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Report No. 36198 - CR

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED PURCHASE OF EMISSION REDUCTIONS BY THE BIOCARBON FUND

IN THE AMOUNT OF US$2.21 MILLION

FOR

COSTA RICA: CARBON SEQUESTRATION IN SMALL FARMS IN THE BRUNCA REGION PROJECT

May 10, 2006

Environmentally and Socially Sustainable Department
Central America Country Management Unit
Latin America and the Caribbean Region

CURRENCY EQUIVALENT
(Exchange Rate Effective April 12, 2006)

Currency Unit = Colones
527 Colones = US$1

Fiscal Year
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

BCF	BioCarbon Fund
CPS	Country Partnership Strategy
CCAD	Central American Commission on Environment and Development (*Comisión Centroamericana de Ambiente y Desarrollo*)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CO_2e	Carbon Dioxide equivalent
COOPEAGRI	*El General* Agricultural and Industrial Cooperative (*Cooperativa Agrícola Industrial y de Servicios Múltiples El General R.L.*)
DNA	Designated National Authority
ER	Emission Reduction
ERPA	Emission Reduction Purchase Agreement
FONAFIFO	National Forestry Financing Fund (*Fondo Nacional de Financiamiento Forestal*)
FSC	Forest Stewardship Council
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GoCR	Government of Costa Rica
IBRD	International Bank for Reconstruction and Development
IDF	Institutional Development Fund
KfW	German Credit Bank (*Kreditanstalt für Wiederaufbau*)
LULUCF	Land Use, Land Use Change and Forestry
MINAE	Ministry of Environment and Energy (*Ministerio de Ambiente y Energía*)
MBC	Mesoamerican Biological Corridor
NPV	Net Present Value
NGO	Non-governmental organization
OCIC	Costa Rican Office for Joint Implementation
PAD	Project Appraisal Document
PDD	Project Design Document
PSA	Payment for Environmental Services (*Pago por Servicios Ambientales*)
SINAC	National System of Conservation Areas (*Sistema Nacional de Áreas de Conservación*)
UNFCCC	United Nations Framework Convention on Climate Change

Vice President:	Pamela Cox
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COSTA RICA: Carbon Sequestration in Small Farms in the Brunca Region

CONTENTS

MAP: IBRD 34778

COSTA RICA: Carbon Sequestration in Small Farms in the Brunca Region (or COOPEAGRI Project)

PROJECT APPRAISAL DOCUMENT

Latin America and Caribbean Region
LCSEN

Date: April 21, 2006 Country Director: Jane Armitage Sector Director: Laura Tuck Project ID: P094155	Team Leader: Armando E. Guzmán Sectors: Forestry (100%) Themes: Climate Change (P), Other environmental management (S)

Project Financing Data:

[ ] Loan [ ] Credit [ ] Grant [ ] Guarantee [X] Other: Carbon Finance

For Loans/Credits/Others: The project does not involve Bank financing. Total Bank Carbon Financing amounts to US$2,207,123

Proposed terms: US$3.75 per ton CO_2e for 588,565 t of CO_2e by 2017 (or 393,953 t of CO_2e by 2012)

Financing Plan (US$m.)

Source	Local	Foreign	Total
Borrower (FONAFIFO)	1.03	0.00	1.03
COOPEAGRI	0.15	0.00	0.15
IBRD/IDA	0.00	0.00	0.00
Others (Bio Carbon Fund):	2.21	0.00	2.21
Total	3.39	0.00	3.39

Borrower: National Forest Financing Fund (FONAFIFO)
Responsible agency: FONAFIFO
Address: FONAFIFO, Avenida 7, Calles 5 y 3, Apartado Postal 594-210, San José, Costa Rica.
Web site: www.fonafifo.com
Telephone numbers: (506) 257-8475 or Fax: (506) 257-9695 or (506) 258-1614, (506) 258-1614
Contact persons:
Mr. Jorge Mario Rodríguez Zuñiga, Executive Director (jrodriguez@fonafifo.com)
Mr. Oscar Sanchez Chaves, Coordinator Environmental Service Payments Program (osanchez@fonafifo.com)

Estimated disbursements (Bank FY/US$m)

