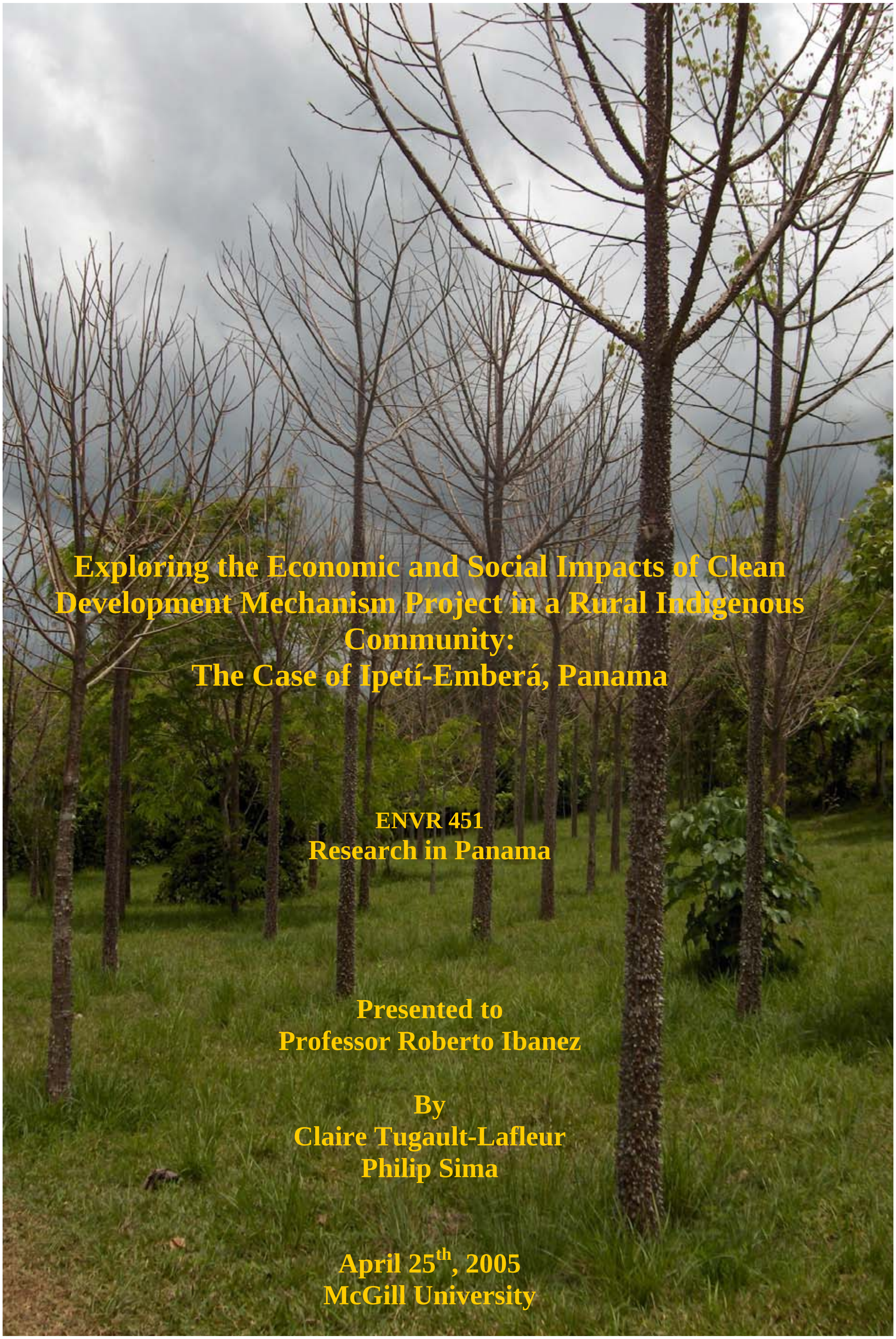

Exploring the Economic and Social Impacts of Clean Development Mechanism Project in a Rural Indigenous Community:
The Case of Ipetí-Emberá, Panama

ENVR 451
Research in Panama

Presented to
Professor Roberto Ibanez

By
Claire Tugault-Lafleur
Philip Sima

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McGill University

INTRODUCTION:

Project Context: the Kyoto Protocol and the Clean Development Mechanism

Changes in atmospheric carbon concentrations have been attributed to anthropogenic activity, most notably fossil fuel emissions and land use change (Hall, 1989; Post et al., 1990). The accumulation of atmospheric carbon dioxide is believed to be responsible for 60% of the observed effects due to global warming (Kirby and Potvin, 2004). Annually, about 6.5 Gt C are emitted by fossil fuel combustion (Kirby and Potvin, 2004), while land cover changes annually contribute 1-2 Gt C (IPCC, 2000). Tropical deforestation is a major cause of changes in land-use patterns, proceeding at an annual rate of over 154,000 km^2 (Aldhous, 1993; Kirby and Potvin, 2004).

In 2001, the Kyoto Protocol at COP7 (Seventh Session of the Conference of Parties to the UN Framework Convention on Climate Change (UNFCC)) implemented the Clean Development Mechanism (CDM). CDM activities allow developed countries to meet a part of their emissions reduction by carrying out specific forestry activities that sequester carbon in developing countries (UNFCCC, 2001). Currently these forest activities are limited to afforestation and reforestation (AR) (UNFCCC, 2001). Afforestation takes place on land that has not been forested for at least 50 years, while reforestation takes place on land that did not contain forests before 1990 (UNFCCC, 2001). Averted deforestation projects (ADEF) that prevent carbon emission be protecting a forested threatened by deforestation are currently ineligible under the CDM (UNFCCC, 2001). Developing countries engaging in AR activities are compensated for sequestered carbon. Current prices are between \$4-10/tC, although future estimates are in the range of \$15-\$20/tC (den Elzen & de Moor, 2002; Grubb *et al.*, 2001).

A number of small scale AR projects already exist. For example, in April 2003 the government of Holland invested \$18 million in CDM-eligible clean energy projects in Panama (ANAM 2003). The Scolel Té project in Chiapas, Mexico, includes 2000 hectares for sequestration (Plan Vivo, 2005). Participants of the Scolel Té Project are 400 small-scale land-holders, representing 30 of the communities in the region (Smith and Scherr 2003). The expected revenue from carbon sales in 2002 was \$180,000 and has provided a wide range of social and economic benefits to the community (Tipper, 2002).

The Potential for CDMs in Panama

Annually, tropical deforestation in Panama is occurring at a rate of 1.6% (FAO, 2003). From 1990 to 2003, it was estimated that about 52,000 hectares of forest was lost. (FAO, 2003). Forests are cleared mainly for timber extraction and cattle ranching (Wali, 1993; Herrera, 2005). Population growth in Eastern Panama, namely the Bayano Lake region and the Darien province, is pressuring remaining stands of intact forest (Goldenberg et al. 2004). For instance, total population in the Bayano Lake region has grown from 5000 to 20,000 during the 1980's (Wali, 1993). Deforestation in Panama is exacerbated by agrarian codes, which promote the occupation of land through deforestation as a means to gaining title. In 1994, a forestry law was passed to prevent the rapid loss of virgin forests in the region, but this new law has yet to be effectively implemented due to poor law enforcement from official authorities (Fisher and Vasseur, 2002; Herrera per. communication, 2005).

Study Site: The Community of Ipetí-Emberá

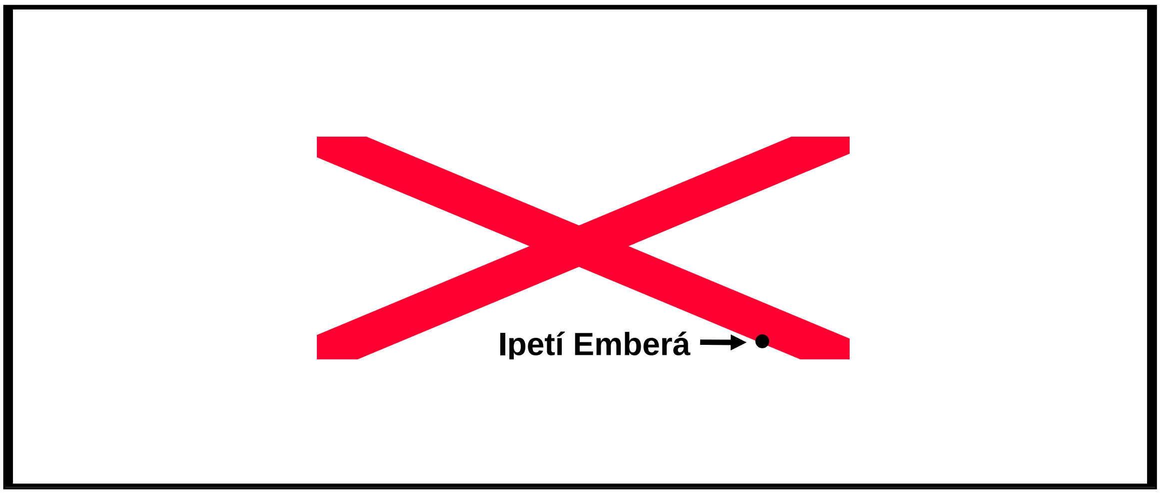


Figure 1: Map of central and eastern Panama Source: www.mapquest.com

The Ipetí-Emberá community in the province of Panama is part of a carbon study involving researchers from the Smithsonian Tropical Research Institute (STRI) working in partnership with McGill University. The town of Ipetí is composed of three distinct autonomous groups: the Kunas of the *Comarca* of Madungandi, the Emberás and the Ipetí *Colonos*. The community of Ipetí Emberá was established in 1973, following the construction of a hydroelectric dam on Lake Bayano that forced the resettlement of over 500 Emberás (Herrera F., 2000). The community is located in the eastern part of the Panama Province, at about 120 km east of Panama City and 1 km south of the Pan-American Highway (see figure 1). Today, Ipetí-Emberá is an indigenous community composed of roughly 70 families and comprises roughly 400 individuals. The community is set in 3,198 hectares of communal land referred to as the *Tierra Colectiva* (TC), which is divided into small plots, *parcelas*, each managed by individual households (Barrios et al., 2002). Legally, the Emberá in Ipetí do not have private or communal land titles. Community regulations prevent households from selling their land to outsiders. Because the people of Ipetí are still waiting for official land titles, many community members are very familiar with the limits of the land on which they hold claim (Ibid.).

In the 1970's, when the TC was formed, intact forest was the predominant land cover (Goldenberg at al). At the time 12 families practiced hunting and fishing with a small extension of subsistence agriculture and all production was only for subsistence purposes (ibid). In 1980, 36 additional families migrated to the community, followed by another group in 1985 (Herrerra F., pers. communication, 2005). There has been increased population pressures in the last years, resulting in deforestation, as migrant families cleared land in order to provide for their subsistence needs. Moreover, the construction of the highway to Ipetí in 1980 led to the expansion of cultivation, because it allowed people to sell their agricultural surplus by providing access to external markets (Herrera, pers. communication). Deforestation was further accelerated after a government agricultural extension project introduced cattle ranching to the community in the mid-1980's (Heckadon-Moreno, S. 1984; Wali A., 1993). In recent years, many households have made at least a partial transition from traditional subsistence production to the cash economy because they require money to buy consumer goods and to pay for education (Potvin, pers. communication).

Livelihood activities mainly consist of subsistence cultivation, cattle ranching, day labour, tourism activities, and handicraft production (Goldenberg et al., 2004). Although the Emberás have traditionally been hunter-gatherers, declining wild game population has pushed most to rely on agriculture (Pacheco, personal communication, 2005). The economic exploits of timber harvest and cattle ranching continue to threaten the remaining forests in Ipetí Emberá (Herrerra F., pers. communication). As well, it is widely believed in the community that the water temperature of rivers in the TC is increasing due to deforestation, leading to increased water borne illnesses (Pacheco, 2005). Additionally, the population of Ipetí is highly skewed toward the youngest age classes, suggesting potential rapid population growth in the future (Goldenberg et al. 2004).

Land use has changed substantially in Ipetí Emberá since the 1970's. Intact forest cover has decreased from about 80% of the total TC in the 1970's, to 60% in the 1980's and down to 50% in the 1990's (Goldenberg et al. 2004). Today 45% of the total TC remains as intact forest (ibid). Pasture, which previously did not exist in the TC before 1970's, accounts today for 18% of the communal land holdings (Ibid.). Cultivated land, which was sparse in the 1970's, now occupies 8% of the TC (Goldenberg et al. 2004).

Changes in land-use are inevitably associated with changes in carbon stocks. In 2001, the possibility of a carbon pilot project was presented to various members of the Ipetí Emberá community by McGill University professor Catherine Potvin. This two-year study investigated the feasibility of implementing a CDM project in Ipetí. The primary objective of the study was to develop a long-term land management plan that would increase carbon storage in the TC, attract external investment, and at the same time, improve the overall standard of living in the community. In order to develop a land management plan both beneficial to the human and environmental ecosystem, the team first needed to assess the carbon sequestration potential within the TC of Ipetí before investigating realistic options for land use changes that would store additional carbon and also improve local livelihoods (Barrios et al. 2002). A significant proportion of the study's budget was dedicated to capacity building activities in order to provide local people with the skills and knowledge necessary to carry-on the project themselves the project after the departure of the research team.

Preliminary research by Mc Gill researchers suggested that such a carbon sequestration plan could feasibly attract an investment of $200,000 based on the projected price of $10/tC. In collaboration with OUDCIE, the *Dirigencia*, and community members, a series of alternative land use strategies were developed based on their carbon sequestration potential and their utility in meeting the local needs of the people. The present socio-economic study was involved in the last steps of this pilot-project.

