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Asunción, Paraguay, September 2000.



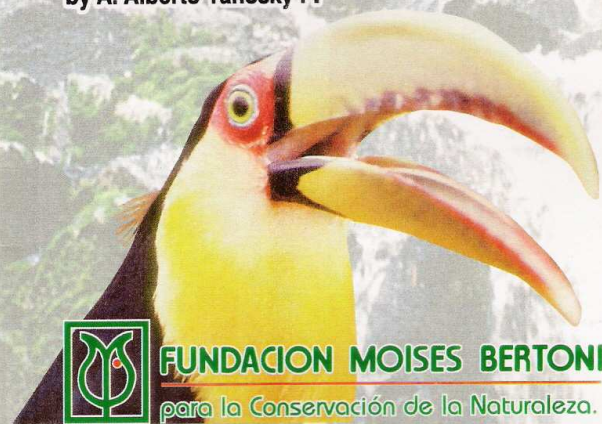
Entrance to Mbaracayú Forest Reserve



# THE MBARACAYÚ FOREST RESERVE IN PARAGUAY

**A GHG Investment as a Catalyst for  
Conservation and Development**

by A. Alberto Yanosky F.



**FUNDACION MOISES BERTONI**

para la Conservación de la Naturaleza.

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## THE MBARACAYÚ FOREST RESERVE IN PARAGUAY: A GHG Investment as a Catalyst for Conservation and Development

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**Summary:** The Mbaracayú Forest Reserve is a perpetually protected nature reserve of 64,400 has. located in northeastern Paraguay. The reserve is unique in that it is privately owned and is the only national protected area established by an international agreement recognized by an act of Parliament. This agreement, signed by the government, the UNDP, two Paraguayan NGOs, and The Nature Conservancy of the United States, recognized the biological importance of the Mbaracayú as a significant remnant of the globally endangered Interior Atlantic Forest type now reduced to less than 5% of its original range. The conservation and management of the Mbaracayú is a private initiative of NGOs who accepted the responsibility of raising the funds to purchase and protect the reserve. The willingness of the AES Corporation to finance the project as a Green House Gas Investment was the catalyst that encouraged the NGOs to sign the agreement with the government and the UNDP, and to take on this major responsibility. Protection of the reserve requires the support of the local communities surrounding the Mbaracayú, including the indigenous Aché who continue subsistence hunting and gathering on the reserve. Management actions include an aggressive program to increase rural incomes and improve social well being in the neighboring communities through agricultural extension services, community development, and increased economic opportunities. From the commitment of funding of AES a major conservation and development program has emerged that is unique in Latin America.

### I. INTRODUCTION

Carbon sequestration is a strategy to slow down the accumulation of atmospheric carbon dioxide by absorbing carbon into the soil and perennial vegetation. This can be achieved through reforestation, agroforestry or forest management activities that preserve or increase an existing carbon "sink." Carbon sinks include forests and other ecosystems, as well as sustainable agriculture crops that sequester carbon in the soil and in long-life harvested products. Carbon sequestration projects not only offer long-term carbon storage benefits, they also influence sustainable land use and conservation practices.

The Mbaracayú Forest Reserve is a perpetually protected, privately-owned nature reserve of 64,400 has. located in northeastern Paraguay. It is the only national protected area established by an international agreement recognized by an act of Parliament. The purchase of this land was relied to NGOs and AES Corporation was involved in this initiative. The willingness of the AES Corporation to finance the project as a Green House Gas Investment was the catalyst that encouraged the NGOs to sign the agreement with the government and the UNDP, and to take on this major responsibility.

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By means of Mbaracayú outputs and history, it is very clear that Land-use Change and Forestry (LUCF) activities mitigate C emissions<sup>3</sup> by:

- a) avoiding or conserving the carbon pools on the land (slowing deforestation, preventing logging, improving forest harvesting practices),
- b) carbon sequestration or expanding the storage of carbon in forest ecosystems by increasing the area and/or carbon density of forests (by establishing plantations and agroforests, allowing for natural regeneration, or improved soil management, and to increase storage in durable wood products), and
- c) substitute sustainably grown wood for energy intensive and cement-base products (biofuels, construction materials). Furthermore, though it is not measured, the Mbaracayú program has avoided the local and regional impacts of soil erosion caused by deforestation evident in declining water quality, variability of water courses and siltation.

Water management is a pending issue in Mbaracayú. Nevertheless, soil erosion into the region's water reservoirs and watersheds has been studied and has shown the presence of metals and synthetic organic compounds from agricultural pesticides in the region's surface water<sup>4</sup>. Mbaracayú is acting as a filter for exogenous materials and producing high-quality water. The impact from the accumulation of those materials on biodiversity still needs to be researched. This is one issue that needs to be mitigated by proper watershed management, including reforestation and forest cover protection. FMB has been helping WWF to prepare a biological vision of the ecosystem in which Mbaracayú is playing a unique role in the conservation of the ecosystem at the international level. Reforestation and conservation of the watershed provide substantial biodiversity benefits by connecting Mbaracayú to adjacent forest reserves and increasing the total area of contiguous protected forest by thousands of hectares

## II. A CONSERVATION OPPORTUNITY

In the late 1970s a Paraguayan forest products company defaulted on a loan from the International Finance Corporation of the World Bank Group. After a protracted bankruptcy proceeding, the IFC was awarded title to 57,700 has. of forestland in northeastern Paraguay. This property, known as the Mbaracayú, had been protected from invasion and logging by IFC over the last ten years, pending resolution of the court case, and its natural forest was relatively undisturbed. With the award of title in 1987 the IFC prepared to sell the property in order to recover a part of its initial investment. A price of US\$5 million was placed on the Mbaracayú for its timber values and its potential for industrial scale agriculture and grazing development.

However, there were complications to the sale of the land for development. World Bank policy, which is applicable to the IFC, prohibited loans or investments that would give incentives to the destruction of tropical forests and their conversion to agriculture. A second complication was the claim of the indigenous Aché for a portion of the

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<sup>3</sup> Brown *et al.*, 1996 Management of forests for mitigation of greenhouse gas emissions. Cambridge University Press (chapter 24).