FY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Annual	98,078	196,346	294,615	294,799	262,061	165,713	165,713	156,210	252,563	79,140	121,376	120,510
Cumulative	98,078	294,424	589,039	883,838	1,145,899	1,311,611	1,477,324	1,633,534	1,886,096	1,965,236	2,086,613	2,207,123

Project implementation period: 2006–2017
Expected effectiveness date: May 2006
Expected closing date: May 2018

Does the project depart from the CPS in content or other significant respects?	○ Yes ○ No

Does the project require any exceptions from Bank policies? Have these been approved by Bank management? Is approval for any policy exception sought from the Board?	○ Yes ○ No ○ Yes ○ No ○ Yes ○ No
Does the project include any critical risks rated "substantial" or "high"?	○ Yes ○ No
Does the project meet the Regional criteria for readiness for implementation?	○ Yes ○ No

Project development objective

The project development objective is to generate 588,565 tons of CO_2e emission reductions by 2017 through the reforestation of 4,140 hectares of privately-owned lands in southeastern Costa Rica. This will be accomplished by reforesting in a period of three years: 1,200 ha of pasture lands using natural regeneration; 2,490 ha of pasture lands using forest plantations; and by planting 180,000 trees using agroforestry systems in 450 ha of crop and pasture lands. The project will also generate additional ecological, wildlife, and landscape diversity benefits in the project area.

Project description

Building on FONAFIFO's Payment for Environmental Services program and COOPEAGRI management's forest experience in southeastern Costa Rica, two components have been conceived for the project:

Component 1. Contracting landholders to provide environmental services. Under this subcomponent, environmental service contracts will be issued with participating landholders, mainly for the provision of anthropogenic GHG removals, through human-induced promotion of natural seed sources (natural regeneration), forest plantations, and tree planting in agroforestry systems.

Component 2. Monitoring and evaluation of (i) anthropogenic GHG removal, and (ii) social and economic impacts. The project will support the implementation of a new monitoring system for afforestation/reforestation projects that include the participation of small and medium farmers in tropical regions. The project will also monitor and report any socioeconomic changes during project implementation.

Which safeguard policies are triggered, if any? Environmental Assessment 4.01, Forestry 4.36 and Pest Management 4.09

Significant, non-standard conditions, if any, for: None.

Board presentation: None, as no lending instrument is involved.

Loan/credit effectiveness: Effectiveness will be achieved upon execution (signature) of the Emission Reduction Purchase Agreement (ERPA). The ERPA in turn will be signed after negotiations.

Covenants applicable to project implementation: None.

A. STRATEGIC CONTEXT AND RATIONALE

1. Project Eligibility

Costa Rica signed the Kyoto Protocol on April 27, 1998, and ratified it on August 9, 2002. The Designated National Authority (DNA) is the Costa Rican Office for Joint Implementation (OCIC), an entity created by the Government of Costa Rica (GoCR) in 1996 under the authority of the Ministry of Environment and Energy (MINAE). The project qualifies as a reforestation activity as per draft decision CMP-1 of COP7 of the Marrakesh Accords (2001)[1] because the project activities will develop on lands under pastures and crops that did not have forest cover prior to December 31, 1989. Costa Rica adopted a forest definition, as required by the Marrakesh Accords, through Resolution R-174-MINAE dated April 20, 2005, and published it in the Official Gazette ("LA GACETA") No. 114 on Tuesday, June 14, 2005.

The GoCR expressed full support to the project through the OCIC on July 27, 2004. The project is expected to be officially ratified in May 2006.

Country and sector issues

In the second half of the twentieth century, Costa Rica was one of the most rapidly deforested countries in Latin America. Deforestation occurred predominantly in tropical dry and moist life zones during the early periods; later, it moved to tropical and premontane moist and wet zones. By 1983, only the less accessible high rainfall zones in rugged terrain retained relatively undisturbed forests. Road development, which provided access to the forest, was an important agent of change in all reference periods.

