can in the process call up a Pandora's box of historical and contemporary local community conflicts, which had remained unresolved, thus creating rather than solving problems.

There is no single solution as to how projects can ensure 'success', in terms of equity. A potential starting point is for projects to engage in a process articulated and prioritised by local stakeholders. It is to be hoped that this engagement will lead towards ensuring land rights and carbon rights to local people. A constraining factor with regard to carbon forests is the linear objective of forest carbon to mitigate greenhouse-gas emissions. As such, there is a significant challenge regarding the degrees of freedom from which the project is able to

diverge from its original mitigation objectives. This is a crucial point in which the process might encounter unanticipated conflicts, requiring flexibility on the part of project directors.

The following matrix focuses on the poverty-alleviation benefits and costs to communities reached by these projects.

Table 8.2. Principal social impacts of carbon projects studied

Project	*Beneficiary groups*	*Action undertaken*	*Observable results so far*
Bananal	Women's groups in agrarian reform settlements.	Financing a sweet factory using native fruits of the *cerrado*	$60/month gross revenue to the group.
	Rural communities, urban dwellers, and schools.	Distribution of seedlings of forest and orchard species.	Lack registry of distribution and follow-up monitoring. Positive educational effects.
	Schoolteachers and students.	Training and capacity-building courses.	Training and motivation for implementation of agroforestry systems.
	Agrarian settlers.	Native seed purchase.	Process is only at initial stage.
Peugeot	Rural workers.	Jobs in resfforestation.	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 70ha.
	Juruena municipal population	Increment in the service tax	Additional resources for local health, education, and agriculture services.
Plantar	Company employees.	Job permanence.	1,270 jobs in the nursery, forest, and industrial areas.
	Small retail and services enterprises.	Multiplier effect in the local economy.	Permanence of jobs and economic activities (nursery, charcoal).
NKMCAP	Community members.	Provision of credit incentives and rotating funds.	93 microprojects. Lack of success caused by cultural and infrastructure problems.
		Acquisition of logging concessions.	Reduction in the number of jobs derived from this activity.
		Land title.	Support to process of transferring land rights, reducing local conflicts in the process.

8.2 Environmental assessment considerations

8.2.1 Carbon sequestration

The main environmental impact of a forest carbon project must be its impact on climate change; in terms of the amount of carbon sequestered. Because this would be the investor's prime motivation, the project justification will include detailed presentation of net carbon additionality. Yet it is fundamental that designated national authorities (DNAs) for approval of CDM projects be capable of screening projects that offer capacity to both sequester carbon and offer sustainable development benefits in a complementary and consistent fashion, enhancing the credibility of this new market.

It is important to learn from the experience of these pioneering projects, to train specialized personnel that can assume the task of reviewing new proposals. Table 8.3 below summarises the experience to date with the projects reviewed in this study.

Table 8.3 Carbon sequestration objectives and accomplishments of projects

Project	*Modality*	*Proposed action*	*Project expectation*	*Observable results so far*
Bananal	Avoid deforestation.	Permanent preservation of 200,000 ha located in the Araguaia National Park (PNA) and the Cantão Environmental Protection Area (APAC).	21.0 million tons C (77.07 million tons CO_2).	Partnership with the government institutions responsible for park protection did not materialise.
	Reforestation and regeneration.	Reforestation and regeneration of 60,000 ha of degraded forest and *cerrado* areas in the PNA.	3.9 million tons C (14.3 million tons CO_2).	Partnership with the government institutions responsible for recuperation of degraded lands did not materialise.
	Agroforestry.	Implantation of 3,000ha (1,500ha in initial proposal).	210,000 tons C (= 0.77 million tons CO_2).	The first AFS modules are in process of being established (total area 15ha).
Peugeot	Reafforestation and enrichment of secondary forests.	Plant 5,000ha of native forest species on established pastures and enrich secondary regeneration areas.	2.0 million tons C (7.34 million tons CO_2).	Planting area reduced to 2,000ha, almost fully planted. Sink reduced to 500,000 tC (1.83 million tons CO_2). Seedlings distributed locally.
Plantar	Reforestation and assisted regeneration.	Reafforesting 23,100 hectares with eucalyptus and assisting in regeneration of 478ha of native vegetation.	4.54 million tons CO_2).	Planting in initial phase.
	Fuel substitution.	Charcoal substitution for coke in pig-iron production.	7.9 million tons CO_2).	On completion of first planted forest cycle (from the seventh year).
	Emissions reduction.	Improvement of carbonisation kilns (methane emissions reductions).	0.44 million tons CO_2).	Still in research phase; installation of improved kilns to begin once project is certified.
NKMCAP	Avoid deforestation	Avoiding and reducing emissions from logging and agriculture in an area of 1,523,446 ha inside the Noel Kempff Mercado National Park	14.0 million t C (51.38 million t CO_2)	Area fully protected from deforestation by timber concession acquisition. Expectation reduced to 7.0 million t C (25.69 million t CO_2), as a result of baseline and leakage assessments.