Description of Host Organization

The 'Organización de la Unidad y el Desarrollo de la Comunidad Ipetí-Emberá' (OUDCIE) is a NGO established by community members in 1998 guided by the following objectives:

1. Realize programs related to conservation, protection and sustainable development of natural resources
2. Sustain the indigenous culture and traditions
3. Assume the responsibility to resolve ecological problems that might present themselves in the community (Barrios et Al. 2002).

The *Dirigencia* is the political body in charge of the administration of socio-economic and policy issues in the community (Goldenberg et Al. 2004). OUDCIE assist the *Dirigencia* in carrying out development rural projects. This provides a way of ensuring that the projects are participatory, respect Emberá culture, and provide benefits to all members of the community (Barrios et al., 2002).

Product for Host Community

Two products were generated for the host community:

1. The expected product for the host organization was the writing up of a draft application of a CDM project, *Guia de Endoso*, for the community Ipetí-Emberá. The Guia de Endorso is essentially the application form that must be submitted to the Autoridad Nacional del Ambiented (ANAM) de Panama in order to become a certified carbon vender. This 4 page form asks for three main components. First, the construction of a **baseline scenario**, a **mitigation scenario,** and an **assessment of the economic feasibility** of implementing a CDM for the community. As well, there are other social questions about the impacts a CDM could have on the proposed area.

2. The second product was the creation of a cost benefit analysis scenario for each family based upon proposed future land use change. This would be given to each family after data collection and analysis was complete. From this analysis families would know the cost and benefits inherent in their desired land use change, as well as the amount of labor needed for the changes. The sheet would also show residents how costs were calculated so they could use it as a tool for future management decisions.

OBJECTIVES

The overall objective of our work is to contribute to the carbon study by providing information that will assist in the creation of a viable long-term land use plan for the community. The specific objectives of our project fall into three main categories.

1. Write up the draft application of a CDM for the community Ipetí-Emberá

Completing a draft application to be submitted to ANAM involved two major components.

> It was necessary to calculate a **baseline scenario** on the basis of present deforestation trends, population growth, and subsistence needs, etc. A copy of the baseline scenario or *linea de base* can be found in appendix 2.2. This including studying the factors affecting the deforestation rates along the Pan-American Highway in the Bayano Lake region
>
> It was also necessary to come up with a **mitigation scenario**. That is, we had to estimate the quantity of land and carbon sequestered with the implementation of a carbon project. This meant calculating the amount of carbon that could be potentially sequestered according to an alternative land-use scenario

A completed copy of the *Guia de Endoso* can be found in appendix 2.1.

2. Assess the economic feasibility of implementing a CDM in the context of re-forestation activities for Ipetí-Emberá

The second objective is to examine the economic feasibility of a carbon project by conducting a cost benefit analysis (CBA) specific to Ipetí-Embera. The will CBA include a number of economic estimates using different scenarios. The first is a formal high cost scenario, followed by a formal low cost scenario. There will also be an informal cost scenario that includes the quantity of labor, measured in number of days. There will be high and low estimates for the sale of Certified Emission Reductions (CER), informally called 'carbon credits.' Finally, we will investigate possible financial benefits from reforestation products (e.g. lumber and fruit). In order to compete effectively in the international carbon market, the cost of sequestering carbon will have to be lower than the value of expected benefit. As the current price of carbon is low, often around $5.00 tC (Tipper, 2002), it is important to quantify the total benefits of land use change in order to determine feasibility, not simply the price of a CER.

3. Examine the social benefits and risks associated with small-scale, community-based agroforestry CDM projects

This third objective for this study is to explore the role of family ties and help networks by re-visiting the concept of social capital in the context of CDM projects and their potential for rural development. This last objective will re-examine some of the main ideas present in the wide body of academic literature on social capital and examine them in the specific context of reforestation activities in Ipetí-Emberá.

APPROACH AND METHODS

As mentioned earlier, the final product for the OUDCIE is a draft application of a CDM project in Ipetí (*Guia de Endoso*) that will be then submitted to the ANAM department of climate change, the official body in charge of coordinating AF activities in the context of CDM projects for Panama. The general methodology for this study can be broken up into five distinct steps.

First, our team needed to discuss the product with members of the Commission and later share ideas with the community through two steps of workshops. Second, conduct interviews in Ipetí Emberá to gauge interest in a CDM project. Third, we researched on the past and present social and economic factors affecting land-use at the local and regional level to establish a baseline scenario of deforestation rates in the area. Fourth, we looked at scientific literature methodologies for deriving the amount of potential carbon sequestered according to different land-use scenarios. This entailed getting a handle on using allometric equations that would allow us to convert Above-Ground Biomass (AGB) to tons of carbon that could be sequestered according to each type of land use. Fifth, gather as much possible information concerning the economic components of reforestation in Ipetí. From this data collection enact several CBA scenarios in order to accurately convey the possible investments in a CDM.

The Approach: PRA

Projects and research in rural areas have increasingly incorporated elements of participatory methods in order to enable rural people to share, enhance, and analyze their knowledge of life and conditions, to plan and to act (Chambers, 1994). Moreover, more and more development organizations have incorporated these values and principles using a methodological tool called ‘Participatory Rural Appraisal’ (PRA). PRA has the objective of gathering information through the participation of the local community, while increasing local capacities through the building of knowledge and skills (Chambers, 1994). Throughout workshops and interviews, our team favored these approaches. Ultimately, it is the community members themselves who will take the decision of going forward with the carbon project and changes in land-use. It is important that the community understands clearly the role of McGill university scientists in this project.

1. Examining collectively the potential for Carbon Sequestration: Workshops

Our first meeting with OUDCIE representatives, professors was organized on January 9th in order to discuss the proposed product for the host community and establish a clear methodology that would take into account the community’s needs and expectations for this project. Key dates for two workshops were set for discussing the proposed product to the entire Ipetí community. The first workshop would discuss carbon and the context of a CDM activity for Ipetí (January 23rd). The second workshop would deal with agro-forestry and sustainable agriculture (February 12th and 13th). These workshops would be important in 1) making the knowledge accessible and ensuring that information about carbon project circulated among community members; 2) addressing possible fears, hopes and expectations about implementing a carbon project; 3) discussing management issues; 4) enhancing the sense of the project ownership among community. This capacity-building element was seen as particularly important within the context of a possible carbon project in Ipetí.

The goal of the first workshop on carbon held on January 23rd was to get the community's for the two students do complete a *Guia de Endoso*. The workshop also served as a platform to receive collective feed-back on people's fears and expectations for the proposed research to be done. Also, it was necessary to discuss possible management issues related to the implementation of such a project and the multiple questions accompanying such decision: what potential benefits could be gained, what potential problems could arise with reforestation, how would the benefits be redistributed equally amongst community members, etc. One problem that became quickly apparent was that there is a balance to be reached between the total amounts of land needed to fulfill basic needs and the amount of land that can be put for reforestation. Indeed, questions of inequity arise because it is not everybody in those projects who can participate to the same extent, simply because they do not own the same amount of land. Some have much more land to put in such projects than others. Prime land for reforestation includes *potrero* (pasture), *rastrojo bajo y alto* (short and long fallow) and *arroz mecanizado* (mechanized rice). Conversely, some members are land-less or only possess *bosque* (virgin forest) that does not count as potential land for reforestation. Such questions needed to be discussed as a group in workshops as well as individually with each community member during interviews.

After the first workshop, our team decided to look at the possibilities a CDM project individually. That is, trying to come up with an individual land-use scenario for all the land-owners interested in a carbon project in the Tierra Colectiva and from this data, derive the potential amount of carbon that could be sequestered for the community.

The goal of the second workshop held on February 12th and 13th was to discuss how people could start adopting reforestation practices in more concrete terms and examine agroforestry alternatives as means of sequestering carbon and what impact this could have in livelihood opportunities. The first day of the workshop was organized around the central theme of sustainable agriculture with two environmental specialists, both specialized in sustainable agroforestry practices. Two professors and technicians in agroforestry were invited to talk about the different land-use possibilities that would offer both possibilities to sequester additional carbon while enhancing food security and diversifying household's economies.

The second day, the governing body of the OUDCIE and two Mc Gill students held a community meeting to discuss the actual change they were interested in doing and answer some questions as well as discuss some problems that might come up with implementing such project. Several questions were raised; namely, what would be the various costs involved in implementing such project? How could benefits be divided? How much land each land-owner could put for the project? How to ensure fair and equitable participation from all families in the project? Should people go collectively or individually in changing their land-use practices? The purpose was not necessarily to get a straight answer from everybody but to start thinking about the different options available in the future. Finally, individual interviews were scheduled with the community for the next five days (Internship week 1).

2. Examining collectively the potential for Carbon Sequestration: Interviews

During the first internship week, the team of two students conducted a series of interviews in teams of two (1 student paired with 1 member of the Commission) with each landowner in Ipetí. Each interview lasted about an hour. In addition to answering survey questions, the interviews served as a mechanism to clarify some points about the CDM if participants had questions about the carbon project. Although responding to the surveys required standard responses from participants, the interviews also served as an opportunity for community members to voice concerns and suggestions about the project. A copy of the survey can be found in Appendix 3.2.

The general content of our interview questionnaire is described in the following paragraphs. The first and second question of the survey asked about the quantity and type of land. Responses were either given en hectares or *cabuyas*, depending upon the preference of the participants. *Cabuyas* are a common unit of measurement used in Ipeti-Embera where 1 *cabuya* is equal to 1.75 hectares. Land use types were standardized as the following: *bosque* (intact forest), *rastrojo alto* (tall fallow), *rastrojo bajo* (short fallow), *potrero* (pasture), *cultivo* (crops), *plantano* (banana and plantain), *tumbo nuevo* (newly cut), *plantacion* (hardwood plantation), frutales (fruit trees), *arroz mecanizado* (rice grown using mechanical capital), *cerca viva* (living fences, which are made using barbed wire and live trees planted every 1-3 meters), and *silvicultura* (silvipasture).

The 3rd and 4th questions asked how much land was necessary, on an annual basis, to cultivate for family subsistence, how long the land is left in fallow, and for some interviews, how long the owner grows on a single plot. This information served in getting a general idea of the amount of ha of virgin forest would be cut down and burn for subsistence agriculture or cattle ranching practices.

The 5th, 6th, and 7th questions addressed participation and general interest of the community in changing future land-use practices. There were several standardised responses derived from the various suggestions made during the workshop I. A list of the different choices possible was established. Participants could chose from putting either 80% of the land, all of their high fallow, all of their pasture, 50% of their land, or 10 hectares. These choices were meant to more help structure the responses of the participants but due to the high diversity of plot size and type, participants could also give responses outside the range of choice proposed.

The 8th question asked which stakeholders should be responsible for managing the carbon project. Standardised responses, again derived what participants had proposed during the first workshop, were the following: with each head of the family, with each family, with the local congress, with the *dirigencia* and OUDCIE, or each family and the *dirigencia*.

The 9th and 10th questions asked what type of land use they would enact and where on their plot would they do this. This is a particularly important part of the interview as it would help build a collective mitigation scenario from all the individual responses from the participants. There were standardised responses for reforestation that included the following: forestry plantation, fruit trees, agro forestry, silviculture, and living fences. In addition, participants were also made other suggestions.

After answering each of these questions, participants were asked to sketch their present land use (participatory individual mapping exercise). They were given an existing map of the TC as a reference for the sketches. They were then asked to draw their plot in the future for five, ten, fifteen, twenty, and twenty-five years, incorporating the land for the carbon project (imaginary mapping exercise). Some participants also sketched their future plot in the case of the failure to implement the carbon project. This part of the interview was useful in elaborating a baseline scenario and getting an idea of the present rate of deforestation and livelihood needs in the region

3. Past, Present and future land use and land management plans: participatory change mapping

After coming back from internship 1, we had sufficient data to begin writing the product for our host community, the *Guia de Endoso*. This part of the methodology involved more specifically the construction a baseline and mitigation scenario for the community.

3.1 Calculating the Baseline

A baseline scenario establishes the potential trends in land-use for the future **without** the implementation of a carbon project in the community. Establishing a baseline scenario involves estimating the changes in land-use and carbon stocks, using present trends in deforestation for the region. Indeed, under a CDM, projects must meet the “additionality criterium”. That is, projects must show that the emissions or sequestration profile with the implementation of a CDM would be different than that of the baseline scenario. We need to go back in time to reconstruct changes in land-use and get an idea of the deforestation rates in the region.

We used data collected by McGill researchers for a period between 1998 and 2004. Verification of changes in land use was done for more then 50 GPS points over a 2 year period in the context of a GPS mapping project organized by McGill University. This exercise allowed us to have fairly robust indications of changes in land cover in between 1998 and 2003 and therefore to calculate deforestation trends over time for a period of 25 years from 1998 to 2023 (Potvin, 2005). We could then extrapolate the rate of deforestation calculated during this time period and estimate the quantity (in ha) of virgin forest loss over a 25 year period without the implementation of a CDM. Moreover, earlier work by Goldenberg et Al. (2004) allowed us to get a relatively good estimate of the quantity and type of land-use (*potrero, rastrojo, frutal,* etc.) for each landowner in the community.