The deforestation that occurred in the 1960s, 1970s, and 1980s left deep scars on the land. These are more evident on the hillsides of the Pacific Region of Costa Rica where for more than 40 years a savanna-like ecosystem has dominated the landscape in many areas. This ecosystem has remained due to the complex interactions of climatic, physical, biological, and socioeconomic factors (e.g., land pressure, traditional land use

[1] In agreement with draft decision CMP.1 on land use, land use change, and forestry (LULUCF) from COP7 Marrakesh Accords (2001), definitions, modalities, rules, and guidelines relating to LULUCF under the Kyoto Protocol, for LULUCF activities under Articles1 3.3 and 3.4, Costa Rica adopted the following definitions:
(a) "**Forest**" is a minimum land area of 1.0 hectare with tree crown cover (or equivalent stocking level) of more than 30% with trees, with the potential to reach a minimum height of 5 meters at maturity in situ. A forest may consist of closed forest formations where trees of various stories and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations that have yet to reach a crown density of 30 percent or a tree height of 5 meters are included under forest, as are areas normally forming part of the forest that are temporarily unstocked as a result of human intervention or natural causes but are expected to revert to forest;
(b) "**Afforestation**" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years through planting, seeding, and/or the human-induced promotion of natural seed sources;
(c) "**Reforestation**" is the direct human-induced conversion of nonforested land to forested land through planting, seeding, and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to nonforested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on December 31, 1989.

management, soil types, steep slopes, the presence of a marked dry season, forest fires, and the invasion of African grasses such as jaragua (*Hyparrhenia rufa* [Nees]).

The climate and soils in Costa Rica are such that there would not normally be any areas with natural treeless grassland. The originally prevailing vegetation types ranged from savannas, open woodland, and dense forests in areas with a pronounced dry season. As forest was cleared, including areas of low soil fertility, cattle ranching became the most important land use in Costa Rica.

Presently, approximately 45% of cleared land in Costa Rica is under permanent pasture.[2] Much of this was cleared directly from the forests. Now that much of the original forest is gone, prior land use has created an enormous biological debt (in particular, a large area of pastures in the country's North, Central, and South Pacific Zones). Cattle production in Costa Rica requires relatively few external and labor inputs, and for many of these deforested lands, cattle production is currently the best land use option for many farmers. The COOPEAGRI Project will seek to provide new options to these farmers, using the incomes from carbon credits generated by forest restoration activities.

Government Strategy

One of Costa Rica's singular achievements is its dramatic reversal in the rate of deforestation from about 60,000 hectares deforested per year in the 1970s to a present ***net gain*** in forested area each year. The Payment for Environmental Services (PSA) program has been an important part of the package of policies and programs that has led to this achievement. About 260,000 ha of land are enrolled in the program—most of these are existing forests under conservation contracts (95%). This is thought to have resulted in significant local, national, and global benefits, including: (i) income generation for the rural poor; (ii) improvement of watersheds and related impacts on cleaner ground- and surface water; (iii) contribution to carbon sequestration; (iv) conservation of biodiversity for its future economic and sustainable use, for example for tourism and potential bioprospection; and (v) other indirect benefits such as improved public health and infrastructure.

Thanks to the PSA program, Costa Rica has reversed the deforestation crisis of the 1970s, becoming the only country in the tropics with a negative deforestation rate. However, in spite of the program's success, it has not been effective in recovering marginal pasture lands because these lands are not suitable for commercial reforestation, and the remaining forest patches are too small to qualify for the PSA Forest Protection. To recover these areas, forest fires must be controlled and the availability of seed sources must be increased. The PSA program can induce farmers to accomplish these tasks, but it will be required to modify the existing program to include other options for the farmers in these areas, such as reforestation through natural regeneration complemented by the use of agroforestry systems.

[2] Ibrahim et al. 2000.

In the late 1990s, Costa Rica developed the Certified Tradable Offset (CTO) to sell carbon sequestration services generated by conserving the nation's forests. US$2 million worth of CTOs were sold to international buyers in subsequent years. Evolving rules that limited emission reduction sales generated by reforestation or afforestation curtailed this effort. With the Kyoto Protocol now ratified and guidelines in place regarding eligible land use activities, there is a potential to use the Clean Development Mechanism of the Kyoto Protocol to finance forest regeneration in degraded areas—areas that the PSA Program has been unable to address to date because of their high cost. Costa Rica has an estimated 1,087,000 hectares of land where forest regeneration could occur.

Reforestation activities supported by the sale of Certified Emission Reductions (CERs) under the Clean Development Mechanism (CDM) would help restore vegetation in degraded areas that the PSA Program has been unable to reach until now. By doing so, the proposed project will likewise contribute to establishing or improving other environmental services (e.g., biodiversity, hydrological services).