<sup>4</sup> On-going research on hydrological issues lead by Dr. Ramón Ude from The National University of Asunción

Mbaracayú as a part of their traditional hunting and gathering area. The Bank was sensitive of past accusations that its programs had neglected indigenous peoples land use and traditional rights.

An anthropologist working with the Aché community near the Mbaracaryu brought the pending sale to the attention of the Conservation Data Center (CDC) of the Ministry of Agriculture. The CDC was working in partnership with The Nature Conservancy (TNC), a US based international non-governmental organization, on completing biological surveys to build a scientific database for the country. Scientists from the CDC completed a rapid ecological assessment of the Mbaracayú that confirmed the quality and importance of its forests that were largely undisturbed, and its ecological importance as a large remnant of the endangered Atlantic Forest type. The CDC team identified 19 natural plant communities on the property, and habitat for several threatened and endangered animal and plant species. Furthermore, the Mbaracayú was rapidly becoming an island of trees in a sea of deforestation. Paraguayan and Brazilian agro-industrialists were expanding their investments in the forests of the region to harvest the lumber and convert the land into agriculture and pasture. Based on the report of the CDC team, the Minister of Agriculture wrote a letter to the TNC asking for assistance in approaching the IFC on ways in which the land could be protected as a nature reserve.

### **III. NEGOTIATION WITH IFC**

In October 1987 the TNC and the CDC approached the IFC asking for the donation of the Mbaracayú to the national system of protected areas of Paraguay. The staff of the IFC were personally in favor of the idea, but insisted that they had to sell the property for the established price. Privately they expressed doubts that the government of Stroessner would maintain the area as a protected area, and felt that it was more likely to divide it up among various colonels if the soils were good, or to give it the agrarian reform if soils were bad. The also informed TNC that they had a cash offer of \$5 million from an investment group (that supposedly included a son of Stroessner).

The TNC and its Paraguayan parties felt that it would be very difficult to raise the purchase price and subsequent management costs from private donors. Therefore they began a campaign to induce the IFC to lower its price while identifying other sources of funding. The US ambassador in Paraguay was able arrange for visiting U.S. Senators to tour Mbaracayú, and to stress to the government the importance of working for the conservation of the Mbaracayú as a model of its environmental concerns. The senators and other government officials wrote letters to the president of the World Bank requesting his assistance in finding ways to avoid development. International Indian rights groups, concerned about the potential loss of the Aché's traditional hunting areas also pressured the IFC and the World Bank. In February 1989, General Stroessner was overthrown by General Andrés Rodríguez, who saw that this private initiative would not require government funding and would improve Paraguay's image, instructed the government to collaborate with TNC in lobbying the IFC.

Parallel with the efforts to convince the IFC to lower its price the TNC looked for potential funding sources. The USAID offered \$500,000 towards the purchase price

and other smaller contributions were pledged. However, it was the offer of the AES Corporation of up to \$2 million dollars towards purchase and management that convinced TNC and its Paraguayan partner, the Fundación Moisés Bertoni (FMB), that they would be able to finance the purchase and protection of the Mbaracayú.

The President of TNC phoned the President of IFC and offered \$2 million is cash for title to the property. IFC accepted the offer on three conditions: (1) the government of Paraguay would guarantee that it would not expropriate the property; (2) the TNC and the FMB would guarantee not to sell the land or to develop it by conversion of the forest or other extractive uses; and (3) the claims of the Aché for continued use of the land would be respected. These conditions were readily agreed to as they were the management objectives of FMB and TNC.

#### **IV. THE AES CORPORATION INVESTMENT**

The AES Corporation<sup>5</sup>, an independent power producer based in Virginia, is an international leader in the testing of carbon offset investments as mitigation or the Green House Gas released through its burning of fossil fuel. The costs of these GHG investments are treated as a capital cost included in the construction of each new power plant. In 1988, AES announced its first carbon offset investment, a social forestry project in Guatemala to offset the carbon emissions of a soon to be built coal-fired power plant in Connecticut. This project pioneered the concept of carbon offsets long before there was discussion of joint implementation or carbon trading mechanisms. AES Barbers Point facility in Hawaii offered to become the partner to the TNC and the FMB in the conservation and management of the Mbaracayú Reserve when it was acquired from IFC.

In December 1991 AES/Barbers Point agreed to invest up to \$2 million in the Mbaracayú project in exchange for the TNC and FMB maintaining 13.1 million metric tons of carbon sequestered in the forest and soil's biomass. In addition to the carbon sink data, FMB was to provide to AES copies of the management plan for the first three years of reserve protection, and periodic reports on the community assistance and extension work with nearby small farmers and the Aché settlement.

TNC and FMB designed an inventory of the natural forest types of the Mbaracayú to estimate the volume of biomass and weight of carbon that would be lost through logging and conversion to agriculture. Forest faculty members of the National University and the personnel of the National Forest Service made this study. Fifteen sample plots were located in three forest types identified on satellite imagery. Tree data collected were the diameter at breast height for all trees on the sample plot with a diameter >10 cm., merchantable tree height, and total tree height. The biomass volume of solid wood in each tree was increased by a factor drawn from the literature on the volume of branches, leaves and twigs; and by an additional allowance for the biomass volume of roots, dead leaves, rotting wood and fallen trees. From this data total tree biomass in each of the three forest types was calculated in cubic meters per hectare. The area of each forest type interpreted on satellite imagery expanded these

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<sup>5</sup> The Energy Policy Act of 1992, Sections 1605(b) and (c)

forest type volume estimates. These volume estimates in total cubic meters of biomass were converted from volume to weight using a factor for wood density, and then converted to the weight in metric tons of carbon by a factor of 0.5.