Two maps were constructed (1998 and 2004-2005) as part of a community project to look at changes in land-use within the TC. In 1998, community members drew a base map without geo-referencing. The land use categories retained in 1998 were pasture, forest, secondary forests and cultivated land. Discussions with community members indicate that secondary forests of 1998 correspond to the tall fallow of 2003 while cultivated land lumped together crops and short fallows. In 2004, a similar mapping exercise was carried out by some of the GPS-trained community members with the participation of McGill students and a map showing the relative abundance of various land-uses was created (Goldenberg et Al. 2004). As often as possible during the inventory, GPS coordinates were recorded when quadrates were set up and land cover was recorded. Two members of the community, well trained to use GPS, went back to the original location of the quadrates and recorded present land use to record any change in land-use.

Baseline Equation

The baseline scenario to derive carbon from changes in land-use was obtained by projecting the land use changes obtained for time interval 1998-2003 up to 2023, the possible ending date for a CDM project. We then used Jaccard's coefficient of similarity to quantify the occurrence of changes in land use for these precise GPS locations (Kirby K., 2003). The equation is as follows:

$$\Delta A_i * C_i = \{\Sigma\ (A_{i98}C_{i98} - A_{i03}C_{i03})\} * 4$$

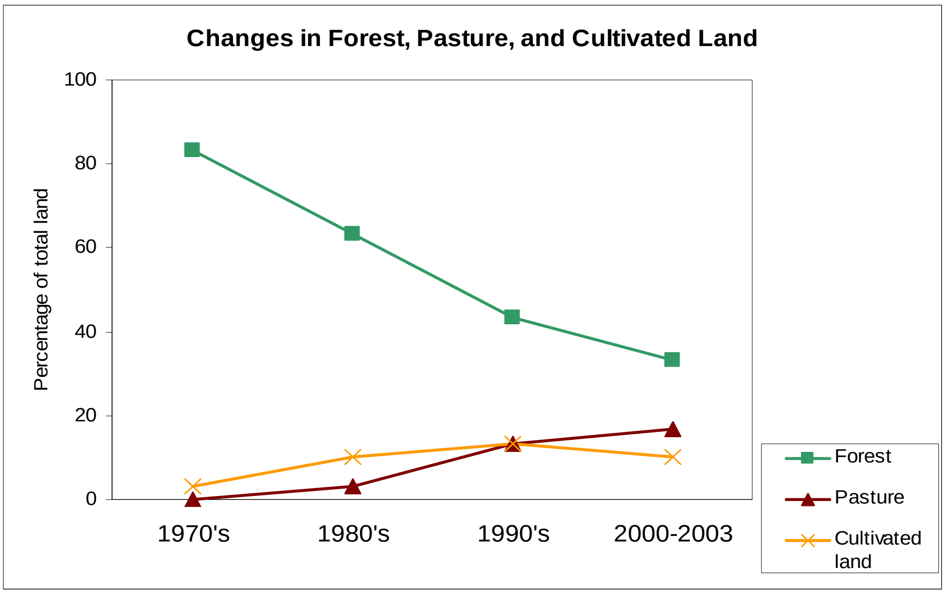
where $\Delta A_i * C_i$ is the change in overall C stocks
$A_{i98}C_{i98}$ or $A_{i03}C_{i03}$ refer to the C stocks in 1998 and 2003 respectively.

Historical Changes in Land-Use

Examining these changes in land-use over time allowed us to reach an estimate a deforestation rate before the monitoring period of 1998-2004. Assuming that, before the flooding of the Bayano dam, the landscape of Ipetí was largely pristine forest (Mckay 1984), we estimated that the forest loss between 1975-1995 was around 1737 ha, that is 54% of the entire *Tierras Colectivas*. The annual forest lost in this twenty year period must have been of around 86 ha per year for an annual rate of lost of 2.3%.

We then examined the deforestation rate for the monitoring period with the GPS data. The baseline equation established a 5 years information base to study changes in carbon stocks over a 25-year period. Knowing that the entire TC is of 3,198 ha we could estimate the proportion of the entire area allocated to each land use and, using the equation, calculate changes in carbon stocks over time. These changes in land-use are shown in figure 2. The main land cover in the TC of Ipetí is intact forests with respectively 1,458 ha in 1998 and 1,431 ha in 2004. General trends in land cover point to an increased in secondary forest from 488 ha in 1998 to 561 ha in 2004 coupled with an increased in pasture from 453 ha in 1998 up to 552 ha in 2004. Conversely, there seems to be a decrease in surface allocated to subsistence agriculture such as crop land, which shrank from 600 ha to 319 ha in 2004.

Figure 2: Participatory assessment of land use trends for three categories between 1970 and 2003, Ipetí-Emberá, April 2004.



It is interesting to see that this rate of deforestation in the monitoring period 1998-2003, which was calculated to be around 2% annually, is smaller than the deforestation rate (2.3%) calculated before the monitoring period. With these estimations for deforestation rates in the region, we were then able to calculate the amount of carbon that would be lost in a 25 year period in the absence of a carbon project. This baseline data (loss in carbon stocks) could then be compared with the proposed changes in the mitigation scenario.

3.2 Establishing Present and Future Land Management Plans with a CDM

The following section explains more precisely our methodology in establishing a mitigation scenario. The mitigation scenario describes the changes in land-use that would occur in the case of the implementation of a carbon project. In an effort to be participative in our overall methodology, we structured our interview questionnaire based upon the responses we had received during workshop I and II.

Finally, some informal interviews were also conducted with some community members involved in cattle ranching as a base for a CBA analysis looking at the trade-offs between reserving land for cattle ranching vs. for tree plantations. Moreover, a personal meeting with the community cacique was done to discuss the role of family ties and traditional division of land *parcelas* within the community over time with the community *cacique*, Omayra Omi.

4. Calculation of Benefits: from tree biomass to carbon emissions reduction (CERs) credits

The fourth step of the research involved analyzing the results from the interviews and compiling individual responses to build the proposed mitigation scenario. The main objective for this part of the methodology was to calculate the net changes in land type distribution for each landowner. From the changes in land-use, we could get an estimate of the quantity of carbon each landowner could capture in the next

25 years. To compile and analyze results, all data was put into a Microsoft Excel spreadsheet.

For each landowner, we looked at their present and future amount and type of land that could be put for a CDM project. We then compared our results with the data obtained in the previous year by the other team of researchers from last year to look for significant differences in numerical values. This last step helped ensure the data we worked with was as accurate as possible.

We quickly realized the data we had gathered from personal interviews was significantly different from the results gathered by Goldenberg et Al. (2004) for the mapping exercise. Some landowners had given us a very rough estimate of the amount of land they actually possessed. This is not surprising given the fact that very few landowners know the actual dimensions of their terrain (Pacheco, personal communication, 2005). Additionally, after talking with some younger family-heads, we realized that many of the young fathers found it was much easier to work the land of their parents than to cultivate their own *parcela*, usually because of the time it took them to reach their own plots. Consequently, they had only a vague idea of the exact dimensions of their *parcelas*. We thus decided to use the data from Goldenberg et Al. 2004) in getting the dimensions of each type of land-use in each parcela.

We then combined both responses by working with proportions of land from Goldenberg et Al totals *terreno* each *dueno* wanted to dedicate to the project instead of taking the "raw" numbers each *dueno* had given us. We then looked at each individual land-use change scenario and calculated for each land-owner the quantity and qualitative changes in their *parcela* (where were the gains, where were the losses and in which quantities). For instance, some of the landholders might want to convert all their *potrero* into plantations while others might want to convert only half and transform them into half in plantations and the other half in *frutales* and so on. After calculating the proportion of terrain that each landowner wanted to convert to tree and fruit plantations as well as *silvipastoral*, we then multiplied each proportion with the associated value of terrain that was recorded from previous mapping study (Goldenberg et Al., 2004).

In order estimate of how many carbon credits are gained in a mitigation scenario, we needed to quantify the average tons of carbon sequestered on average for a 25 year period in different types of land-use. We had to consult previous studies on carbon inventories for different types of land-use in tropical regions (see more in Chave *et Al*., 2003, 2004) as well as in the *Tierras Colectivas* of Ipetí (Kirby, 2004). Using allometric equations, we could convert tree biomass growth into tons of carbon and then obtained the following coefficient for tons of carbon per ha. Table 1 outlines the above-ground C storage values of the different types of land-use in Ipetí Emberá.

Table 1: Above-ground metric tons of C storage values in Ipetí Emberá.

Land use	Net Carbon Gains (tC/ha)
Forest	181.1
Pasture	4.2
Fruit trees	71
Short fallow	7.9

Tall fallow	35.5
Crops	9.7
Platanos	12.7
Mechanized rice	6.8
Teak plantations	125

Above-ground C storage values used to estimate the total carbon stocks in the TC of Ipetí Emberá. Values for forest, pasture and fruit tree plantations come from Kirby and Potvin (submitted, 2004). C stocks in short and long fallow, crops, platanos and mechanized rice were reported in Tschakert et al (submitted, 2004). Because of the difficulties in assessing below-ground C stocks, estimates are based on above ground values only.

For each *dueño*, we calculated an estimate of the amount of present and future above-ground carbon (in tons) for different types of land-use according to responses from the interviews. The final step involved calculating the amount of carbon sequestered for the community as a whole. This was done by simply adding each individual net carbon gains on a spread-sheet using the *Microsoft Excel* program. Once the mitigation scenario and its implication for carbon stocks have been calculated, we can verify conditions for the "additionality criterion" by contrasting both the mitigation and the baseline scenarios.

5. Calculating Costs and Benefits for a CDM

Implementing a CDM project in Ipetí-Embera involves an interface between formal (e.g. westernised market based) and informal (e.g. extensive network of family ties for work and prevalent exchange and barter system) economies. While the benefits of CERs will be paid in dollars, among the Ipetí-Embera, days upon days of manual labour spent to establish these CERs will not receive monetary compensation. While it is highly unlikely that a private investor in a developed country would participate in manual labour to maintain their carbon investment in Ipetí, it is just as unlikely that the head of the family in Ipetí-Embera will pay his siblings to work on carbon project land. This is not to imply that the cost of labour (adhering to common practices of the region like hours per day and salary) should not be included in a formal cost estimate. To do otherwise would exploit the labour of the Ipetí-Embera. This would place the debt of environmental problems (specifically increased atmospheric carbon dioxide), most likely created in the developed world, on the Ipetí-Embera. Yet including the price of labour in an estimate used by the Ipetí-Embera would overemphasize monetary value and neglect the core element of the project, labour. Henceforth, a basket of cost calculations were constructed. These include the following: a high formal cost, a low formal cost, and an informal cost.

The components of the **high formal** cost include those of a professional reforestation company. The calculation of these costs were arrived at through informal interviews with two Panamanian based reforestation companies, *Futuro Forestal* and *Prime Forestry*, informal interviews with inhabitants of Ipeti-Embera, and from research conducted by the students working on this project in 2004. The high estimate costs include the following: maintenance and construction of fences, preparing the land, planting, fertilizing, cleaning and maintenance, and forest protection. Included in the construction and maintenance of fences is manual labour, posts, and other materials. Included in the preparation of the land is an initial cleaning and marking. The price of planting includes the price of seeds, having a truck deliver the seeds, bags for the seeds, and finally distribution and planting. **A key factor of the high estimate is the inclusion of wage labour**. The majority of the costs from this estimate are due to the inclusion of wage labour, which is assumed to be $6 per day. A more detailed explanation of the individual costs included in this estimate can be found in appendix 2.1, annex 4.

The **low formal** cost estimate includes only the bare essentials of reforestation. The costs include the following: materials for fences, fertilizer, and chemicals for use against tree diseases. Due to traditional ecological knowledge of the environment and recent agro forestry classes conducted in Ipetí, it is very likely that many costs can be avoided. For example, seeds of native species can be harvested in the surrounding forests. Concerning the acquisition of seeds, ANAM provides seeds free of charge for reforestation projects. An extremely important aspect of the low estimate is the **exclusion of wage labour**. The residents of the community will enact a carbon project in Ipeti, and it is extremely unlikely any outsiders will be paid for maintaining the land for the project. As mentioned before, it is unlikely that family members who help maintain land for CERs will be compensated in money by the head of the family. A more likely scenario is that sons will assist their fathers free of charge and divide the benefits among the extended family. See appendix 2.1, annex 4 for explicit details.

The **informal** cost is an attempt to capture the quantity of labour necessary to invert land for carbon sequestration. The unit is in number of days, assuming an eight-hour day. The figures for this estimate come from interviews with individuals in Ipetí, as well as from interviews with Ph.D. Catherine Potvin who has extensive knowledge about reforestation in Panama. The breakdown of calculations can be found in appendix 2.1, annex 4.

All costs and benefits are calculated from the community for a whole, as well as for individual families. Not every family is included in the analysis for a number of reasons. The first reason is that not every family was present during our time in the field or during the time that our assistants in Ipeti were available. Some families simply didn't want to participate in the project, others did not have their own land, and other families could not participate based upon their land holding. Participants that could not participate because of their current land holds had either all or the vast majority of their land in existing forest. Because of the denial of averted deforestation as a means of guarding carbon stocks, those families that had all forest could not participate in the project. Many individuals who had a house in Ipeti, did not have their own land, and so they worked with their father—these people were excluded from the survey.

Transaction cost, those cost which are inherent a CDM project, are estimated to be roughly $50,000. General transaction costs of a reforestation CDM include the following: project documentation, completion of *Guia de Endoso*, validation of operational entity, development of CERs sales agreement, project registration with CDM executive board, monitoring and verification, sale of CERs, adaptation of funds levy (EcoSecurities 2003). Transaction costs can vary between $50,000 to $200,000 (ibid.). It is our belief that due to the small project size, and the assistance of the McGill pilot study, transactions will be around the $50,000.