8.2.2 Biodiversity maintenance

One of the most important environmental by-products derived from carbon projects is that of biodiversity maintenance through acquisition and protection of forest remnants that, in the absence of the project, would in all likelihood be converted to agricultural uses. The absence of financial mechanisms in the Convention on Biological Diversity (CBD) resulted in carbon projects being perceived by many international environmental NGOs as a potential alternative mechanism for global biodiversity maintenance. However, since COP7 at Marrakech, with the exclusion of avoided deforestation from the first commitment period of the Kyoto Protocol, projects developed with this component suffered a reversal.

Amazon-based NGOs, unwilling to accept defeat, continue to fight for inclusion of avoided deforestation in the second commitment period. They believe that without a financial mechanism that motivates preservation of the standing forest, occupation based on slash-and-burn followed by pasture establishment will continue, leading to continued carbon-dioxide emissions, The need for such a mechanism in the climate accords stems from an equally necessary recognition that the majority of greenhouse gas from tropical forest regions are still generated by deforestation and associated burning. Although it is argued that such conversion is 'temporary', the evidence of permanent land-use change in much of the Amazon basin belies this argument.

The experience from the Bananal carbon project suggests that if protection actions are carried out within a defined and realistically sized buffer zone, additionality from avoided deforestation may become defendable and measurable. Another perspective for this kind of project is the non-Kyoto carbon market or the sale of carbon credits to investors who seek projects that would mitigate climate change while jointly conserving biodiversity. Carbon credits may be used in part to finance extension, education, and enforcement activities of government agencies and NGO developers and partly to finance the establishment of plantations in farmers' properties either for the restoration of forest resources or for sustainable production purposes.

In any case, the required environmental assessment of carbon sequestration projects can oblige project implementers to invest in actions to ameliorate biodiversity impacts. Among the principal requirements are respect for permanent preservation areas (springs, riverbanks, hilltops, and steep slopes) and legal preserve areas (from 20 to 80 per cent of the total property area, depending on the biome) in the Brazilian case.

An important environmental indicator is that of whether internationally recognised social and environmental certifications have been secured over the project area or have been obtained by project executors in similar projects. Host countries may in fact reward projects that go beyond the norms implied by certification. This was the case of the Plantar project, which assumed a proactive stance regarding environmental measures, having previously adopted FSC criteria in its plantations, as well as 'child friendly' norms that earned it the respected Abrinq Foundation seal for avoidance of child labour.

One of the main positive impacts generated by carbon forest projects reviewed is that of assuring greater control over accidental fire spread, cited by specialists as the principal source of damage to biodiversity in the tropics (Nepstad et al., 1999).

Despite the potential environmental benefits, the actions today permitted by the Marrakech accords as additional in CDM projects (afforestation and reforestation) can have significant impacts on biodiversity. To maintain or restore biodiversity, seedling distribution can be a very efficient way to assure establishment of useful trees, with the eventual effect of reducing pressures on native forests. Nevertheless, unless such distribution follows technical criteria regarding species diversity and use of native trees, it does not guarantee repair of damaged ecosystems, since demand is often greater for exotic plants or traditional fruit trees. Even in forest plantations based on use of native species, such as the initial 32 species tested at the outset of the Peugeot project, the executors reduced the number of planted species drastically to assure a greater success rate in reafforestation. Projects that seek primarily to enhance the financial viability of forest plantations typically will involve even fewer species, and will mostly focus on industrial monocultures such as the Plantar project. In these cases, mitigatory actions are necessary to protect remaining biodiversity.