The total estimated weight of carbon that could be conserved by protection and management of the Mbaracayú Reserve and adjacent lands was estimated at 27 million metric tons. As this was twice the target weight of 13.1 million tons set by AES, the company accepted the survey results and agreed to contribute US\$ 2 million towards the purchase and management of the reserve. An initial payment of \$500,000 was used for the purchase from IFC, and the balance of \$1.5 million was used to capitalize a perpetual trust fund. Income from the fund will be used exclusively for the costs of protection and management of the reserve.

## **V. ESTABLISHMENT OF THE MBARACAYÚ FOREST RESERVE**

With the funds received from AES and USAID and other donors, the conservancy was able to borrow the balance needed for the cash payment to IFC. The other IFC conditions were completely satisfied by the international agreement signed by the government of Paraguay, the Representative of the United Nations development Programme, and FMB and TNC. The agreement declared the Mbaracayú Forest Nature Reserve to be: under the legal protection of the state, free from expropriation or alienation, prohibited extractive uses of its resources except for research, and provided for the Aché to continue to enjoy subsistence hunting and gathering on the reserve. As this met all the conditions of sale of IFC, the transfer of title from IFC to the Fundación Mbaracayú, an entity created by FMB and TNC to hold title, took place on January 1992, four years after the initial approach to the IFC.

## **VI. RESERVE MANAGEMENT CHALLENGES**

FMB immediately assumed management responsibility for the Mbaracayú, initially retaining the patrolmen of IFC. The immediate challenges were the physical protection of the reserve, involvement of the Aché in protection and management.

### **1. Protection**

FMB found that illegal hunting and wood harvesting was rampant along the borders of the property, including a major incursion by a logging company. The first protection action of FMB was to recruit and train its own staff of park guards, and to begin to patrol the boundaries of the reserve. A second action was to survey and mark the boundary of the reserve so that people would have knowledge of when they were trespassing. Initial challenges to the management protection of the FMB were claims of ownership of parts or all of the reserve that came forward, often with obviously falsified documents. However, the law that created the reserve establishes that the property cannot be divided, and any claim of compensation for loss of title must be directed to the government. Illegal entry into the reserve to establish marijuana plantations occurred in the early years of protection, and was controlled with the assistance of the military. Illegal hunting is a continuing problem, although effective patrolling is reducing the occurrence. After eight years of management, FMB is justly

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proud of its success in protection of the biological diversity of the reserve, and the conservation of its biomass.

## **2. Aché Participation**

The Aché, an indigenous group of hunters and gatherers that were recently removed from the forests, live near the borders of the Mbaracayú that is part of their traditional hunting grounds. The Aché continue subsistence hunting on the reserve in accordance with the law establishing the reserve. A management concern of FMB was whether the wildlife population on the reserve would be able to sustain the hunting of the Aché. A three-year survey of the wildlife normally hunted by the Aché was completed along with data on their take of game for subsistence purposes. This study found that the species commonly taken by the Aché were in abundance and unlikely to be affected by continued hunting. These surveys did find that population numbers diminished along the borders of the property near rural communities, suggesting that poaching is still a problem. As well as assisting in patrolling, the Aché also are employed to mark the boundaries of the reserve, guide the patrolmen in locating poachers, and to assist visiting researchers and tourists.

## **3. Research**

Protection and management of the Mbaracayú is justified by the richness and diversity of its plants and animals. The reserve is a center of plant diversity according to the National Museum of Natural History/Smithsonian Institute<sup>6</sup> recorded as Site SA18 together with other 58 sites in South America. It has been also named as an Endemic Center for Birds and is declared an IBA, Important Bird Areas, because of the internationally accepted criteria for endemism and species under different threats.

Over 80% of its area is covered by Interior Atlantic Forest, an ecosystem considered as a conservation priority at the global level. Mbaracayú also contains another ecosystem, the Cerrado at the southern limit of its range, which has high conservation priority conservation at the regional level. Over the last eight years major field research programs have been implemented on the reserve by the British Museum of Natural History, Oxford and Cambridge University, Texas Tech University, among others. They have found the Mbaracayú's flora to be extremely diverse.

Over 1,000 plant species are recorded and it is estimated that there may be more than 2,500 species of flowering plants, some of them of economic importance and others with diverse applications. The reserve has a high occurrence of ferns, 115 identified so far, some of which were never recorded in Paraguay previously. Twelve species of palms are identified in the reserve, and an additional three species are expected to be found based on nearby observations. Of the 420 bird species registered for the Reserve (67% of the well-known avifauna of Paraguay), 12 are threatened at the global level and 22 are near threatened. These data locate the reserve among the most significant high-priority areas for the conservation in the Americas. The discovery of the critically threatened White-winged Nightjar (*Caprimulgus candidans*) in the reserve and the

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<sup>6</sup> Centres of Plant Diversity: Vol. 3 Site Assessment Pages

knowledge on this bird's population, locates the place in one of three well-known sites where the species dwells. The reserves harbors an extremely high diversity of insects, where 1,070 species have been identified up to the moment and this representing only 5% of the collects during a three-year project at the reserve. Mbaracayú has the highest diversity of butterflies for the country.

#### **4. Community Outreach**

FMB was conscious from the beginning that the support of the local community was essential for the effective protection and management of the reserve. It also was aware that the neighboring settlers were hunting in the Mbaracayú without concern for any conservation objectives. If access to these lands was going to be restricted by FMB as a part of its management, there was a need to provide a benefit or service to the community. Prior to taken over the protection of the reserve, FMB began a program of agricultural extension and community service to the people living near the reserve. This extension service promoted the formation of farmer associations for the conversion of cut and burn agriculture into sustainable farming crops and practices. Citrus trees, yerba mate plantations, pig and chicken production, and bee keeping have been demonstrated to the Paraguayan farmers and to the Aché. Through the FMB a small processing plant and buying station has been developed that is having a significant effect on local farm incomes. This outreach effort is based on Participatory Rural Training Program techniques reaching all communities living close to the reserve's boundaries. Local people were incorporated as direct beneficiaries of the outreach program working on agricultural productivity, health, education, infrastructure, technical assistance and environmental education. Direct support for the work of the FMB has been received from donors in the US, Holland, the European Union and now the French Global Environment Facility. The emphasis is working to empower the people of the buffer zone of Mbaracayú.