Discount rates for the CBA were not included in the analysis due to time constraints. Also, there is difficulty in choosing an appropriate discount rate.

RESULTS

Our result section is organized as follows. First, we will examine the **proposed mitigation scenario** for the community. That is, we will present the quantitative and qualitative net land-use changes if the carbon project was implemented, based upon the responses of each landowner. Second, from these individual responses, we will present the net changes in carbon stocks occurring in the hypothetical mitigation scenario and contrast those changes with the **baseline scenario**. Third, we will present results from our **cost-benefit analysis** for each individual land-use scenario. That is, we will explain the financial feasibility assessment for each family and for the community as a whole. These results will be the basis upon which we will be able to evaluate the feasibility of implementing the CDM project in Ipetí. The final section will **access participation in a CDM**.

Not all families in Ipetí were surveyed for a number of reasons, the most obvious one being that not every family was present during our 8 days in the field to do interviews. Also, some families simply did not want to be part of the carbon study. Others reported not having any land they could put towards the project. They reported not being able to participate because of their *parcelas* were mainly all virgin forest. Finally, some households had a house in Ipetí but did not have their own land. Consequently, they worked with their father—these people were excluded from the survey. During the weekend of April 17th and 18th, our team came back to present the result of our analysis to community members. Some of the households that previously did not want to participate in the project demonstrated interest in the work being done and wanted to be surveyed. Four addition surveys were completed on the weekend of April 17th and 18th, but the results are not included in this paper.

1. Proposed Mitigation Strategy: Net Land-Use Changes

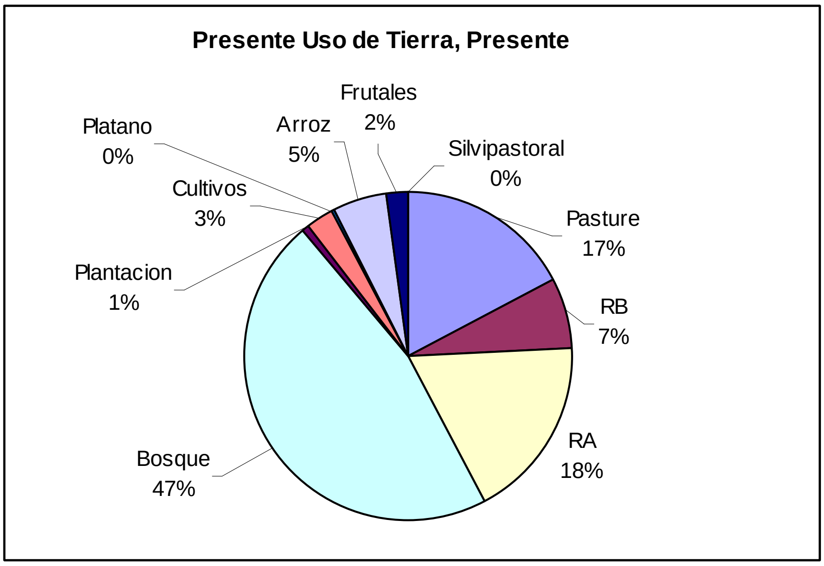
Quantitative net changes in hectares for each family are depicted in appendix 2.4). In sum, a total of about 643 ha of land out of the 3,198 ha of the *Tierra Colectiva* would be dedicated for carbon mitigation activity. This sum is obtained by adding all the land from each individual landowner interested in the project and the land owned by the *Dirigencia* (approximately 56 ha that would transformed in plantations).

In quantitative terms, with the implementation of a CDM, there would be a **total loss** of 218.4 ha of pasture, 67.6 ha of short fallow, 276 ha of high fallow and 79.17 ha of mechanized rice. There would be a **total gain** of 347.26 ha in plantations, 155.79 ha in fruit plantations and 140.67 ha in *silvipastoral*. There is a slight increase in cultivated land (*cultivos y platanos*), 1.78 ha. One landowner declared cutting some of his forest for *silvipastoral* (14.38 ha) with or without the implementation of a carbon project. Finally, 3 community members chose to put living fences (fences composed of living trees as posts and barbed wire) around their *silvipastoral* agrosystems, representing for a total of 7,580 m in perimeter.

All these changes in land-use for the community as a whole are shown in figure 3A and 3B. The figure gives us a quick snapshot of the present (figure 3A) and future (figure 3B) distribution of land type within the *Tierras Colectivas* in the case of a mitigation scenario. Figure 3A uses data from last year's study (Goldenberg et Al. 2004) while figure 3B shows the resulting new distribution of land-type in the mitigation scenario. The two charts shows where the main gains and losses in terms of land type would occur at the end of the 25 year period. For instance, one can notice a decrease in pastoral land, from 17% to 14%. The biggest **losses** occur in the high fallow (*rastrojo alto*, RA), its proportions falling from 18% to 8%, and short fallow (*rastrojo bajo*, RB), falling from 7 to 5%. The proportion of mechanized rice fields *(arroz mechanizado*) falls from 5 to 2% of the total *Tierras Colectivas*. The biggest gains occur in tree plantations, from 1% to 11%. Fruit plantations (*frutales)* increase from 2% to 8%. *Silvipastoral* systems increase from 0 to 5%.

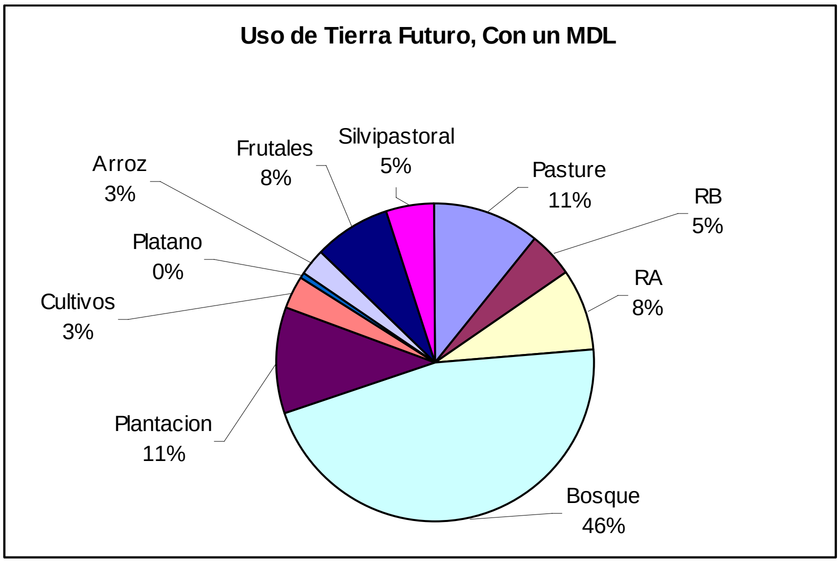
Figure 3: Changes in Land-Use, Present and Future

A) Land-Use Distribution, in 2004



Source: Goldenberg et Al. (2004)

B) Land-Use Distribution, in 2023



Proposed Mitigation Strategy: Net Changes in Carbon Stocks

Changes in land-type imply fluctuations in carbon stocks. In order to calculate the net amount of carbon that the community would sequester with the implementation of a project, we compared and contrasted carbon figures for the baseline and mitigation scenario.

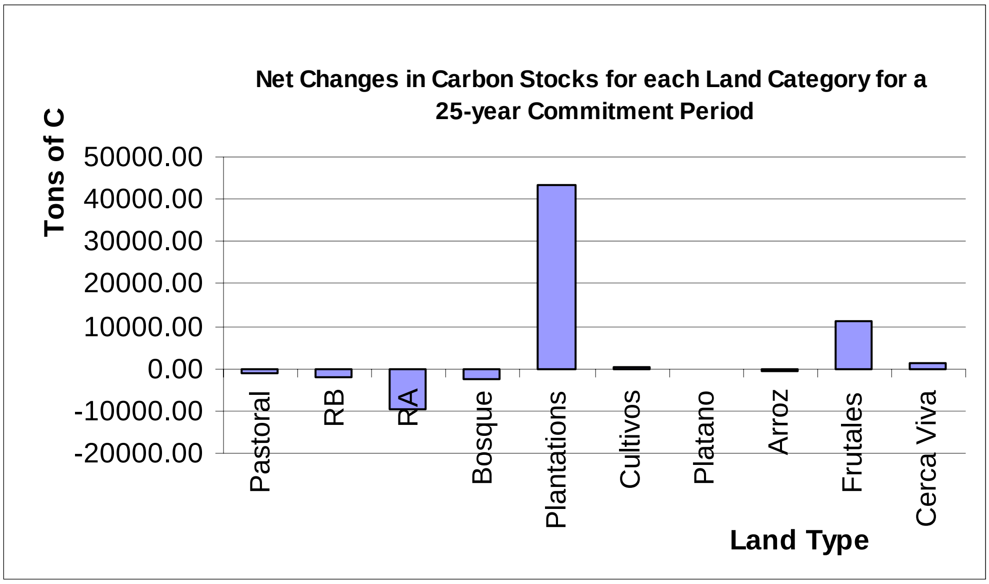
With the implementation of a CDM, the great majority of the land would be converted into three main categories of land-use: 1) tree plantations; 2) fruit plantations and 3) silvipastoral systems. Table 2 displays the net carbon gain or loss for each land-use category over a 25-year period.

Table 2: Net Changes in Carbon Stocks in the Mitigation Scenario

Land-Use Type	**Carbon Net Changes (in Tons)**
Tree Plantations	43,407.8
Fruit Plantations	11,060.9
Silvipastoral	2,110.1
Rastrojo Alto	-9586.3
Rastrojo Bajo	-1899.3
Pastoral	-917.11
Arroz Mechanizado	-538.4
Cultivos Platanos	181.6 22.6
Bosque	-2615.4

Figure 4 displays graphically values from table 2. The graph pictures the contribution of each land-use in terms of carbon sequestration potential. One can quickly see that the great majority of the carbon sequestered would largely be stocked in tree plantations, with the next biggest contributor to carbon storage would be fruit plantations and then *silvipastoral*. The largest losses of carbon would occur in tall fallow (*Rastrojo Alto, RA*).

Figure 4: Net Changes in Carbon Stocks for each land category of the *Tierra Colectivas*



Once all the net carbon gains or losses were calculated for each land category, we could derive the **net changes in carbon stocks** by adding all the net losses and gains of C for each type of land-use (values in the second column of table 2). Additionally, we added an extra 1,094 T that could come from putting living fences around some pasture and *silvipastoral* land. We obtained the sum of **43,689.9 T of C as the net total amount of Carbon that the community could sequester if a CDM project was implemented in Ipetí.** Even if this constitutes a rough estimate, this gives us an idea of the benefits that could come from CERs. Once we obtained this estimate, we then looked back at deforestation rates in the region we had calculated for the baseline scenario.

2. Comparing Mitigation and Baseline Scenarios

Looking at deforestation rates historically and during a more recent 5-year monitoring period allowed us to reach some fairly solid conclusions concerning the present rates of deforestation in the region. As mentioned earlier, deforestation rates have been positive due to a number of socio-economic factors affecting land-use patterns in Ipetí. However, there are signs that deforestation rates have decreased from 2.3% to 2% in the last 5 years, mainly due to the clearing of the forests for slash-and-burn and cattle ranching practices.

Currently, the carbon stocks that we estimated for the baseline totalled 266,836 tones of C. Over 90% of this C is found in the intact forest and our data from the baseline section suggest that intact forest disappear at an annual rate of 2% (Figure 5). Tall fallows, or secondary forests, are the second largest reservoir of C with 18,023 T of C in 2004. Under this baseline scenario, carbon depletion is likely to occur mainly due to the reduction in forest cover through time due to slash-and-burn and increase land for cattle ranching. **The total C loss calculated for the period 2004-2023 without a C project is around 6,600 T or about 2.5% of the total current C stocks.**

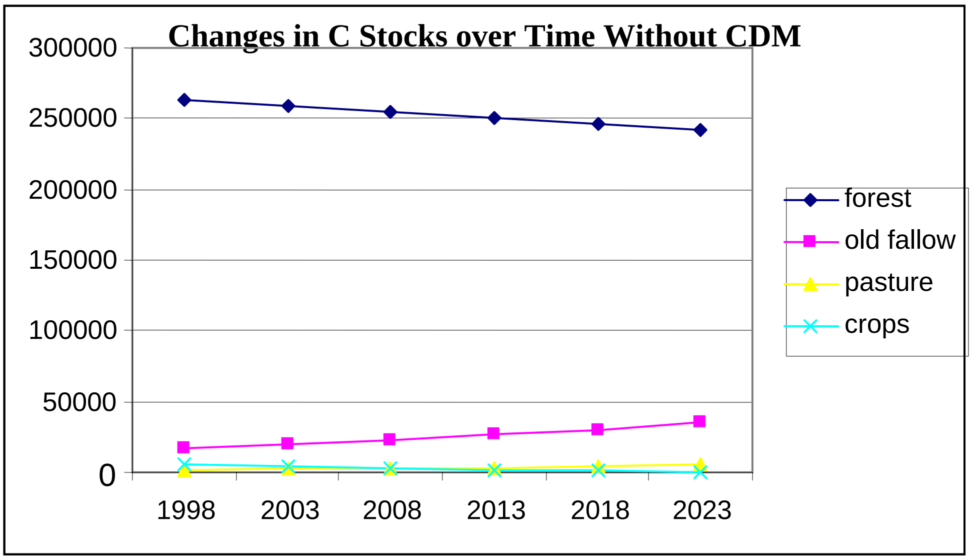


Figure 5: Baseline changes in C stocks (T of C) in the 25 years period of 1998-2023 estimated from the comparison of the two participatory maps and extended in the future.