8.2.3 Spreading awareness of forest conservation and markets for environmental services

Of the four projects studied, three are located in frontier areas, where there are considerable pressures for conversion of the standing forest to agricultural systems. In this sense, forest carbon projects have a substantial role to play in their regions of influence. Projects financed by major corporations are highly visible to the local population, even if their goal initially seems surreal (the goal of 'capturing carbon'). Given the notoriety of the investors and the significance of their investments in reafforestation, the projects have created an opportunity for bringing together different stakeholders, scientists, academics, government officials and NGOs in a given region to discuss the potential of global environmental service markets, in particular the carbon market.

The existence of a carbon market signals the economic importance of protecting forest areas for the local population. People accustomed to valuing forests solely for timber or other crops from their conversion begin to perceive forests differently. The existence of carbon markets also signals the potential of markets for other environmental services, such as watershed management, biodiversity or ecotourism. Proposals for policy alternatives towards the environment in developing countries have been attracted by these options, where there is a need to harmonise colonisation and land redistribution with conservation objectives. There is a very real search under way for innovative economic incentives and instruments that may motivate farmers to adopt sustainable land-use practices (Pagiola et al., 2002; McNeeley and Scherr, 2002).

For the host country, project implementation helps to develop national capacity and to enable the country to participate in an informed way in discussions in international forums, helping to guide global policy so as to reinforce national sustainability. Project executors have been invited to serve as informal members of national delegations to the COPs, with specialised knowledge of the realities of these early projects under way, thus enabling negotiators to refer to actual experience rather than rely on hypothetical examination of policy formulations.

Media coverage of projects and of the idea of carbon sequestration and environmental-service markets also plays a key role in national dissemination of carbon-project awareness.[86]

[86] For example, a cover story regarding s*eqüestro legal* (literally 'legal kidnapping') in the Brazilian business newsweekly *Exame*, with features on each project, was a source of great interest.

At local level, consciousness is growing, thanks to environmental-education activities that involve community members in areas surrounding the projects, or in the Bananal and NKMCAP cases, those in the buffer zones of parks and reserves. In the medium and long term, this can bring change in behaviour and attitudes, reducing human-induced pressures on forests and native biodiversity.

8.2.4 Risk of increase in fast-growing exotic tree plantations

A strong stimulus by the carbon market of large plantations of fast-growing exotics such as eucalyptus, pine or teak represents a very real environmental risk. This is true particularly in Brazil, whose expertise in tropical forest-plantation technology is considered among the most advanced in the world, and where there is a considerable deficit of new planting to meet national wood and pulp requirements. Industry representatives have shown great interest in harnessing the carbon market to justify and help to finance new large-scale plantations for these purposes.

To avert risks associated with large-scale monospecific plantations, the environmental criteria of the CDM should address such factors as the ratio between protected and planted area, both from a quantitative and a qualitative perspective. Such criteria should promote protection and restoration of biological corridors, among mechanisms to protect local biodiversity.

Monitoring and verification of watersheds and water resources affected by forest plantations is another important concern in forest carbon projects. Water absorption and evapo-transpiration from fast-growing plantations is known to reduce the available water in regional hydrologic systems. Furthermore, chemical fertilisers and pesticides used for weed and disease control may imperil water sources. Zoning of plantations at a micro-watershed scale to reflect hydrologic balance and water quality protection is a possible solution.

On the other hand, the industry often advocates planting of exotic forest species as a way to reduce pressure on native forest stocks, whose importance for watershed management is paramount. Although this justification may be appropriate in the case of plantations for biomass energy, where the principal alternative source is native *cerrado* vegetation, it is not so for pulp, since native wood is not used for this purpose.

One way to regulate these activities would be the incorporation of local social and environmental development issues in environmental licensing (a legal requirement for enterprises with potential impacts such as large forest plantations). This would be an immediate way to tie existing legal requirements to those facing CDM projects (Ricas, 2002). The licensing process requires public hearings which allow local stakeholders to participate more effectively.