Carbon Finance Issues

The COOPEAGRI Project met the selection criteria of the BioCarbon Fund and will be one of the first CO_2 emission reduction projects in the Land Use, Land Use Change, and Forestry (LULUCF) sector, which will obtain certification by the CDM Executive Board of the United Nations Convention on Climate Change UNFCCC. The BioCarbon Fund and FONAFIFO signed a Letter of Intent (LoI) that confirms the principal terms of understanding about the BCF's interest in the possible acquisition of the rights and title of up to 620,000 t of CO_2 equivalent (Emission Reductions or ERs) achieved by the proposed project until year 2017. Project activities correspond to a reforestation activity according to the UNFCCC definitions for reforestation and forest. The ratification of the Kyoto Protocol by Costa Rica enables the country to participate in the Clean Development Mechanism. This allows the establishment of greenhouse gas emission reduction projects, which can generate Certified Emission Reductions (CERs) to be traded in international carbon markets. The Bank is willing to buy verified ERs (VERs) instead of CERs in order to support the market development[3].

2. Rationale for Bank involvement

The existing World Bank Carbon Finance funds and facilities, with pledges of over $1 billion, are part of a larger global effort to combat global climate change and are consistent with the Bank's mission to reduce poverty and improve living standards in the developing world. Through the proposed BioCarbon Fund (BCF) Project, the World Bank has a unique opportunity to help alleviate both climate change and poverty by supporting the generation of Certified Emission Reductions (CERs). The Bank, through the BCF, plays a crucial role in the creation of a specific market for CERs from LULUCF

[3] The ERPA to be signed between FONAFIFO and the World Bank will assume the acquisition of VERs. However, the World Bank as trustee of the BioCarbon Fund bears the convertibility risk of the VERs becoming CERs. CERs are units of GHG reductions generated from CDM registered projects, verified by external, UN-accredited third party verifiers, and issued by the CDM Executive Committee.

CDM projects. Because of slow progress in international climate change negotiations and subsequent implementation by the UNFCCC, the market for LULUCF CERs has suffered serious delays in comparison to the faster developing market for CERs from other eligible categories such as renewable energy.

The proposed project is included within the IBRD/GEF–financed Mainstreaming Market-Based Instruments for Environmental Management Project, which has been identified by the World Bank's Country Partnership Strategy (CPS)[4] as one of the projects contributing to natural resources management and strengthening the country's leadership in environmental management. The proposed project is complementary to the IBRD/GEF–financed project in preparation as well as to the ongoing IBRD/GEF US$49.2 million Ecomarkets Project (P052009). The capacity developed by FONAFIFO, through the implementation of the Payment for Environmental Services (PSA) Program in the context of the Ecomarkets Project, will allow the extension of the program to LULUCF activities in Kyoto-eligible land. The Mainstreaming Market-Based Instruments for Environmental Management Project will contribute to the implementation of the COOPEAGRI Project by providing technical assistance for developing and strengthening capacity to monitor carbon sequestration within FONAFIFO.

The COOPEAGRI Project would further develop and contribute to the financial sustainability of FONAFIFO's PSA program by serving as a pilot for carbon sequestration, promoting natural resources management and biodiversity conservation on private land. The project will increase FONAFIFO's efficiency in preparing and implementing emission reduction projects by serving as a pilot for developing streamlined procedures to contract and generate verified emission reductions. Scaling up the COOPEAGRI experience in other areas of Costa Rica will result in a source of funding for the PSA program on small and medium landowners' plots, leading to increased carbon sequestration and knowledge about carbon sinks in the country, the region, and beyond.

The project will build on a partnership between the Bank and the Ministry of Environment and Energy (MINAE) dating back a decade, when a World Bank–IDF grant helped to initiate many of the unique, forward-looking policies that are now under implementation by the Government of Costa Rica. The COOPEAGRI Project is one of the first World Bank BioCarbon Fund projects in Central America and one of the first CDM projects in Costa Rica. This project is expected to raise awareness of the economic, social, and environmental potential of CDM reforestation activities at the national and regional levels.