### **VI. GHG OFFSET ISSUES**

Mbaracayú or RNBM project has not been proposed for a JI or AIJ status<sup>7</sup>; nevertheless it is being managed as if it were, given that it pioneered the concept of carbon offsets before the international discussion of joint implementation began. Within this framework, FMB and TNC use Mbaracayú as a reference framework and discuss methodological issues in baseline-setting, such as:

- *additionality*: the determination of which technology would have been adopted in the absence of offset sales. Some "deception" is expected.
- *direct emissions*: determination of direct emissions conditional on technology,
- *leakage*: determination of indirect impacts on emissions. Permanence of the carbon sequestered.

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<sup>7</sup> As presented in "La Experiencia de creación de la Reserva Natural del Bosque Mbaracayú en el Paraguay a través de un mecanismo de implementación Conjunta". Simposio "La fijación de carbono, oportunidades y potencialidades para el Paraguay", Asunción, Paraguay, 6-7 julio del 2000.

Of these issues, the second is the most straightforward, though not necessarily simple. It is largely a question of measurement and sampling techniques. Detailed protocols for this exist in the energy and forestry sectors.

To demonstrate verifiable C benefits, Mbaracayú was designed and implemented by an initial C inventory, but without ongoing C monitoring. A verification program that provides the data necessary to complete the with-and without-project scenario in transparent and verifiable ways is being carried out. FMB is planning to do this but verification can be easily measured by visiting to the Mbaracayú and “touching the trees” not only in the original 57,700 h but also in the hundreds and hundreds of hectares now under a particular type of conservation initiative (reforestation, afforestation, and other types as natural regeneration, forest enrichment and so on) pushed by the Mbaracayú Programme.

### **Additionality**

The additionality issue, is perhaps the most difficult and subjective issue that needs to be dealt with. The Mbaracayú region has a long history of use and recently<sup>8</sup> it was used for commercial logging activities by a Paraguayan logging company. Mbaracayú was going to be sold to foreign investors to deforest these “improductive lands”, take the timber out illegally and transform these forest soils into agricultural lands with consequent erosion and land degradation.

Between 1945 and 1985, approximately 4,916,452 hectares of forest in the eastern region were cut down, representing an average deforestation of 123,000 h/year. In 1985, were about 3,507,670 ha. of forest left, of which 38,2% were small residual woods and 61,8% were wood of low commercial value. Based on a satellite photo analysis, FMB helped the government and WWF determine that there were only 2,088,581 ha. left in the eastern region in 1997 and that if deforestation continues at the same rate, there would be no more forest left in the region by 2007. Though all conservation units have degraded lands, Mbaracayú has only 1.4% of its area degraded, which is a large difference compared to another key site in Paraguay, San Rafael National Park, which has 41.8% deforestation<sup>9</sup> inside its area. Canindeyú is the national administrative unit (department) which holds the reserve and its buffer zone. Canindeyú has the smallest deforestation rate in the country and has the most important remnants of forest in its area. The reserve itself covers 5% of the department's area and the buffer zone covers 25%, thus indicating that the initial funding has rendered tangible products in terms of forest conservation.

Mbaracayú has clearly shown that it is additional to a “business-as-usual” scenario. Mbaracayú had little, if any, chance of being had it not been for Article 12 of the Kyoto Protocol and GHG emissions would be higher if it were not for the carbon-offsets from the project. This is demonstrated by

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<sup>8</sup> In terms of all what is known for this site.

<sup>9</sup> Interior Atlantic Forest Map, 1997 (SSERNMA, WWF, FMB, CIF) - Asunción

- a) financial additionality, not only by the creation of an endowment based on part of the AES investment but also by the growth of this endowment to more than 5 million dollars, allowing FMB to continue fundraising for this and other projects.
- b) Technological additionality, a place where cotton and tobacco were the only plantations promoted in a perverse national system, where all the communities had lost their traditional knowledge of land management. The continuous threat of losing the genetic diversity of more than 100 manioc subspecies worries Mbaracayú Outreach Program. Mbaracayú brought new technology not only to forestry, agroforestry and agriculture but also in land management where the Aches are evaluating and correcting their hunting activities.
- c) Institutional additionality, not only for the empowerment of FMB but also for other NGOs created by FMB at the national and international level<sup>10</sup>. The formation of grass-roots organisations in the project area represented by more than 50 committees, and recognized officially by the municipality is a clear indication of this. These committees are working on issues dealing with productivity, forestry, health, recreation, education, handcraft, women issues and others representing more than 2,500 people directly involved. Educational and Research Centers all over the globe are paying close attention to this site and contributing with their possibilities for enhancing its chances.

### **Dynamic baselines**

The original 57,700 hectares would permit the preservation of 14.6 million metric tons of C during 35 years, at a rate of 1.53 metric tons per year. One carbon ton equals 3.6 tons of C. Mbaracayú in this order is expected to sequester annually 417,349 tons of carbon in biomass or 7,23 C tons/h/year. This means that 723 g of new carbon in biomass is captured for each square meter (considering bidimensional forest and not tridimensional). Using Costa Rica's experience, Mbaracayú would be near 1,62 kg biomass/sq.meter.

The original 57,700 hectares were expanded to 64,400 in six years time, including 2,000 hectares of degraded forests which are now under natural regeneration and plantation. Additionally, there is an important amount of carbon being incorporated into the soil and clear actions in favor of rural empowerment and natural resource conservation have reduced sowing and the productivity in degraded areas. In the area surrounding the reserve where 15,000 people live, social issues regarding education, democracy, health, local empowerment, land planning, production diversification, are also recognized as ways of increasing the sequestration of carbon.

The potential benefits of dynamic baselines have to be weighed against the greater costs. Mbaracayú is planning to monitor carbon sequestration in the long term but associated costs to really evaluate and appraise the dynamic of carbon in this ecosystem may threaten the decision-making of this plan.