8.3 Economic-assessment considerations

8.3.1 Attracting foreign capital

Brazil and Bolivia are extremely dependent on external capital flows to finance their internal and external debt. Reducing this dependence is a central point in their macroeconomic policies. One of the principal strategies in this regard is to stimulate activities that generate foreign-exchange earnings. Global environmental services markets represent a potential source of overseas direct investment in developing countries.

Carbon project experience has demonstrated these nations' potential to attract investment, and has encouraged learning related to these financial opportunities. Discussion regarding alternatives for occupation of land within the context of climate change occurs exactly at a moment in which these countries are seeking to increase their exports. The primary agricultural export products, such as soybeans, can be devastating in their impacts on occupation of fragile areas such as the Amazon basin, despite the fact that they may be only ephemerally lucrative in these settings.

Projects such as the Ilha do Bananal and Peugeot cases explored here, both situated along the Arc of Deforestation in the Amazon, point to alternatives for generation of foreign exchange more appropriate to fragile tropical soils. Even if not as profitable on a per hectare basis, agroforestry practices and associated reafforestation on degraded sites offer a range of social and environmental advantages. They could compete with extensive ranching and marginally profitable export crops if compensated by the carbon market.

8.3.2 Developing a new agroforestry financing model for Brazil and Bolivia

There is also considerable interest in the carbon finance option from the point of view of small and medium landowners. These also suffer from problems of access to credit lines responsive to the lengthy growing period to forest product harvest. Agroforestry systems represent a land-use option in South American tropical forest ecosystems, but their slow rate of adoption is largely a function of the absence of credit and technical assistance to family farmers and colonists, corresponding to the long time horizon required by forest plantings. The presence or access to markets for tropical agroforestry products is another matter of concern.

The carbon market could potentially serve as a guarantor for credit to small farmers who could become out-grower partners in projects such as Plantar. It could also guarantee financing for initial establishment of small-scale agroforestry systems for producer associations or rural workers' unions. The potential of this market does not however obviate the need for such practices to evidence underlying profitability, including market channels for products.

8.3.3 Developing a new financing model for the industrial forest sector

The development of a new financing model for the industrial forestry sector must also be treated as a strategic matter for developing nations. The productive chain of the Brazilian forest sector, for example, is responsible for 5 per cent of GDP and 10 per cent of exports, generating revenues of $28 billion per year in the domestic and external markets. The sector employs 6.7 million people, about 8.5 per cent of the economically active population (Bartuíra, 2002).

The sector lacks access to credit at terms appropriate to the long-term horizon needed for forest establishment, a situation worsened by the persistence of crippling interest rates. In this context, new financing opportunities arising from the carbon market may have an extremely positive impact, particularly for small and medium enterprises.

8.3.4 Income multiplier effect

The potential for projects to produce an additional income-multiplier effect in their adjacent communities is directly correlated with their level of local service contracting, job, and income generation among the local population. The commercial projects reviewed in this study (Plantar and Peugeot) had a more immediate impact on direct job creation, often occupying an important relative position among local employers. This impact has been generally greater, at least in the initial period, than the effort dedicated to support training, capacity building, and generation of alternative local income sources. In the case of the developmental and conservation projects, however, this emphasis was reversed, with direct project-related employment being either of minor impact (Bananal) or having a negative impact (NKMCAP) due to acquisition of timber concessions.

Projects' purchase of machines, equipment, services, and consumables in the surrounding communities, when available, is another locally pertinent source of both income and government revenues. The service taxes that are collected by local governments particularly during the project-implementation phase can generate significant additional revenues for the municipality, increasing its capacity to invest in social services that particularly benefit poorer segments of the population.

In the context of social assessment during project appraisal, proponents should define their intentions regarding job creation and development of local income generation options. Such criteria include: a required minimum percentage of local labour force; commitment to purchase a certain minimum share of supplies and services in the communities affected by the projects; and a proportion of total project investment placed into a local social and environmental challenge fund.

8.3.5 Attracting new projects and investments

An additional project multiplier effect is its capacity to attract new projects. All projects reviewed had been able to attract or generate other projects, whether specifically related to carbon or other environmental services and rural development. Scientific consortia have particularly been attracted to these projects, as a focus of opportunities for research on urgent questions for global climate policy.

Developmental investments are attracted by the socio-economic and environmental possibilities and potentials discerned in pioneering projects. These may benefit from their managers' experience and proven ability to generate results. But such resources are often attracted too by the level of consciousness exhibited by local leaders, and the community's awareness of the prospects for development they could seize.