B. PROJECT DESCRIPTION

Costa Rica is presently implementing a Payment for Environmental Services Program (PSA) with support from the World Bank, GEF, and KFW. Through the implementation of the Program, FONAFIFO has developed the technical and administrative capacity to

[4] Report No. 28570, approved by the World Bank Group's Board of Directors on May 19, 2004.

promote reforestation projects in the country. Through the COOPEAGRI Project, FONAFIFO proposes to expand the scope of the PSA in southeastern Costa Rica (Pérez Zeledón County). The additional incomes from sales of ERs will allow FONAFIFO to:

(i) create a new PSA modality: reforestation of deforested lands through human-induced promotion of natural seed sources (natural regeneration); and

(ii) improve the cash flow pattern typical of forestry activities, making it appropriate for small and medium landowners' needs.

The project area is located in the Pérez Zeledón County of the San José Province of Costa Rica. It covers three different geographic locations of the county: the Northern Hillsides, the Southern Hillsides, and the Valley. The project will promote the development of a diverse range of land uses within COOPEAGRI's area of influence in order to maximize social and environmental benefits, including the generation of carbon offsets. COOPEAGRI is a cooperative consisting of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle.

Farmers associated with COOPEAGRI will introduce forestry activities on their privately owned farms, supported by the PSA program. The project will have a total of 4,140 ha distributed among three different project activities, which will be established within a period of three years (see Table 1).

Table 1. Project area allocated for each forestry activity

Reforestation Activity	Total area (ha)	Area per year (ha/year)
Natural regeneration	1,200	400
Forest plantations	2,490	830
Agroforestry systems	450[5]	150[6]
Total	4,140	

1. Carbon Finance component of the project

The cost of the project is US$3.39 million. Approximately 65% of the total cost ($2.21 million) will be financed by the BCF, which will acquire 100% of the emission reductions produced by the project in the first 12 years. The rest of the budget will be financed by FONAFIFO (30.4%) and COOPEAGRI (4.4%). Farmers participating in the project will receive US$2.81 million (82.9% of the project budget) in payments for environmental services. The project will generate 895,465 tons of CO_2e over a 20-year period. The World Bank BioCarbon Fund would purchase the emission reductions achieved by the project until year 2017, i.e., 588,565 tons of CO_2e at an estimated price of US$3.75 per ton.

2. Project development objective

The project development objective is to generate 588,565 tons of CO_2e emission reductions by 2017 through the reforestation of 4,140 hectares of privately-owned lands

[5] Equivalent to planting 180,000 trees in agroforestry systems.
[6] Equivalent to planting 60,000 trees per year in agroforestry systems.

in southeastern Costa Rica. This will be accomplished by reforesting in a period of three years: 1,200 ha of pasture lands using natural regeneration and 2,490 ha of pasture lands using forest plantations; and by planting 180,000 trees using agroforestry systems in 450 ha of crop and pasture lands. The project will also generate additional ecological, wildlife, and landscape diversity benefits in the project area.

Performance indicators

The primary performance indicators are:

(i) Timely delivery of 393,953 tons of CO_2e emission reductions (or anthropogenic GHG removals) by 2012 and a cumulative total of 588,565 tons of CO_2e by 2017.

(ii) At least 150 small and medium farmers participating in the project reforestation activities.

Project components

Component 1. Contracting landholders to provide environmental services

Under this subcomponent environmental service contracts will be issued with participating landholders, mainly for the provision of anthropogenic GHG removals, through human-induced promotion of natural seed sources (i.e., natural regeneration), forest plantations, and tree planting in agroforestry systems.

Component 2. Monitoring and evaluation of (i) anthropogenic GHG removal, and (ii) social and economic impacts

The project will support the implementation of a new monitoring system for afforestation/reforestation projects that include the participation of small and medium farmers in tropical regions.[7] The project will also monitor and report any socioeconomic changes during project implementation.[8]

3. Project's global and local environmental objective

The project will contribute to stimulate the market for CERs from LULUCF CDM projects as part of the global effort to reduce global warming by removing carbon from the atmosphere and to cope with climate change in general. The project will also raise awareness of the economic, social, and environmental potential of Kyoto Protocol CDM reforestation activities at the national and regional levels.