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<sup>10</sup> FMB created CICOAM, The International Training Course in Management for NGOs, by which more than 100 directors of NGOs in the Americas were trained in Paraguay and Mbaracayú was always used as an example for practical issues. CICOAM is now an independent NGO contactable at [cicoam@pla.net.py](mailto:cicoam@pla.net.py)

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## Leakage

Leakage – often discussed in connection with forestry projects, are potentially worrisome for fuel-switching and efficiency-increasing projects. Project-level reductions in the demand for fuels can have a 'snapback' effect as other consumers react to slightly depressed prices by slightly increasing consumption. On the other hand, positive spillover effects can amplify emissions reductions if project-sponsored technologies diffuse to non-project facilities. General adjustment or discounting parameters for this purpose should be developed and Mbaracayú could be used as an experiment for this issue. To date and to the best of FMB knowledge, no leakage has occurred. There has been no indication of migration from the communities adjacent to the project area to other areas to deforest, and there has been no increase in timber output from other places. In fact people have come to the area as because of its reputation as a supposedly new development center in the country.

FMB was conscious from the beginning that local communities have had a long tradition of living off forest resources around their communities, in particular the Achés, which were first contacted in 1976 and abandoned the forest in 1978. If access to these lands was going to be restricted in some way, Mbaracayú must address the economic needs of communities to avoid negative impacts on the community and to minimize the risks that local people will impact the project's forests, resulting in leakage. Slash-and-burn, boom-and-burst forest practices were among the most commonly used practices. Conserving forests and establishing long-term sustainable forest growth and management offer a steadier economic base for these communities and greater security because natural resources will be available for subsistence and sustainable management as well. Local people in Mbaracayú, in particular, know that the project will be managed by them in the coming years once the training process is complete. Except for the FMB directors and the Mbaracayú director who are based in Asunción, Paraguay's capital city, at least 60% of the 30 permanent staff working with Mbaracayú are local people, so the project is already local.

Participatory Rural Training Program is the name and philosophy of the outreach program which in turn is FMB's leakage prevention program with the communities neighboring Mbaracayú. Though quantitative indicators have shown FMB the value of community development, external support is being now received to qualitatively measure the indicators of community development. Already available data shows that health and welfare have really improved. All communities living in the watershed and close to the reserve's boundaries were incorporated as direct beneficiaries of the outreach program. The program has been developing activities of sustainable development in the areas of productivity, health, education, infrastructure, technical assistance and environmental education. The endowment established helps put forward actions in favor of the communities living in the vicinity of Mbaracayú. This endowment is at present covering program operation costs and investment projects are being sold abroad to continue the selfmanagement, empowerment and constituency of local communities. Direct support from several NGOs in USA, in Holland, the European Union and now the French Global Environment Facility together with funds secured from CIDA and GEF, are now stressing the consolidation of the

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program focussed on the people and their empowerment in the buffer zone of Mbaracayú.

Indigenous communities, in particular the hunter-gatherer Achés, got the chance, with the help of FMB, to own their 6,000 h land due to a previous law (law no. 110/91). FMB has been fundamental in getting the Aché more land for their cultural practices and is campaigning internationally to add ca. 5,000 h south of the reserve to a new Ache community<sup>11</sup> with a forest and fauna management plan that involves training and empowerment that they may operate their land by themselves. The Achés live in traditional conditions and FMB is supportive of their wish, though is not involved in political issues regarding election of authorities. FMB and Mbaracayú are providing a site where they can preserve their ancestral costumes with the possibility of incorporating foreign/external elements if they choose. To assure this, a team of four Aché is monitoring their hunting to provide quick measurements and decision-making regarding the perpetuity of their resources inside the reserve. FMB has complete knowledge of all elements extracted from the reserve in terms of biomass. This has allowed FMB to estimate biomass per species inside the reserve and the population trends from target species.

Mbaracayú has been used as a model of private conservation and instead of leakages in the negative way, some clear indicators already exist that it was used for the development of private nature reserves (>200,000 ha under stewardship of FMB), and many other types of protected areas.

Migratory processes in the watershed are occurring because of the presence of the Mbaracayú program.

- 1) Villa Ygatimi: the closest semi-urban area, increased from 1,000 to 3,000 people in the 10 last years, got electricity, telephone, and began to be called "Cradle of the Conservation". An urban development plan has been developed by FMB in cooperation with other institutions based on a request from the City Counsel, the project itself is involved in different public works such as recreation, garbage disposal, green sites, youth development, among many others. A UNESCO-supported and recently created Group of Historical Rescue has been created and this group is doing an outstanding job in rescuing historical issues and promoting tourism in the nearby areas.
- 2) Employment: the project generates local employment for 30 fulltime people and gives temporary employment to more than 100 people. The maintenance of the 140 km reserve's boundaries is done by neighboring local communities. The >300 visitors a year have also promoted the development of local infrastructure. The project itself spends \$ 5,000. The local radio has a program on environmental education and conservation issues, this radio broadcasts beyond the watershed's boundaries.
- 3) Health & food security: two ambulances, five health promoters, six health centers, training in first aids and, the water distribution system in Villa Ygatimi have helped

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<sup>11</sup> Nueva Esperanza ("New Hope", ex Takua Poty), group of 40 families that splitted from the original 6,000 h of Chupa Pou east of Mbaracayú.

reduce child mortality 80%. More than 100 tuberculosis cases are under close surveillance and there is a promising high impact plan under study and in search of international funding that will take the public health of these communities to a higher, more secure level. Food crops are promoted, especially in communities with a high level of poverty. More than 100 containers are now being developed by externally trained local artisans to provide storage for grains. More than 200 vegetable gardens are managed on family or communal basis, more than 50 orchards, basic grains (corn, soybean, beans, peanuts, others), 4,000 plants of yerba mate, 500 hectares of manioc and more than 200 beehives are part of the production of fighting against food shortage.