Hence, one can confidently say that the present carbon project complies with the CDM "additionality criteria". If the project gets approval, there will be a significant increase in carbon stocks over a 25-year period. Now that we have examined the possible carbon benefits associated with such project, we now turn to the costs that would be associated with each land-use scenario. Comparing both the carbon benefits with the different costs will allow us to conclude the economic feasibility of implementing such projects in rural communities.

3. Economic Feasibility Assessment

Table 3 shows the high cost estimate for every family for the first three years of the project, as well as the totals for the community. The table also shows the high cost estimates for each surveyed family in the first three years, the total cost for 25 years, and the average cost per year. Total cost for the community appears at the bottom the table. All costs are based upon the number of hectares individuals wanted to devote to the project..

Table 3: High Cost Estimate

	Year 1	Year 2	Year 3	Total	Average Annual Cost
Yerdo R.	$7,553	$2,843	$2,713	$70,111	$2,804
Manuel R.	$51,575	$19,411	$18,526	$478,772	$19,151
Nene R.	$27,835	$10,476	$9,998	$258,389	$10,336
Wilfredo R.	$0	$0	$0	$0	$0
Antonio R.	$6,831	$2,571	$2,454	$63,410	$2,536
Pablo G.	$0	$0	$0	$7	$0
Pinel G.	$30,248	$11,384	$10,865	$280,793	$11,232
Hermini. Ch	$37,233	$14,013	$13,374	$345,633	$13,825
Chichto Ch.	$23,714	$8,925	$8,518	$220,133	$8,805
Cervelina	$15,519	$5,841	$5,574	$144,062	$5,762
Sixto G.	$11,496	$4,327	$4,129	$106,716	$4,269
Pacifico G.	$0	$0	$0	$0	$0
Ramiro G.	$0	$0	$0	-$37	-$1
Nicanor G.	$16,937	$6,374	$6,084	$157,224	$6,289
Contantino G.	$0	$0	$0	$18	$1
Julio G.	$0	$0	$0	$0	$0
Dirigencia	$60,830	$22,895	$21,850	$565,085	$22,603
Paulino S.	$37,987	$14,297	$13,645	$352,635	$14,105
Fernando S.	$8,108	$3,052	$2,912	$75,265	$3,011
Jose S.	$0	$0	$0	$46	$2
Paulino S.	$0	$0	$0	-$9	$0
Juan casama	$0	$0	$0	$0	$0
Reinedio (2)	$23,387	$8,802	$8,400	$217,098	$8,684
Rufino C.	$0	$0	$0	$0	$0
Paneso R.	$30,793	$11,590	$11,061	$285,852	$11,434
Eladio C.	$0	$0	$0	$0	$0
Aurelio C.	$0	$0	$0	$0	$0
Eucevio C.	$0	$0	$0	$0	$0
Antonio C.	$0	$0	$0	$0	$0
Chariano C.	$0	$0	$0	-$1	$0
Jose Degaisa	$0	$0	$0	-$8	$0
Marco D	$0	$0	$0	$22	$1
Nesar D.	$3,555	$1,338	$1,277	$33,005	$1,320
Maurisio D.	$19,431	$7,313	$6,980	$180,377	$7,215
Rocali D.	$48,431	$18,228	$17,396	$450,234	$18,009
Decidiero Caisamo	$79,210	$29,812	$28,452	$735,310	$29,412
Fermin C.	$8,195	$3,084	$2,944	$76,071	$3,043
Alfredo C.	$0	$0	$0	$0	$0
Tecaido C.	$0	$0	$0	$0	$0
Jubenal Q.	$22,604	$8,507	$8,119	$209,831	$8,393
Marco Q.	$0	$0	$0	$0	$0
Diogene Q.	$0	$0	$0	$0	$0

Juvenal Q.	$0	$0	$0	$0	$0
David C.	$0	$0	$0	$0	$0
Quillemo C.	$0	$0	$0	$0	$0
Tito C.	$0	$0	$0	$0	$0
Jaime C.	$2,325	$875	$835	$21,583	$863
Antoníno C.	$2,694	$1,014	$968	$25,004	$1,000
Minolio M.	$0	$0	$0	$15	$1
Familia Mecha	$0	$0	$0	$14	$1
Deni M.	$0	$0	$0	$0	$0
Fulgenio P.	$3,643	$1,371	$1,308	$33,816	$1,353
Bonarge P.	$8,166	$3,073	$2,933	$75,802	$3,032
Felix B.	$29,629	$11,151	$10,643	$275,394	$11,016
Bonifacio	$0	$0	$0		$0
Lisandro Fl.	$9,699	$3,650	$3,484	$90,037	$3,601
Juan+Salomon B.	$6,895	$2,595	$2,477	$64,010	$2,560
Oldemar B.	$6,839	$2,574	$2,457	$63,489	$2,540
Tircio B.	$0	$0	$0	$2	$0
Ariel M.	$13,541	$5,096	$4,864	$125,702	$5,028
Noreberto C.	$0	$0	$0	$0	$0
Jeremia	$4,331	$1,630	$1,556	$40,205	$1,608
Arcindo U.	$21,761	$8,190	$7,817	$202,655	$8,106
Ultiminio C.	$12,584	$4,736	$4,520	$116,818	$4,673
Totals	**$693,577**	**$261,041**	**$249,131**	**$6,440,588**	

On a per hectare basis, the first year costs roughly $1077.40, the second year costs $405, the third year costs $387, and in 25 years it costs about $10,001.50. This is an average of roughly $400 per year. As can be observed from the figure, the highest costs are incurred during the first year of the project. The individuals with $0 cost estimates are those that are not participating in the project or were not interviewed. Many of these costs are substantial due to the fact that many individuals desired to devote large tracts of land into the project. **With 43,689.9 tC sequestered at a price of $6.49 millions (transaction costs included), the minimum price of a CER must be $149 in order to make that project financially feasible.**

Table 4 shows the low cost estimate for implementing a CDM in Ipetí-Embera. A complete list of details concerning the calculation of this estimate can be found in appendix 2.3, annex 4. Costs were calculated for the first year, second year, third year, every year after the third year until the twenty fifth year, and finally the total for all the years. On a per hectare basis, the first year costs roughly $173, the second year costs $30, the third year costs $45, and in 25 years it costs about $688. This is an average of roughly $28 per year. Again, the greatest costs are incurred in the first year of the project. The total costs for the low estimate is around $443,511. Adding a $50,000 transaction cost to the low estimate total makes the cost about $493,511. The daily income of the region, which for most is under a dollar a day, is similar to the average costs, many of which are over $350 per year, of the low estimate. **With 43,689.9 tC sequestered at a price of 493, 511 (transaction costs included), the minimum price of A CER must be $11 in order to make that project financially feasible.**

Table 4: Low Cost Estimate for Implementing the CDM

	Year 1	Year 2	Year 3	Each year > year 3	Total	Average / year
Yerdo R.	$1,213	$210	$315	$140	$4,823	$193
Manuel R.	$8,282	$1,436	$2,154	$957	$32,935	$1,317

Nene R.	$4,469	$775	$1,163	$517	$17,774	$711
Wilfredo R.	$0	$0	$0	$0	$0	$0
Antonio R.	$1,097	$190	$285	$127	$4,362	$174
Pablo G.	$0	$0	$0	$0	$0	$0
Pinel G.	$4,857	$842	$1,263	$562	$19,316	$773
Hermini. Ch	$5,979	$1,037	$1,555	$691	$23,776	$951
Chichto Ch.	$3,808	$660	$990	$440	$15,143	$606
Cervelina	$2,492	$432	$648	$288	$9,910	$396
Sixto G.	$1,846	$320	$480	$213	$7,341	$294
Pacifico G.	$0	$0	$0	$0	$0	$0
Ramiro G.	$0	$0	$0	$0	$0	$0
Nicanor G.	$2,720	$472	$707	$314	$10,815	$433
Contantino G.	$0	$0	$0	$0	$0	$0
Julio G.	$0	$0	$0	$0	$0	$0
Dirigencia	$9,768	$1,694	$2,541	$1,129	$38,872	$1,555
Paulino S.	$6,100	$1,058	$1,587	$705	$24,258	$970
Fernando S.	$1,302	$226	$339	$151	$5,177	$207
Jose S.	$0	$0	$0	$0	$0	$0
Paulino S.	$0	$0	$0	$0	$0	$0
Juan casama	$0	$0	$0	$0	$0	$0
Reinedio (2)	$3,755	$651	$977	$434	$14,934	$597
Rufino C.	$0	$0	$0	$0	$0	$0
Paneso R.	$4,944	$857	$1,286	$572	$19,664	$787
Eladio C.	$0	$0	$0	$0	$0	$0
Aurelio C.	$0	$0	$0	$0	$0	$0
Eucevio C.	$0	$0	$0	$0	$0	$0
Antonio C.	$0	$0	$0	$0	$0	$0
Chariano C.	$0	$0	$0	$0	$0	$0
Jose Degaisa	$0	$0	$0	$0	$0	$0
Marco D	$0	$0	$0	$0	$0	$0
Nesar D.	$571	$99	$149	$66	$2,270	$91
Maurisio D.	$3,120	$541	$812	$361	$12,408	$496
Rocali D.	$7,777	$1,349	$2,023	$899	$31,122	$1,245
Decidiero Caisamo	$12,719	$2,206	$3,308	$1,470	$50,582	$2,023
Fermin C.	$1,316	$228	$342	$152	$5,233	$209
Alfredo C.	$0	$0	$0	$0	$0	$0
Tecaido C.	$0	$0	$0	$0	$0	$0
Jubenal Q.	$3,630	$629	$944	$420	$14,434	$577
Marco Q.	$0	$0	$0	$0	$0	$0
Diogene Q.	$0	$0	$0	$0	$0	$0
Juvenal Q.	$0	$0	$0	$0	$0	$0
David C.	$0	$0	$0	$0	$0	$0
Quillemo C.	$0	$0	$0	$0	$0	$0
Tito C.	$0	$0	$0	$0	$0	$0
Jaime C.	$373	$65	$97	$43	$1,485	$59
Antonino C.	$433	$75	$113	$50	$1,720	$69
Minolio M.	$0	$0	$0	$0	$0	$0
Familia Mecha	$0	$0	$0	$0	$0	$0
Deni M.	$0	$0	$0	$0	$0	$0
Fluencio P.	$585	$101	$152	$68	$2,326	$93
Bonarge P.	$1,311	$227	$341	$152	$5,214	$209
Felix B.	$4,751	$824	$1,236	$549	$19,113	$765
Bonifacio	$0	$0	$0	$0	$0	$0
Lisandro Fl.	$1,557	$270	$405	$180	$6,194	$248
Juan+Salomon B.	$1,107	$192	$288	$128	$4,403	$176

Oldemar B.	$1,098	$190	$286	$127	$4,367	$175
Tircio B.	$0	$0	$0	$0	$0	$0
Ariel M.	$2,174	$377	$566	$251	$8,647	$346
Noreberto C.	$0	$0	$0	$0	$0	$0
Jeremia	$695	$121	$181	$80	$2,766	$111
Arcindo U.	$3,494	$606	$909	$404	$14,089	$564
Ultiminio C.	$2,021	$350	$526	$234	$8,036	$321
	$111,362	**$19,311**	**$28,967**	**$12,874**	**$443,511**	

Table 3 shows the number of days necessary per year to enact the given land-use changes for the first, second, third, and years following the third, as well as the total, and average number of labor days that will have to be dedicated for this project.

For instance, if we take the case of Fluencio Pacheco (highlighted above), we can see it will take him 284 days to enact his land-use changes during the first year, 169 the second year, 169 the third year, and finally 85 days per year until the project is completed. In the case of Fluencio's brother, Bonarge, he would need to work for 637 days for the first year in order to invert his land. Obviously, he cannot work for more days than there are in a year. Hence, he will either have to have some help him with the project. If one extra person helped, then both could work for roughly 318 days during the first year to realize the proposed changes.

On a per hectare basis, the first year necessitates 84 days of labour, the second year 50 days, the third year 50 days, each year following 25 days, for a total of 734 days in 25 years. This averages roughly 29 days per hectare per year. A day of labour is considered eights hours in the field. Again, it is evident that for many, this project will require full time labor**. With 447,054 days needed for 25 years, this would require that roughly 49 people work 365 days a year for 25 years to upkeep the project.**

Just to finish the first year of labour necessary to enact this project, it would take over 135 individuals working for a full year (365). While the population of Ipetí is about 500, many are children too young to work, some are too old to work, women often do not participate in forestry labour, and some work outside the city. Hence, 135 people probably the most optimistic estimate of the number of available workers. On top of these considerations, residents have numerous other occupations, making it impossible for them to work for 365 days/yr on the carbon project. A project of this scale would require outside labour. Otherwise, the project would have to be implemented over a higher number of years.