Most managerial motivation for investment in carbon projects originates from the search for ways to communicate a good social and environmental image to consumers and host-country societies. In the projects analysed here, the image issue was a central motivating factor for Peugeot-Citroën, and very important for both the AES Barry Foundation and AEP.

We also observe that projects that seek to accomplish something beyond simply sequestering carbon, such as biodiversity protection or social development, tend to be preferred by companies that seek to gain image. On the other hand, companies that intend to reduce their

carbon-emissions liability, such as those that compose the investor group of the PCF, tend to prefer projects whose objectives are to maximise generation of carbon credits.

This typology of project expectations of investors is significantly related to the level of concern assumed by project proponents and executors for local sustainable development. This suggests the need to assure certain minimum standards in this regard, as well as to demonstrate how additional social and environmental benefits for forest carbon investors may be obtained where such groups wish to improve their image.

8.4 Further lessons learned

Many lessons learned from the research and associated recommendations were discussed in the previous items regarding the impacts caused by the projects visited in this study. In this section, we seek to point out additional lessons and recommendations that arose during the course of the review that go beyond specific social, environmental and economic impact assessment. These include concern for property rights in the context of the forest carbon market, means to overcome high transaction costs and to acquire knowledge regarding technical aspects of forest establishment.

8.4.1 Land ownership and rights to carbon credits

The credits generated in forest carbon projects belong to the proprietor of the land or to whoever retains legal ownership over the bundle of rights and responsibilities that accrue with legal title. If the investors themselves are not the owners of the land, some guarantee over the rights to carbon credits is needed, in the form of a contractual agreement signed between the investor and public or private landowner prior to project presentation for approval to the designated national authority.

The lack of land titles by many small farmers and rural settlers could represent an unsurpassable barrier to the establishment of carbon projects on their lands because of uncertainty for investors. In frontier areas of Brazil and Bolivia, in those limited cases where land titling does exist, it is often many tiered and susceptible to judicial challenge, leading to equivalent uncertainties.

Rights over carbon credits also can be clouded when the land to which these credits accrue is state property, and it is deemed equitable that the state act on behalf of local communities who have usufruct rights over these lands. On the other hand, introducing the thorny issue of carbon credits to communities may raise expectations that cannot be fulfilled, given uncertainties in the market.

In general, partnerships with government institutions in carbon projects need to be formalised. Shared activities and responsibilities as well as expected budgetary contributions must be clearly defined from the outset to assure transparency and stakeholder engagement. Rights over land and to the proceeds of environmental service payments require adequate legal and contractual definition prior to project implementation.

8.4.2 High transaction costs

The pioneering forest carbon projects are characterised by high transaction costs for a number of reasons. Initially, restrictive carbon market rules limited interest in projects that

incorporated efforts to avoid deforestation. Uncertainty persists regarding other aspects, including such concerns as utilisation of officially protected areas as carbon sinks, and establishment of criteria defining projects' expected contribution to sustainable development. Such doubts have led pioneering project investors and executors to pay a premium to implement their projects and oblige them to constantly re-think their strategies throughout project implementation.

Carbon sequestration projects permitted for CDM investment in Marrakech for the first commitment period are restricted to those that include afforestation and reafforestation. Despite this restriction, it must be admitted that there is much to be learned about the establishment of tree plantings. This implies additional costs as project developers literally invent techniques for reafforestation. Except where projects are engaged primarily in planting fast-growing exotic trees such as eucalyptus or pine, in which Brazil is already expert, we still have much to learn about establishment of native species (forests) over pastures and on degraded sites.

With regard to establishment of agroforestry systems by family farmers, the challenge is even greater. Knowledge, capacity and social capital for projects of scale that would interest investors in the carbon market remain as hurdles to be surmounted.

8.4.3 Existing certifications

A possible criterion to indicate those forest plantation projects that should be made eligible for CDM is to verify the social and environmental certifications already acquired by the proponents. FSC certification would represent a significant departure from current practice, particularly if the criterion regarding promotion of local development were given greater weight. Another recommendation is to adopt instruments to monitor social and environmental impact similar to those undertaken in certified forest management, where the requirements imposed are made progressively more stringent over time.