- 4) Education: maintenance of educational centers, specialised talks and lectures, working closely with the Ministry of Education, and supplies of basic educational needs. Costa Rica's Earth Program has been brought to the area to promote higher education in sustainable development using local natural resources.
- 5) Infrastructure: 50 km of public roads maintained on monthly basis, 100 km of public roads open to the communities, a close relationship with the Ministry of Public Works and Communication that provided support to build roads, bridges<sup>12</sup> and roadside signs. Electricity was brought to the reserve and the Aché Community in 1996, Paraguay's President launched this event and the extension of rural electricity benefited more than 2,000 people in the watershed.
- 6) Forestry and agroforestry: the program has promoted the reforestation of more than 300 ha. with native and exotic trees. Another 500 ha. of natural regeneration on degraded lands are being studied and promoted in local communities, added to another 500 hectares of native forest enrichment with both exotic and native species. Enrichment is usually done with yerba mate trees and at this moment more than 7,000 plants have been reintroduced in native forests.
- 7) Industries & commercialization: one of the problems in the production chain is the commercialization and the complete lack of industries in the area. FMB negotiated a loan of half a million dollars with the IDB to create an agroindustry for the gathering, processing and commercialisation of local farm/forest products. This company generates employment, gathers local production and generates cash in considerable amounts for the first time in the watershed's history.
- 8) Empowerment and grass-root organisations: the formation of more than 50 committees for different issues (farming produce, health, road, electricity, water supply, etc.) especially those created to lobby to regional and national authorities to call their attention to the area. This has resulted in great amounts of investment in the area. More than 2,500 people are involved in these organisations and almost all of these are officially recognised.
- 9) IBA-Biosphere Reserve-World Heritage Site: The site has been proposed by the government to the UNESCO to be declared Biosphere Reserve by the Man & Biosphere Program and as World Heritage Site because of the natural and cultural conservation issues to the UNESCO Science Direction. The category of Important

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<sup>12</sup> a particular building of three bridges on the road from Villa Ygatimí to the reserve, the Ministry's expenditure was \$ 40,000 worth. Road side signs indicating distance and direction to the Reserve on the principal highway of Paraguay have provided support to promotion of the site and security in terms of arrival.

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Bird Area is added to the sites of global importance by giving shelter to threatened species.

### **Duration of abatement/sequestration and forestry projects**

Forestry projects have different durations of impact than do industrial emissions abatement projects. Sequestration, or deforestation prevention, is always potentially reversible. The difference needs to be explicitly accounted for when assessing baselines and calculating offsets. One solution is a "pay-as-you-sequester" scheme, in which sequestration services are reckoned on a ton-year basis (keeping a ton out of the atmosphere for a year), and credited at regular intervals. This facilitates setting up sequestration projects in situations where political and implementation risks discourage long term (20 or 30 year) contracts.

When FMB and TNC began discussing the preservation of this land, Paraguay was living a dictatorial regime with little respect for private investment, but the coalition-building work done to protect the land allowed the government to sign an international agreement for the conservation of Mbaracayú which was later ratified in a national law (112 from 1991). The area was declared protected in perpetuity by the national government and international/national institutions and created an Honorary Counsel presided by the United Nations to secure the permanence of the project by means of establishing the necessary mechanisms so that in 35 years time, the program will be sufficiently mature and self-managable at the local level to secure its independence.

The occurrence of natural disturbances, especially fire, is of concern because disturbances can affect the permanence of carbon offsets. Within Mbaracayú fire has only occurred in the posteriorly purchased Cerrado portion. Nevertheless, fires are natural to the Cerrado and FMB has found this an excellent occasion to study fires and have practical guidelines for prescribed burning in the short run. Fires do not occur in the forest area (Interior Atlantic Forest) and because of the extensive wetlands, fire is not likely to spread throughout the area.

### **Inventoring and monitoring of carbon in Mbaracayú**

The carbon offsets are estimated as the difference between the with-project case and the projected without-project case. Projecting the without-project case is predictable but problematic because of the need to predict what changes the area would likely have undergone if the project had not been implemented. This is affected by many socio-economic, cultural, and political conditions.

- **Practical experience**

In conclusion, *Applied Energy Services* (AES) launched their mitigation program in 1998 and began with a project in Guatemala and a plant in Connecticut. *Barbers Point* followed – a coal-powered Plant in Oahu (Hawaii) which will release 13.1 metric tons of carbon to the atmosphere in approximately 35 years. The mitigation was achieved through investing in biomass conservation in Paraguay: protection of forests and social

development in the Mbaracayú area. TNC and FMB were already in search of funds to purchase the original 57,715 ha. of forest. The negotiations with AES would permit the conservation of biodiversity and threatened species in this highly endangered ecosystem and would also allow the Achés people to continue with their forest-related cultural issues. The major threats of this site were logging and transformation to agriculture land. The owner, IFC agreed to sell the property to TNC/FMB for less than its market price. Matching funds were required and \$2,000,000 was needed to buy the land: USAID \$500,000, AES corporation \$500,000, private source from TNC \$750,000 + \$250.000.

#### **Previous Projects of Carbon Capture<sup>13</sup>**

<b>Projects</b>	<b>Investors/Sponsors</b>	<b>Starting Year</b>
CARE Guatemala project of Agroforestration	AES	1989
Conservation Project of the Mbaracayú Reserve, Paraguay	AES	1990
Reforestation Project in Malaysia, Tcheck Republic and Netherlands	FACE Foundation	1992
Project to Reduce the Impact of Wood Extraction in Malaysia	New England Power	1992
Oxfam-Coordinator of the Indigenous Communities of Amazon (COICA) Project of Forestal Protection	AES	1992
Project of Reforestation of the Ecuadorian Sierra	FACE Foundation	1993

- **Agreement**

The Agreement between AES Barbers Point Inc., TNC and the FMB, occurred on the 6<sup>th</sup> of December 1991 and on the 12<sup>th</sup> of December AES sent the first \$ 500,000 for the goal of establishing a nature reserve that would protect biodiversity. TNC–FMB engaged to protect and administer the Mbaracayú reserve through promoting the active participation and involvement of the Achés people and other local communities. TNC–FMB had to complete the financing to buy Mbaracayú and it was decided to create a fiduciary fund with the \$1,5 million with accumulative interests up to \$ 2 million. An agreement that “AES will invest \$2 million in the Mbaracayú project to capture a total of 13.1 million metric tons of carbon” in the forest and soil’s biomass was made. The stipulated amount was of \$0.153/metric ton of carbon. AES disbursed the funds after agreeing to the monitoring plan. Five percent of the fiduciary fund’s capital value has been put aside to cover the costs of administration and the management of the project.