Table 5: Labor Estimate for Implementing a CDM in Ipetí

	Year 1	Year 2	Year 3	Each year > 3rd year	Total 25y	Average/year
Yerdo R.	589	351	351	175	5,145	206
Manuel R.	4,021	2,394	2,394	1,197	35,137	1,405
Nene R.	2,170	1,292	1,292	646	18,963	759
Wilfredo R.	0	0	0	0	0	0
Antonio R.	533	317	317	159	4,654	186
Pablo G.	0	0	0	0	0	0
Pinel G.	2,358	1,404	1,404	702	20,607	824
Hermini. Ch	2,903	1,728	1,728	864	25,366	1,015
Chichto Ch.	1,849	1,101	1,101	550	16,155	646
Cervelina	1,210	720	720	360	10,573	423
Sixto G.	896	534	534	267	7,832	313

Pacifico G.	0	0	0	0	0	0
Ramiro G.	0	0	0	0	-3	0
Nicanor G.	1,320	786	786	393	11,538	462
Contantino G.	0	0	0	0	0	0
Julio G.	0	0	0	0	0	0
Dirigencia	4,746	2,825	2,825	1,413	41,471	1,659
Paulino S.	2,962	1,763	1,763	881	25,880	1,035
Fernando S.	632	376	376	216	6,145	246
Jose S.	0	0	0	0	0	0
Paulino S.	0	0	0	0	0	0
Juan casama	0	0	0	0	0	0
Reinedio (2)	1,823	1,085	1,085	651	18,321	733
Rufino C.	0	0	0	0	0	0
Paneso R.	2,401	1,429	1,429	815	23,187	927
Eladio C.	0	0	0	0	0	0
Aurelio C.	0	0	0	0	0	0
Eucevio C.	0	0	0	0	0	0
Antonio C.	0	0	0	0	0	0
Chariano C.	0	0	0	0	0	0
Jose Degaisa	0	0	0	0	0	0
Marco D	0	0	0	0	0	0
Nesar D.	277	165	165	83	2,422	97
Maurisio D.	1,515	902	902	541	15,222	609
Rocali D.	3,800	2,254	2,254	1,296	36,826	1,473
Decidiero Caisamo	6,176	3,676	3,676	1,838	53,964	2,159
Fermin C.	639	380	380	213	6,085	243
Alfredo C.	0	0	0	0	0	0
Tecaido C.	0	0	0	0	0	0
Jubenal Q.	1,762	1,049	1,049	554	16,041	642
Marco Q.	0	0	0	0	0	0
Diogene Q.	0	0	0	0	0	0
Juvenal Q.	0	0	0	0	0	0
David C.	0	0	0	0	0	0
Quillemo C.	0	0	0	0	0	0
Tito C.	0	0	0	0	0	0
Jaime C.	181	108	108	54	1,584	63
Antoníno C.	210	125	125	63	1,835	73
Minolio M.	0	0	0	0	0	0
Familia Mecha	0	0	0	0	0	0
Deni M.	0	0	0	0	0	0
Fulgenio P.	284	169	169	85	2,482	99
Bonarge P.	637	379	379	189	5,563	223
Felix B.	2,334	1,380	1,380	693	20,349	814
Bonifacio	0	0	0	0	0	0
Lisandro Fl.	756	450	450	260	7,369	295
Juan+Salomon B.	538	320	320	160	4,698	188
Oldemar B.	533	317	317	159	4,659	186
Tircio B.	0	0	0	0	0	0
Ariel M.	1,056	628	628	336	9,709	388
Noreberto C.	0	0	0	0	0	0
Jeremia	338	201	201	100	2,951	118
Arcindo U.	1,721	1,016	1,016	612	17,216	689
Ultiminio C.	981	584	584	292	8,573	343
Total	**49,406**	**29,382**	**29,382**	**15,404**	**447,054**	

Table 6 shows the total amount of quantifiable monetary benefits possible in a carbon project after 25 years. The first estimate is a low estimate of the income from CERs, when the price per ton of sequestered carbon is $4. The second is a high estimate of the income from CERs, when the price per ton of sequestered carbon is $10. The next column is a high estimate of lumber sales assuming the height of trees to be 25 meters in twenty-five years. The final column is a low estimate for lumber sales; it assumes trees to be 15 meters in 25 years, a reasonable estimate according to PhD C. Potvin (personal communication, 2005).

Table 6: Total Monetary Benefits for a CDM Project in Ipetí

Dueño	CER $4/ton	CER $10/ton	Lumber High	Lumber Low
Yerdo R.	$2,510	$6,274	$602,181	$361,309
Manuel R.	$17,137	$42,844	$4,112,183	$2,467,310
Nene R.	$8,269	$20,673	$1,109,439	$665,663
Wilfredo R.	$71	$177	$0	$0
Antonio R.	$2,064	$5,161	$462,932	$277,759
Pablo G.	$0	$0	$0	$0
Pinel G.	$10,492	$26,229	$1,206,091	$723,655
Hermini. Ch	$12,598	$31,496	$1,484,406	$890,644
Chichto Ch.	$7,270	$18,175	$945,364	$567,218
Cervelina	$4,039	$10,097	$618,846	$371,308
Sixto G.	$2,664	$6,661	$458,293	$274,976
Pacifico G.	$0	$0	$0	$0
Ramiro G.	$0	$0	$0	$0
Nicanor G.	$5,051	$12,628	$675,199	$405,119
Contantino G.	$0	$0	$0	$0
Julio G.	$0	$0	$0	$0
Dirigencia	$26,845	$67,111	$4,776,214	$2,865,728
Paulino S.	$12,852	$32,130	$1,514,472	$908,683
Fernando S.	$631	$1,579	$69,305	$41,583
Jose S.	$0	$0	$0	$0
Paulino S.	$0	$0	$0	$0
Juan casama	$0	$0	$0	$0
Reinedio (2)	$934	$2,334	$266,422	$159,853
Rufino C.	$0	$0	$0	$0
Paneso R.	$1,826	$4,564	$976,510	$585,906
Eladio C.	$0	$0	$0	$0
Aurelio C.	$0	$0	$0	$0
Eucevio C.	$0	$0	$0	$0
Antonio C.	$0	$0	$0	$0
Chariano C.	$0	$0	$0	$0
Jose Degaisa	$0	$0	$0	$0
Marco D	$0	$0	$0	$0
Nesar D.	$1,295	$3,237	$141,740	$85,044
Maurisio D.	$0	$0	$221,323	$132,794
Rocali D.	$4,374	$10,935	$1,076,734	$646,041
Decidiero Caisamo	$25,889	$64,722	$4,485,861	$2,691,517
Fermin C.	$239	$599	$121,320	$72,792
Alfredo C.	$0	$0	$0	$0
Tecaido C.	$0	$0	$0	$0
Jubenal Q.	$7,265	$18,163	$1,372,977	$823,786

Marco Q.	$0	$0	$0	$0
Diogene Q.	$0	$0	$0	$0
David C.	$0	$0	$0	$0
Quillemo C.	$0	$0	$0	$0
Tito C.	$0	$0	$0	$0
Jaime C.	$389	$971	$99,819	$59,892
Antoníno C.	$392	$981	$107,379	$64,427
Minolio M.	$0	$0	$0	$0
Familia Mecha	$0	$0	$0	$0
Deni M.	$0	$0	$0	$0
Fulgenio P.	$1,531	$3,827	$257,709	$154,626
Bonarge P.	$2,382	$5,955	$520,573	$312,344
Felix B.	$11,886	$29,715	$1,179,450	$707,670
Bonifacio	$0	$0	$0	$0
Lisandro Fl.	$1,115	$2,787	$205,186	$123,111
Juan+Salomon B.	$1,526	$3,814	$388,282	$232,969
Oldemar B.	$2,055	$5,137	$500,815	$300,489
Tircio B.	$0	$0	$0	$0
Ariel M.	$2,151	$5,376	$432,007	$259,204
Noreberto C.	$0	$0	$0	$0
Jeremia	$1,442	$3,605	$345,331	$207,198
Arcindo U.	$1,030	$2,575	$247,892	$148,735
Ultiminio C.	$4,249	$10,623	$501,674	$301,005
Total	**$184,462**	**$461,154**	**$31,483,930**	**$18,890,358**

One might ask why it appears that some individuals receive no benefits from CERs, but receive benefits from lumber. This is due to the fact that these individuals decided to cut forest to start lumber plantations.

Finally, it is important to realize that although these benefits are based on a twenty-five year project, it is possible that many of those benefits occur before the end of the 25-year period. For example, carbon credits could be paid up front, meaning that the value of 25 years of sequestering would be realized in the first year of the project.

Figure 6: Cost Benefit Analysis for Six Scenarios:

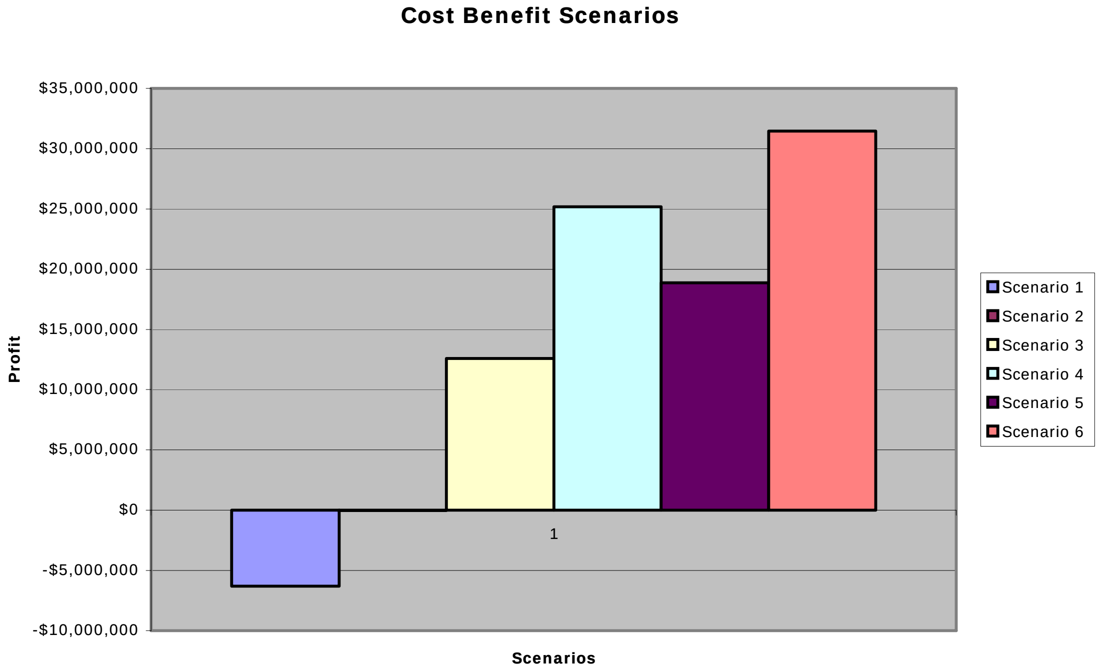


Figure 6 represents the estimates of six different collective CBA scenarios over 25 years. All cost scenarios include $50,000 as a transaction cost. Scenario 1, represents the highest implementation cost ($6.49 million) and a low return for CERs ($4 per tC). The loss for scenario 1 is roughly $6.1 million.

Scenario 2 represents low implementation costs for the inversion of all the land ($493,511) and a higher return for CERs ($10 per tC). There is a loss of $32, 357 implied, representing a serious economic barrier in implementing a carbon sequestration project. It implies that even with the absolute lowest costs, a price of $10 per tC will not cover the costs of implementing this project. However, if we exclude the transaction cost of $50,000, then there could be a $17, 643 net profit. Realistically however, these transaction fees cannot be avoided.

Scenario 3 is a high implementation cost ($6.49 million), low CER profit ($4 per tC), and low returns from wood sale. The profit for scenario 3 would be around $12.85 millions.

Scenario 4 includes high implementation cost, low CER return, and high wood sale (trees 25m). The profit for this scenario would be around $25.17 millions.

Scenario 5 involves low implementation cost, high CER return, and low return from timber sales. The profit for scenario 5 is then $18.85 millions. Scenario 6 includes low implementation cost, high CER return, and high return from lumber. The profit of scenario 6 is $31.45 millions. The graph shows that even with the highest implementation cost, the lowest CER return, and the lowest returns from lumber sales, the endeavor can still be profitable for the community. Without lumber sales however, the project does not make a profit unless the price of carbon is higher than $10.70. This last point is significant and will be further discussion in the analysis section of the paper.

Table 7 compares the different possible land use benefits over a 25-years time period. It is relevant to compare the economic returns one could get from the different economic returns from possible land-use scenarios before implementing a CDM in the community. The table is cost comparison of different land use types over 25 years for 12 hectares of land. Information about cattle ranching comes Jeremia Cansari, a resident of Ipetí who is involved in cattle ranching on his father's land. According to his interviews, starting with 2 cows, in 5 years, there will be a total of 12 cows. The price of a fully-grown cow is roughly $400. The price of maintaining a cow varies between $25-80 per cow for things such as vaccinations. Farmers do not supplement the cattle food sources; hence there is no input cost for food. According to Jeremia, 6 hectares of land should be sufficient to sustain these cows. Using 12 hectares would allow the farmer to rotate land to ensure sustainable future production. This process assumes that every 5 years the farmer starts the process of buying 2 cows, and selling 12 at the end. In reality, it is highly unlikely that the farmer would purchase more than one cow every 5 years. Introducing one cow every 5 years would allow for reproduction without inbreeding. Hence, the costs of cattle ranching may be overestimated. If the farmer sells his mature cows after the 5-year period, he should be able to sell in total about 60 cows. The benefit of cattle for the 25th year includes the benefits one would receive from a cow born in the 25th year, but sold five years later. The same is true for all cows born after year 21 to year 25. For this estimate the value of cattle is high, as well as the expected constant return of 12 total cattle in a 5-year period. With this estimate, in 25 years, the net benefit of 12 hectares of cattle land is $18,000. As can be scene, costs are highest in the first year of purchasing a cow, and then stable off at about $34 per cow (or $80 per year).