8.4.4 Catalysing project benefits through existing socio-environmental networks

The relative ability of projects to benefit local communities is greatly catalysed by the existence of networks of government entities and NGOs, with pro-active local development and environmental roles. The aligned efforts of socio-environmental organisations to build synergy among their respective achievements, improves the potential efficacy and draws out the effects of each individual organization's activity.[87] Carbon projects established in the context of such networks stand a greater chance for replicability and innovative spin-offs.

8.4.5 Utilising environmental services markets for protected areas

It is important that government agencies, be they state or federal, wake up to the possibility of utilisation of economic or market instruments, such as the carbon or water markets, as new possibilities for generation of revenues to support their responsibility to protect protected

[87] In north-west Mato Grosso, for example, several federal, state, and local government organisations and NGOs have built a cooperative network among their respective projects in the region, including a GEF-funded project to 'Promote Conservation and Sustainable use of Biodiversity' implemented by Pro-Natura; the Peugeot-funded Carbon Sequestration Project; the Italian-funded Fire Combat Programme administered by the Centro de Vida Institute; and the G7-financed Integrated Environmental Management Programme carried out by the state environmental agency FEMA, among other initiatives under way.

areas. Rural development agencies should also take proactive roles in developing projects jointly with rural producer organisations, who stand to benefit from the potential market for carbon, and avoid that discussion on such instruments be limited only to environmental forums. The Proambiente programme that began implementation as an option for smallholder agroforestry credit in the Amazon is an example of how environmental service markets can catalyse interest among rural-producer organisations.

8.5 Criteria and indicators

8.5.1 The role of the designated national authority

The criteria each designated national authority (DNA) adopts in project review are of fundamental importance to guarantee that forest carbon projects presented for registry contribute to national goals for sustainable development. Global regulations for the CDM delegate to these institutions the power to approve projects according to the sustainable development prerequisite. Thus, the extent to which the DNAs apply coherent social and environmental criteria in their review will affect the manner in which projects reflect these concerns in their design and implementation.

There is some concern over trade-offs between adoption of more rigid review criteria and the number and type of investors that may be attracted to a given country. If policymakers feel it is more important to attract hard currency independent of the effect of projects on local sustainability, the more flexible the criteria the better. On the other hand, if local sustainable development is the principal focus (however this concept may be defined), criteria are needed that clearly encourage project executors to adopt explicit actions that will bring verifiable social and environmental benefits.

Another conceivable trade-off observed is that between the amount of carbon sequestered and the relative prioritisation of social-development activities. Major commercial projects are more focused on tree planting and consequent carbon accumulation than local development aspects. They allege that efforts to furnish income-generating alternatives for neighbouring communities or the incorporation of small farmers in their planting schemes, will be difficult to accomplish efficiently and competently. Once again, the DNA will have to define what affected communities should expect of investors and executors to ameliorate impacts and assure continuing local benefit and acceptance.

8.5.2 Proposed criteria and indicators for forest carbon projects in the CDM

Based in part on a critical review of indicators suggested by others (Novaes et al., 2001; La Rovere, 2002; Brown and Corbera, 2003) and on the results of the analysis presented in this study, we propose adoption of the below indicators, in the hope that they may be useful to policymakers.

Although the approval of CDM projects based on criteria and indicators is the responsibility of government, the assessment criteria can also be used by civil society[88] to inform potential project investors of features paramount to their primary concerns.

[88] For instance, this is one of the objectives of the *Observatório do Clima* (the Climate Observatory), a network of Brazilian social and environmental NGOs concerned with climate change.

The criteria and indicators suggested in Table 8.4 represent a contribution to the debate about initial definition of qualitative features that should be the subject of project review. Similar tables can be used as an aid in project monitoring. Managers and investors can therefore use such tables for assessment when proposing new projects and when seeking to obtain social and environmental certifications.

Table 8.4. Indicators proposed for forest carbon project 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 recognised social and environmental certification of forest use.

Component	*Criterion*	*Indicator*
Environmental	A net increase in terrestrial carbon storage is anticipated due to the project.	Total tons of CO2 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. Compliance with land use/ environmental legislation.
		Proportion of area reafforested 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.

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