- **Estimation of the sequestered carbon in the biomass of the Mbaracayú forest**

The forest mass was targeted in three distinct sections according to their morphology:  
a) section A of 57.700 ha (with 8 prospected natural communities)

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<sup>13</sup> Olander, J. 2000. Las opciones Forestales en el mecanismo de desarrollo limpio: un resumen de los principales temas para los países andinos. Ecodecision, Quito, 57 p.

- b) section B of 4.624 ha ( with Bosque Medio and Campo Sucio), and
- c) section C of 6.476 ha (property of the Aché community).

The first estimation of the biomass's volume was completed in September 1991. Professionals of the National Forest Services (Ministry of Agriculture and Livestock) did the inventory, based on three types of woods in five lots of 2000 m<sup>2</sup> each. The data collected for each tree (1857 in 15 lots) were those internationally recognized<sup>14</sup>. Additional volume was registered with felled trees, frequency and measured lianas (vines)<sup>15</sup>.

- **Calculation of the wood volume and the expansion of the biomass**

The forest inventory team calculated the volume and the biomass was obtained using the Total Volumen (m<sup>3</sup>/ha). Two additional factors were used

- a) a factor to augment the total volume of the wood to the total biomass on the ground including branches, leaves and twigs; and,
- b) a factor for the biomass of the forestal ground and underground layer.

The biomass of the roots, dead leaves, rotting wood and fallen trees were also included in the calculation, and the biomass in m<sup>3</sup>/ha was converted in weight. The biomass's carbon content is 50% (0.5) of its weight.

- **Estimation of the carbon captured by Mbaracayú**

The total weight of carbon captured in the above ground, the roots and the arboreal cover was 16,639,630 for section A, 734,270 for section B and 1,945,975 for section C, for a total of 19,319,875 metric tons of carbon. The volume of the type classified as forest in saturated ground, was estimated at 4,200,000 metric tons. An additional capture of 1,5 ton of C/ha/year was determined. Since calculations were done in 1991, these were checked by experts.

It is important to remember that in 1991 the carbon sequestration issues were beginning, and that the premises and calculations that the World Resource Institute (WRI) and others had at disposal were not fully accepted. The TNC project leader<sup>16</sup> circulated the calculations of carbon estimates to experts<sup>17</sup> (Randall, *in lit.*)<sup>18</sup>. The comments received were very positive and encouraging. The largest comments came from professionals at AES that were very interested on the additionality and displacement aspects. The IFC was informed that some Brazilian investors were interested in buying the property. They planned to use it for cultivation of soya after

<sup>14</sup> Diameter at chest-height, height both commercial and total.

<sup>15</sup> Aldwyn Gentry, Missouri Botanical Garden, defined Mbaracayú as the richest site in vines in all South America. His widow, Dr. Elsa Zardini is still a frequent botany research in the reserve, now focussed on cerrado plants.

<sup>16</sup> Mr. Alan Randall, leader on this negotiation.

<sup>17</sup> Sandra Brown (University of Illinois) had an outstanding reputation concerning tropical biomass and she was one of the authors of the existing literature. Dr. Mark Trexler was a very well-known consultant in carbon policies, and along with other people at WRI, studied the calculations carefully

<sup>18</sup> August 26, 2000

extracting the forest mass. It is because of this that Mbaracayú fulfilled the additionality issue and therefore the project was accepted. With regard to displacement, a good extension program working with local people to improve their means reducing the need and pressure for transforming the reserve to cultivations. Another important argument was that there was nowhere else the Brazilians could purchase 57,000 hectares of forest.

## VII. FUTURE ACTIONS

Total carbon emission by AES / Barbers Point were estimated in 13.1 million tons and they will be mitigated by 27.0 millions tons of carbon sequestered in Mbaracayú. TNC / FMB will help sequester or prevent the release of carbon in the atmosphere and even 25% would exceed 13.1 million tons. The big advantage is that Mbaracayú belongs to the private sector and an NGO owns the land. Only by "managing" the land, can FMB and TNC accomplish the agreement. The monitoring of the growth and succession of the forest will not lead to high costs, though it has not been officially done. This forest will not be logged but will include additional projects outside in the Watershed neighboring the reserve.

The conditions in the project agreement are satisfied because the biomass continues to be protected and has even been increased, the community program is successful and is advancing towards a secure future and, the project will be economically self-sufficient in the near future. It's also one of the richest sites of biodiversity in Paraguay and of Interior Atlantic Forest. The Mbaracayú Program has been successful in avoiding deforestation and conserving the carbon pools on the land (slowing deforestation, preventing logging, improving forest harvesting practices). The carbon sequestration was expanded and the storage increased in forest ecosystems by increasing the area and/or carbon density of forests (by establishing plantations and agroforests, allowing for natural regeneration, or improved soil management, and to increase storage in durable wood products), and 3) substitute sustainably grown wood for energy intensive and cement-based products (biofuels, construction materials). The sequestration of carbon can be verified by coming to Mbaracayú and "touching" the trees

- This project contributes to the objectives of sustainable development in the country. In having established mechanisms for the voluntary approbation of Paraguay and adequate procedures for the public participation.
- There is a real reduction of the net emission or augmentation of carbon sequestration. The geographical and temporal limits of the Mbaracayú forest and the accountability methods are showing real and complete impacts of the emissions.
- This project fulfills the requirements of standard measurements with a high grade of precision and exactitude. When there is doubt or uncertainty, estimation supervisors are used.