Table 7: Land Use Scenarios, Net Profits in 25 Years for a 12 Hectare Plot

	Cattle			**CDM**			**Rice Mech**			**Lumber**		
Year	Costs	Benefits	Net	Costs	Benefits	Net	Cost	Benefits	Net	Cost	Benefits	Net
1	$880	$0	-$880	$2,076	$9,600	$7,524	$0	$420	$420	$2,076	$0	-$2,076
2	$80	$0	-$80	$360	$0	-$360	$0	$420	$420	$360	$0	-$360
3	$80	$0	-$80	$540	$0	-$540	$0	$420	$420	$540	$0	-$540
4	$80	$0	-$80	$240	$0	-$540	$0	$420	$420	$240	$0	-$540
5	$80	$4,800	$4,720	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
Net Yr 5	**$1,200**	**$4,800**	**$3,600**	**$3,756**	**$9,600**	**$5,844**	**$0**	**$2,100**	**$2,100**	**$3,756**	**$0**	**-$3,756**
6	$880	$0	-$880	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
7	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
8	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
9	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
10	$80	$4,800	$4,720	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
Net Yr 10	**$2,400**	**$9,600**	**$7,200**	**$4,956**	**$9,600**	**$4,644**	**$0**	**$4,200**	**$4,200**	**$4,956**	**$0**	**-$4,956**
11	$880	$0	-$880	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
12	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
13	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
14	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
15	$80	$4,800	$4,720	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
Net Yr 15	**$3,600**	**$14,400**	**$10,800**	**$6,156**	**$9,600**	**$3,444**	**$0**	**$6,300**	**$6,300**	**$6,156**	**$0**	**-$6,156**
16	$880	$0	-$880	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
17	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
18	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
19	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240

20	$80	$4,800	$4,720	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
Net Yr 20	**$4,800**	**$19,200**	**$14,400**	**$7,356**	**$9,600**	**$2,244**	**$0**	**$8,400**	**$8,400**	**$7,356**	**$0**	**-$7,356**
21	$880	$0	-$880	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
22	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
23	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
24	$80	$0	-$80	$240	$0	-$240	$0	$420	$420	$240	$0	-$240
25	$80	$4,800	$4,720	$240	$0	-$240	$0	$420	$420	$240	$1,020,000	$1,019,760
Net Yr 25	**$6,000**	**$24,000**	**$18,000**	**$8,256**	**$9,600**	**$1,044**	**$0**	**$10,500**	**$10,500**	**$8,256**	**$1,020,000**	**$1,011,444**

Note: Transaction costs are not included in the CDM cost or net estimate.

Benefits from a CDM project are measured for 25 years using 12 hectares of land. The measurement assumes that 80 tons of carbon will be sequestered per hectare. This is a moderate estimate. For example switching from pasture to plantation, in 25 years for 1 hectare would sequester 120 tons of carbon. Switching from pasture to fruits would sequester about 67 tons of carbon per hectare in 25-year period. With the diversity of land types, 80 tons per hectare over 25 years is a moderate estimate. The price of a CER is assumed to be $10 per ton, and all of the benefits are received in the first year. Costs are based on low estimates for reforestation. The benefits are received all at once, certainly allowing for the finance of reforestation. Yet by the end of 25 years, very little profit is left over from the CDM. **If transaction costs are $50,000, and Ipetí reforestation efforts account for roughly 550 hectares, transaction costs per hectare become $90. With 12 hectares, each at $90 in transaction costs, the total transaction cost is $1,090 (Net profit $1,044 minus transaction cost of 12 hectares, yielding the sum of $1,090). That implies a loss of $46 over 25 years.**

Currently, the *Dirigencia* is renting rice fields to *colonos* in Ipetí at a price of $35 per hectare per year. The benefits for mechanized rice are assumed for 12 hectares. We assume that there are no costs in land maintenance. We used a low cost estimate for plantation for the reforestation process. Again, 12 hectares are used for the plot size. The high payback estimate from wood assumes an average tree height of 25 meters for a 25-year period.

If we perform another scenario for a CDM and we look at a switch from pasture land to plantation, the maximum CDM profit would be of $5,150. This estimate includes transaction costs. This is significantly lower than all other land use scenarios. **In comparison to cattle ranching, a CDM project would have an opportunity cost of -$12,850. Yet, if the CDM project has lumber as an end product, the profit could be about 56 times greater than cattle ranching.**

4. Assessing Participation in a CDM

Appendix 3.1 gives a list of all the family groups in Ipetí. We can observe about 25 extended family groups in Ipetí. As mentioned earlier, CDMs entail a great deal of costs and benefits who are not going to be equally divided and this might affect future family networks, ties and dynamics within the community. Table 3 in appendix shows the level of carbon sequestration participation per family.

Each family is recorded and was given a number for a given group. We then organized families in a spreadsheet so that we can quickly see the quantity of land put in the project and if there is relative equality in project participation. Because some families showed higher interest in the project, not all families have put the same amount of land for the CDM. Also, the amount of land one can put also depends on the number of children per family and the quantity of terrain the family can start with.

We can observe that quantities of land given for the project are not equal (see appendix 3.3). The mean amount of land put per family is 25.7 hectares, but this number is not representative of the reality because 3 families reported not being interested in the carbon project. The different levels of willingness and commitment to participate in the project might be a serious impediment in the future. How this will potentially affect the organizational capacity of implementing a CDM will be examined in the last part of the discussion section.

DISCUSSION

The discussion section is organized according to the main objectives explained earlier in this paper. First, we will reflect upon the methodology used in this study by discussing some of the benefits and limitations of carrying out workshops and individual interviews. Second, we will reiterate some main take-home message we derived from the results of both the carbon calculations (carbon benefits) and economic feasibility assessment. In doing so, we provide some context on some of the current national, legal and economic barriers related to the implementation of carbon projects for rural communities. Finally, we will wrap up this discussion by bringing forth some of the main points of the academic literature on social capital, and relate these to the challenges in developing a CDM for Ipetí.

1. Interviews: Limitations and Benefits

As it was discussed earlier in the methodology, efforts were made to develop a methodology that was based on inclusive participatory methods, both throughout workshops and individual interviews. However, it is important to remember that the concept of participation is a very flexible term, which is being used abundantly in many different contexts by many different actors with intentions often more political than scientific (Chambers, 1994). It was sometimes difficult during workshops to ensure fair and competent participation from each land-owner, as some seem to hold more political power in the community as others. Interviews allowed us to speak individually in a more calm setting some of the questions each of them could have related to the carbon project.

Interviews as a methodological tool carry important drawbacks. One important limitation was the difficulty encountered in the attempt to get the *dueños* draw their *parcelas* and the loss of accuracy of taking such measurements. Because some of the *dueños* were not comfortable with drawing, we sometimes had to rely on verbal descriptions. Emphasis was also placed on posing a diversity of questions and re-phrasing questions. However, the limited time spent with each *dueño* likely lead to some misunderstanding between the interviewers and the *dueño* and therefore, to a loss of accuracy. Another important limitation was with respect to land use definition. Initially, a great effort was made before to achieve consensus on these definitions. However, because this consensus was achieved with a limited number of community members (4-5), and because people's use of land use terms is flexible, confusion over land use definitions by the *dueños* probably lead to some loss of accuracy when drawing the their *parcelas*.

Nevertheless, interviews carried a number of direct and indirect benefits. Some of the direct benefits include a clarification of the CDM activity and the various procedures such activity would entail in terms of creating potential livelihood opportunities. Interviews allowed discussing individually with each landowner some of the questions and opinions concerning the project and raise some potential ideas and fears and/or expectations concerning the management of the project. Interviews were also useful in helping to ensure each landowner understood the potential benefits but also risks associated with carrying out a CDM project. For instance, individual participatory mapping exercise helped in building personal commitment to the actual implementation of the project as well as pointing out the possible difficulties that could arise in the next years with the implementation of a CDM in Ipetí. This last point demonstrates considerable understanding and analytical capacity from the part of the members in the community. Indeed, many of the landowners we talked to shared with us some of their fears regarding the project. The two most common problems that were discussed were: 1) the leakage problem; 2) the compensation schemes (how were people going to get their money and when?); and finally 3) the rights to land after the 21 years commitment period. Some of the *duenos* had a hard time accepting the fact that they would not receive any form of compensation for not cutting down their forest. Some pointed out to the problem of controlling the deforestation process outside of the *Tierras Colectivas*. That is, they pointed out to the problem that some land-owners might decide to protect their forest inside the TC but go elsewhere to put their cows in new pasture land (leakage problem).

After taking the time to discuss with them some of the management issues associated with the project, many of the landowners were happy we had taken the time to sit with each of them and clarified some questions and concerns they had for the project.

2. Barriers to Equity and Development in the CDM Projects

Barriers at both the national, regional and local sphere are affecting the economic and social feasibility of carbon sequestration projects for local indigenous communities. A major challenge in the next coming years will be in identifying alternatives that would not only store additional carbon but significantly enhance local livelihoods, and ensure long term sustainability and economic security. Goldenberg et Al. (2004) describe various factors affecting the success of AR practices in Panama: 1) the national and legal policy framework; 2) the lack of land tenure and clear status of land rights; 3) the absence of available capital and market infrastructure and access to information; 4) the presence of technical and financial support; 5) the presence or absence of local skills and knowledge and finally 6) the sustainability of land use practices (Ibid.). All these factors, at the macro and micro scale, affect significantly the long term sustainability and equitability of carbon projects.

Scheer and Smith (2003) have pointed out that tradeoffs often exist between the social benefits of projects and their attractiveness to investors. That is, small-scale, community-based agroforestry projects such as small-scale plantations, agroforests, secondary forest-fallows, community forest rehabilitation and multiple-use forest management have the highest potential for livelihood benefits pose the fewest risks because production of carbon credits are highly dependent upon the active collaboration of communities. Moreover, such small-scale projects hold substantial benefits and ecosystem services such as the preservation of biodiversity, protection of watersheds, soil productivity and erosion, etc. Meanwhile, carbon-sequestering activities such as large-scale plantations and strict forest protection pose considerable livelihood risks for communities, the most easily identifiable being the loss of access to land and forest, which these communities use under customary law.

However, due to high transaction costs involved in small-scale projects, the data available so far indicates that large-scale projects are more cost-efficient (Ibid). In addition to this economic barrier, authors point out that, in order to be successful, community-based projects require a number of socio-economical preconditions.

Consequently, one could argue that considerable efforts will have to be put forward in local-capacity building activities.

As pointed out by Klooster and Masera (2000) as well as Brown and Corbera (2003), the experience of community-forest management holds important potential in both sequestering carbon and promoting rural development. Klooster and Masera, in examining the case of Mexico's forests, point out however that realizing this potential will demand both capital and social investment, on top of technical assistance and training in business and forest management. In other words, development planners cannot focus solely their efforts on the scientific and the technical aspects of CDM projects. They conclude by saying that current policies of the Mexican state tend to favor large-scale plantations as part of CDM activities and exclude community-based forest management practices from CDM activities. This exclusion is largely due to the fact that many of the environmental and social services are not properly taken into account by state planners and managers. They argue however that when adequately implemented and "under appropriate social arrangements", community forest management projects avoid deforestation and restore forest cover and density.

Currently, the legal framework in which CDM activities are addressed in Panama is inadequate in promoting the adoption of CDM projects by small-scale farmers (Fisher and Vasseur, 2002). Reasons for this lack of legal support are similar to the ones discussed earlier in the Mexico case. In 1992, a law of reforestation incentives (law 24) was established to create incentives and tax breaks for reforestation (Leg. Assembly, 1993 in Fischer and Vasseur). This law, however, does not include the provision of financial incentives to small land-owners to reforest their land (Fischer and Vasseur 2000, 2002). Prior to 1962, an agrarian code existed which promoted the traditional occupation of land through deforestation as means to gaining title. A forestry law was passed in 1994 as a measure to combat this, however, it is still not effectively implemented (Fischer and Vasseur, 2000), nor does it help facilitate reforestation among small farmers. Under this law, reforesters are required to obtain permits before harvesting trees, but this process is fraught with uncertainty and is perceived as overly burdensome by potential reforesters (Fischer and Vasseur, 2002).

In the locally-specific case of Ipeti, some of these barriers are more or less apparent. For instance, the lack of legal land title over the *Tierra Colectivas* is an important legal barrier in implementing a CDM. Insecure land tenure implies that farmers could be evicted from their lands, which has been shown by many authors to also pose a barrier to the adoption of sustainable land use practices. Moreover, interviews conducted in 2004 indicated that the lack of legal tenure in Ipetí has been responsible for the encroachment of neighboring colonists into the *Tierra Colectiva*, which may particularly pose a constraint for certain *dueños* to invest in reforestion practices (Goldenberg et Al. 2004).

Another pressure issue is the status of landholdings in Ipetí. Communal landholdings have been identified as an important means for reforestation activities under the CDM (Klooster and Masera, 2000). As such, the *Tierra Colectivas* could provide a potential opportunity for the co-management of land use by the community for a carbon project. This possibility, however, is uncertain due to the fact that the *Tierra Colectivas* holds a particular status that is not representative of either private or completely communal land. That is, the *Tierras Colectivas* are not communal land in the traditional sense of ‘commons’ land. They are regulated by a traditional rule that dictates that the land may not be sold, but *dueños* may effectively manage their lands as if they were privately owned (Goldenberg et Al. 2004).