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- The conservation of the Mbaracayú forest clearly represents standards to determine the addition.
  - The risks that this project has displaced the emissions or generated new ones outside the limits (leakages), have been contemplated and neutralized in an effective way.
  - This project assures long-term sequestration by including a medium to prevent the reversion of the project.
  - This project does not displace the necessary inversions in the transition towards a model of development of low emissions at international level as it was already previewed at the Kyoto Convention.

### **VIII. CONCLUSIONS**

The most challenging issues for the future are:

1. Transferring the project to be completely local and empower local communities to increase their self-esteem and education.
2. Achieving a high degree of public health.
3. Poaching and illegal plantations inside the Mbaracayú forest. Park guards still find hunters on the reserve and illegal plantations that also add a security issue.
4. Deforestation has crept up to the very edges of the property, although at a lesser scale compared to the country's rate.
5. Be more open with neighboring communities and close suspicion among some sectors of the reserve's neighbors that believe Mbaracayú is actually a front for drug dealers from the United States.
6. Design and implement an ongoing C monitoring and verification program that provides the data necessary to complete the with-and without- project scenario in transparent and verifiable ways.
7. Find the complete self-sustainability of the project in the short run, and
8. Evaluate the implications of Mbaracayú and the watershed of being only a 300,000 hectare island of forest in a completely deforested region.

Based on Mbaracayú experience climate change mitigation projects offer an economic incentive to conserve existing natural forests, afforest degraded lands, or implement sustainable forest management. All these activities can enhance or conserve existing biodiversity, protect watersheds and soil resources, reduce local air pollution, enhance food production, transfer technology, and contribute to the sustainable development of the host nations. Increase of economic opportunities for local communities is another co-benefit of forest-based projects, viability of communities and contribution to sustainable long-term, locally driven, economic development in and around forest projects.

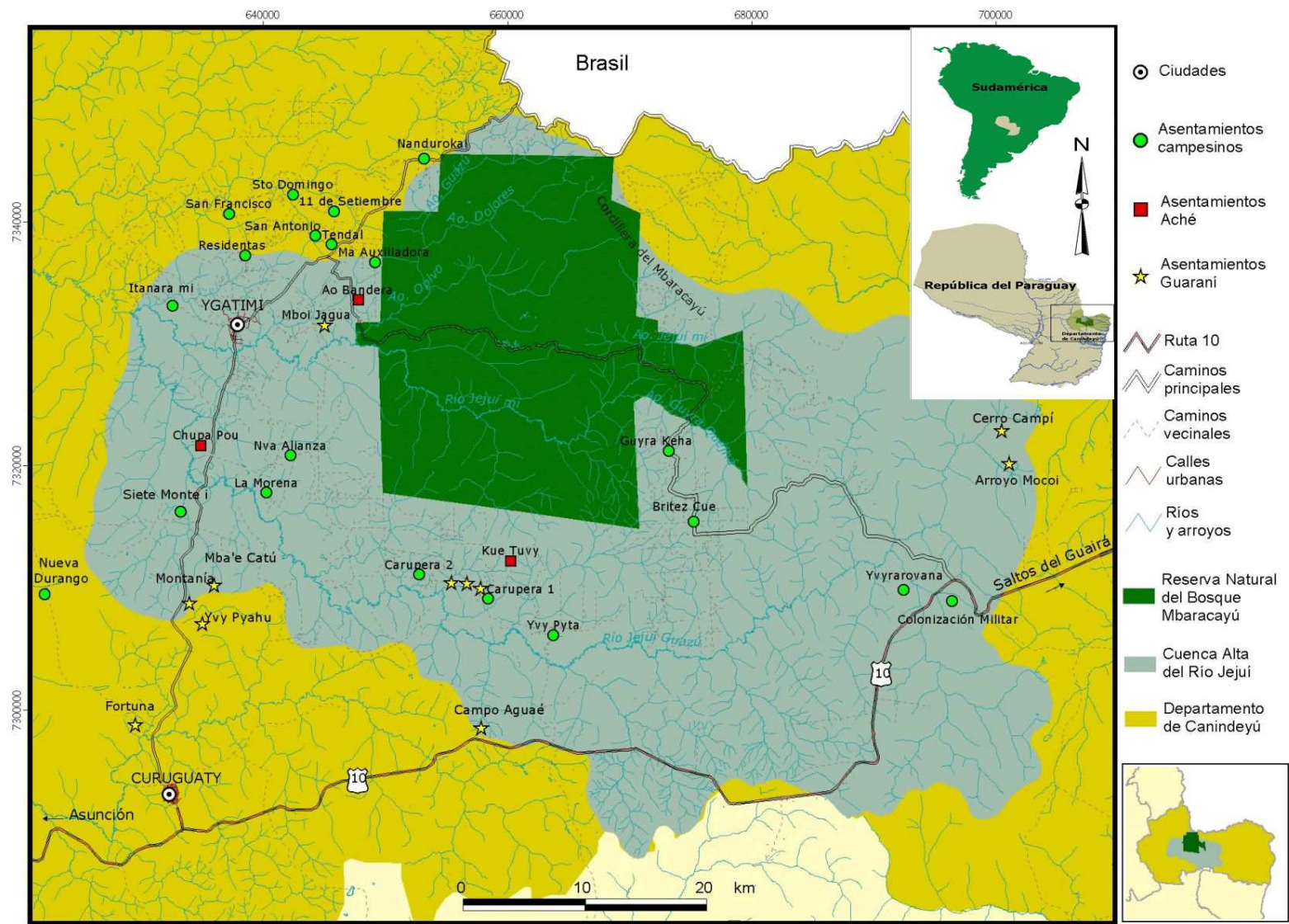
Mbaracayú has little risks, different from other projects that have the political risk of nationalization, complete project failure and other major changes in forest concessions or the fear that LUCF projects will not be accepted as part of Article 12 of the Kyoto Protocol (CDM). Project authorities are convinced that Mbaracayú is already out of risks

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by being supported by an internationally committed team and legally supported; however, it is known that this project was started before the Kyoto Protocol and consideration of the CDM was not a factor at that time.

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*A GHG Investment as a Catalyst for Conservation and Development*