Another major barrier with implementing a CDM in Ipetí was the absence of any compensation scheme for averted deforestation. Families could not understand how a CDM essentially consist in sequestering carbon by putting more trees, but that initiative would not compensate for protecting already-existing forests. Many of the younger families were interested in participating but were excluded because they only had forests in their *parcelas* and thus could not sequester additional carbon. This means that those with the highest carbon stocks were excluded from the project, thus enhancing the feeling of unfairness within the community. Other families did not think it was fair that they could not cut their forests during the 25 year period without receiving any compensation.

3. Economic Analysis of Costs and Benefits for Ipetí

Additional Economic Benefits to CERs

There are many limitations in the approach used in calculating the net benefits of implementing a carbon project. Because many benefits, such as ecosystem health, are difficult to quantify, a large portion of the benefits could not be calculated. Even the calculation of net benefits from increased fruit production could not be achieved because of lack of information and the dynamic nature of the fruit market. If somehow the benefits of fruit production could be measured surely it could tip the balance of profitability of a carbon project.

The following will be an attempt to list benefits of the carbon project that were not quantified in monetary terms. First and foremost is the capacity-building component of the carbon pilot project. Various members among the community learned how to use GPS technology and how gather data in the field to estimate carbon yields. The construction of a GIS map for Ipetí-Embera was a learning experience for those who helped Frederick Lebel gather and organize data (see Goldenberg et Al. 2004). The map also helped the community visualize their land-holdings in relation to each other and to Panama as a whole. The numerous community meetings and workshops educated community members about the global climate change phenomenon and the basics of the carbon cycle. Interviews served not only as an opportunity to gather information, but also as a forum for international exchange between Canada and the Embera people of Panama. The pilot project was learning experience for all participants and stakeholders, yet this learning experience is not easily quantifiable in monetary figures.

Another extremely promising outcome of a carbon project in Ipetí is that it promises future employment opportunities for a growing population that is increasingly pressured seeking work outside of the community. During interviews, many individuals pointed out that this carbon project might bring additional employment opportunities , thus decreasing the amount of people that have to leave Ipetí to search for jobs. For instance, employment could only be achieved if benefits were paid on a regular basis to those working on the carbon project. This may require some form of wage labour be paid for working towards the carbon project.

Another benefit a CDM could provide for Ipetí-Embera is that it represents a form of grassroots, community-based development program. The Ipetí-Emberás have had a history of government-caused disparity. In the 1970´s the community was relocated in Ipetí by the government because of the flooding of Lake Bayano for a hydro-electric dam. The Ipetí-Embera never received any of the benefits of hydro-electricity. More than a third of a century later, their electricity source comes from a petroleum generator, that functions (sometimes) from 7pm to 10pm. During workshops, many community members proposed that the carbon project initial costs could be covered by the government as a form of compensation scheme for being relocated by the Bayano corporation. Moreover, when the community of Ipetí-Embera has asked the government to pave the road into their community, nothing has come of their requests. There is thus a strong feeling of resentment and the general opinion that the community should not depend upon the government to develop socially and economically. Many in the community believed the income from the carbon project could generate benefits that would stay in the community and would be more relevant than any government-based rural development scheme.

The possible local environmental benefits could not be calculated and hence were absent from monetary benefits. These benefits could include increased biodiversity, soil stabilization, decreased sediment runoff, increased soil productivity. Many of these benefits hinge upon multiculture and not monoculture plantations and fruit plots.

There are cultural benefits that are not easily quantifiable in a cost-benefit analysis. Some participants talked about planting trees of cultural significance. Some talked about how there were no more palm species to make roofs, and that they wanted to grow these tree species. This can be viewed as an avoided cost for housing. For example, many communities are beginning to purchase zinc roofs due to the difficulty in finding palms. The palms used for a CDM could also replace the cost of purchasing a zinc roof. Others wanted to grow tree species they could use to carve crafts and sell at the local store.

Payment Structures

The payment period for different land-use changes is an extremely important concern for the community. Although timber plantations have by far the highest economic return, it takes 25 years before getting results from their investments. Many participants during interviews joked about how they would probably be dead before they saw any benefits from timber. Different payment schemes of CERs could provide much needed finances during the 25 year period, not simply at the end. Fruit trees are promising because they take only three years from planting until products can be harvested.

Perhaps the most promising payment land-use option has nothing do with a CDM—cattle. After purchase of two cattle, returns begin accruing with minimal investment. Cattle ranching necessitates only a few vaccinations and some fodder. The high liquidity of those asset is a major benefit for many of those farmers. According to many cattle ranchers in Ipetí-Embera the main reason for having cattle was in case of an emergency. Cattle can easily be sold at any age for a high price: $100/youth, $250/

juvenile, \$400/adult (Jeremia C., pers. communication). In many ways, cattle acts like a farmer's bank account and life-insurance plan, especially given that there are no formal financial institutions in Ipetí. Cattle meat is seldom consumed in Ipetí. Cattle rather offers an unprecedented form of economic security. Cattle ranching will remain a significant economic activity as long people perceive that cattle will mean quick and easy money to pay for emergencies, education, or other immediate needs.

Ideal Situations

The net returns from this carbon project depends upon cost estimates chosen (high or low), the CDM return price of Carbon per ton, and the type of land that is converted. To sequester the most carbon in a 25 year period, it is necessary to convert land types with low carbon capacity (pasture, short fallow, and mechanized rice) to high sequestering activities (timber plantation and fruit plots). For example, changing a hectare of tall fallow to fruit plantations means there is only a net gain of 35.5 tons for a 25 year period. At a price of \$10 per tC, the profit from carbon would be only \$355. The cost of implementing this land use change over 25 years is \$688. A constant \$688 price for converting a hectare of land is only an estimate. It may be that converting different land types, under different locations and local environmental conditions, will have different costs.

It is important to mention that an economic loss using CERs as the only benefit does not mean that the project should not go through. It simply means that all the changes necessary cannot be financed through a carbon project. For example, if the people of Ipetí wanted to undergo a similar land conversion without any CER credit, they would be about \$450,000 in debt (using a low cost estimate). Using a low implementation cost and a high CER return, the community is about \$35,000 in debt, meaning community members would be compensated for \$435,000. The positive externalities of reforestation like fruit and most importantly lumber production can lead to substantial additional income in the community. As such, the carbon project can not be seen as an 'end' to income generation, the project must rather be seen as the 'means' for financing long term sustainable changes in land-use.

4. Assessing Social Capital for CDM Implementation

This last section of the discussion reviews the concept of social capital in the development literature and will provide the basis in starting a social feasibility assessment for the carbon project. More specifically, we will go over some of the social enabling conditions that we deem crucial in making the mitigation scenario socially equitable in the long run for the community.

The concept of social capital is a notion that has received an increasing amount of attention from the part of development theorists and policy makers (Bebbington, 1999). At the most general level, social capital is referred to as the 'glue' that holds society together and it is embodied in the relations between and among people (Coleman, 1990). Early studies in Ipetí pointed out to the many financial, technical, administrative and legal barriers to the implementation of GHG mitigation projects. These barriers are increasingly being acknowledged in social impact assessments. For instance, the present cost-benefit framework is one example of an analytical tool that attempts to make more visible the economic tradeoffs involved in changing land-use patterns.

Meanwhile, a growing awareness of the importance of social capital in facilitating the implementation of development activity has been growing in the past decade. This has led to a controversial debate as to whether carbon trading will create economic opportunities for the rural poor and lead to an improvement of general societal well-being. Indeed, some have argued that CDM provide both tremendous risks and potential benefits for rural development (Klooster D. and Masera O. 2000; Smith and Scheer, 1998, 2002; Ohloff A. 2005). Similarly, there has been a considerable amount of academic literature looking at the economic and financial costs and benefits of CDM projects. From a rural development perspective, climate mitigation measures provide an exciting opportunity for the merging of local and international interests. In the case of Ipetí like in many other rural indigenous communities, the success of carbon initiatives requires not only conducive policies at the national and legal sphere nut also a strong level of organization, planning and management skills. Unfortunately, social research on the organizational requirements for carbon projects has remained fairly limited.

However, it has been argued that carbon project could operate as a way of promoting social capital by enhancing local capacity and lowering costs of implementation for small communities involved in reforestation activities (Ohloff, 2005; Saunders, 2002). Nevertheless, climate change projects may have implications for other development priorities regarding, for example employment, afforestation, land degradation, health, market development, information flows, the reduction of transaction costs, and education and learning effects. In many ways, the achievement of those goals depends greatly depends upon the existence of pre-existing networks of help and local capabilities as well as the community's ability to actively participate in the development process.

Much of the current foreign aid initiatives such as the promotion of carbon trading rely upon strong organizational capacity from the community to manage those projects and ensure benefits will be equally shared. While there has been considerable development of economic tools assessing the economic feasibility of those projects, very few research has been done on local capacity building activities as a mean to reduce transaction costs (through, for instance, education, learning effects, the spreading of information, and technology transfers) and efficiency gains for implementation of those projects. Because those carbon projects carry both significant economic benefits and risks, it is crucial that a social impact assessment be carried out before any project is implemented.

In the case of Ipetí, the relatively unequal distribution of land among farmers in the *Tierra Colectiva* is an example of a social equity issue that will need to be addressed by community members in the future context of managing a carbon project. Moreover, because of the diversity of land-type each farmer has, it is important to realize that some strategies may be more appropriate for some farmers than others.

Informal interviews with individual landowners suggested that a sense of community ownership of land and social organization is present (Goldenberg et Al. 2004). The present structure of communal decision making suggests that some degree of common management of a carbon project is a definite possibility. In other words, adopting a change in land-use cannot be feasible on an individual basis. Family networks reveal to be important in determining the local management of the project. This last point is illustrated on how people talked about organizing the share of work and benefits associated with a change in land-use. Appendix 3.2 lists all the different family groups in Ipetí. Each family-head (male in this case) is the first person appearing beside each family number, with above them a list of their sons. Women were not represented for the reason that they do not usually own any land title and work the land of their husband's family. We can see that there exist currently about 25 family groups in the community, with the heads of the family always possessing the highest amount of land. Not all sons have their own *parcela*. The youngest ones usually live with the parents and work the land of their father's *parcelas*. Multiple generations living in the same roof is fairly common. In some cases, the oldest sons who had their own *parcela* preferred to work the father's *parcela* because their own land was too far away in the *Tierras Colectivas*. For this reason, many of the son interviewed only had *bosque* in their terrains (and thus no land for reforestation activities). In such cases, it becomes more advantageous for the sons and extended families to work together rather than to participate individually in the project.

Such differences among farmer's capabilities and opportunity costs must be taken consideration with respect to the equitability of the distribution of CDM benefits in future AR plans. Now that the governing bodies of OUDCIE and the *Dirigencia* have some of the technical and administrative tools to go forward with the carbon project (*Guia de Endoso*), much discussion remains to be done among community members about management issues related to the project.

Ensuring Project survival:

In an informal interview with former Panama Field Study Semester student, he expressed that the key in ensuring long term sustainability is that farmers get paid for their labour (Love B., personal communication) A similar view was also shared by Jason Cochran, head of the Peace Corps Sustainable Agriculture Division for Panama, who believed that voluntary community labour or coop programs simply do not stand the test of time. Jason Cochran believed that farmers need to see results, whether in terms of cash or agrarian products, on a short term basis or a project can easily fall apart. According to Cochran, fruit trees take about 3 years before starting to produce. Once farmers have the fruit, the actual monetary income derived from the fruit is of less concern, real benefits come rather from having the product available for the household. Conversely, lumber takes roughly 25 years to yield significant returns to the initial investment. Plantations do have multiple thinning, during which it is possible to sell some wood products. This can provide some form of income before the final cutting. From these interviews, and the desire to have increased employment opportunities within Ipetí-Embera, it appears that wage labour would be a critical component in ensuring the survival of the a CDM. Continual wage labour income might be a strong incentive by itself to implement such project. This could provide an additional source of income until they start to see returns on their investments such as fruit sales and small lumber returns from thinning.

Ensuring project survival will thus require not only economic returns from changes in land-use but also a strong managerial, communicative and organizational capacity from the part of community members.

Where to Go from There

The direct involvement of McGill University in the pilot carbon project has ended. The next step forward lies ultimately on the Emberá people of Ipetí. When we left Ipetí, we gave to each participant a handout listing all the economic costs and benefits about the future user of their land. These handouts and the *Guia de Endoso* provide important tools for people in understanding how costs were calculated and hope will provide some guidance for future decision-making. One potential difficulty lies in the inhabitant's ability to interpret the numbers. This will have to come through time and the project itself is a learning process. We hope that as participants become more interested in the results from this study and feel ready to implement it, they will desire to clarify terms and prices. Perhaps, they will begin asking questions and this could promote discussion among the community. Future questions will inevitable arise and there should be some form of long term commitment from the part of McGill University to the sharing of information and ideas in order for stakeholders to maximize benefits.

Some recommendations have been made to improve the ways CDM projects are carried out in the field. For instance, various types of costs needs to be included in socio-economic impact assessments. Smith and Scheer (2003) discuss the need to include the economic competitiveness of community-based carbon projects. They also make some practical recommendations regarding the legal and market-based instruments that could be used in making those projects financially viable such as government policies creating better conditions for socially beneficial carbon projects. Practical recommendations to support local livelihoods include proactive measures in empowering disadvantaged inhabitants (local-capacity building activities). This could entail for instance giving clearly defined rights to forests and forest resources and the dismantling of powerful timber marketing and processing monopolies. Moreover, they briefly touch upon proactive measures to empower local communities such as mandatory social impact assessments, minimum standards for stakeholder consultations, etc.

Hopefully, the sum of those effects will enhance the feasibility of community agroforestry and afforestation initiatives in Panama.

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