[7] A new monitoring methodology has been prepared and will be presented to the UNFCC–CDM Board.
[8] Component 3C: "Monitoring social and economic impacts" of the proposed IBRD/GEF Mainstreaming Market-Based Instruments for Environmental Management project will support this effort. This subcomponent will strengthen FONAFIFO's monitoring systems related to measuring socioeconomic impacts of the program, with a particular emphasis on the poor as well as small- and medium-sized landholders.

The COOPEAGRI Project addresses one of the key challenges in achieving objectives in the strategic areas of the World Bank's support for the 2005 Costa Rica National Environmental Strategy (ENA). The project will address the overarching goal of sustained economic growth with equity by attracting investment. This is especially valuable because in contrast to the majority of other foreign investments in Costa Rica, the project will benefit the rural area, where more than 65% of the country's poor live.[9]

The Costa Rica National Forestry Development Plan (NFDP) targets the reduction of global atmospheric carbon dioxide (CO_2) concentration through the implementation of projects aimed at the restoration and sustainable management of forests.

C. IMPLEMENTATION

1. Institutional and implementation arrangements

The main institutions involved in the implementation of the proposed project include the National Forestry Financing Fund (*Fondo Nacional de Financiamiento Forestal*–FONAFIFO), and the Agricultural and Industrial Cooperative–COOPEAGRI. FONAFIFO will be the main institution responsible for the implementation of the project. The implementing agency is currently implementing the World Bank–GEF Ecomarkets Project and preparing a follow-up operation.

FONAFIFO will have full responsibility for overall project management and supervision, including monitoring and evaluation (M&E). The M&E activities will be carried out in close collaboration with COOPEAGRI; proper agreements would be signed for this purpose.

2. Monitoring and evaluation of outcomes/results

Project supervision will be carried out by the Bank and an independent Designated Operational Entity (DOE) that would be trained in Bank safeguard issues. In addition, since COOPEAGRI is FSC certified, annual audits and a full reassessment every five years are required. The BioCarbon Fund will deduct the Bank's supervision costs from the payments to COOPEAGRI. The same is done for the DOE unless the sponsor pays the costs directly as described below. The FSC certification, audits, and reassessments will be paid directly by COOPEAGRI. FSC costs are part of COOPEAGRI's overall administrative costs for its operations.

The Forest Stewardship Council (FSC)

Forest certification systems have proliferated in the last five years. The three that have been in place for the longest time represent nearly 90 percent of forest certification worldwide. These are the U.S.–based Sustainable Forestry Initiative (SFI); the Program for Endorsement of Forest Certification Schemes (PEFC), which originated in the EU; and the Forest Stewardship Council (FSC), an international network.

[9] Costa Rica, Social Investment and Poverty, Report No. 24300-CR, The World Bank, 2003.

Founded in 1993, the FSC is often considered a model in standard-setting for sustainable forest management and for rigorous, independent, third-party assessments and audits. The FSC is an international system with significant areas certified in the U.S., Canada, and Europe. It is also one of the few systems, and the largest, operating in developing countries. Forest certification by the FSC is based on 10 principles and 56 criteria (P&C) that apply to all tropical, temperate, and boreal forests. Many of these P&C also apply to forest plantations and to a certain extent nontimber forest products and other services. The ten principles considered include: 1) compliance with local country laws and regulations; 2) clear legal definition of tenure and use rights and responsibilities; 3) recognition of and respect for indigenous peoples' laws and customary rights; 4) community relations and workers' rights; 5) assurance of economic viability and a wide range of environmental and social benefits from the forest; 6) environmental impact prevention; 7) development and execution of a forest management plan; 8) development and operation of a monitoring and assessment strategy; 9) maintenance of high conservation values for forests; and 10) guidelines for plantations. The FSC requires a field visit by a multidisciplinary team, consultations with local stakeholders, peer review of draft reports, negotiation with clients on terms and conditions, and annual audits. A full reassessment is required every five years.

The Bank's new Operational Policy on Forests (OP 4.36) requires all projects that involve commercial harvesting of forests to be certified under an acceptable independent forest certification system. FSC principles fully comply with the Bank's certification criteria.

The cost of certification (that is, for becoming certified the first time) ranges from US$5,000 to US$20,000, depending on the size of the unit and the complexity of the case. However, an additional average of US$2,000 must be considered for annual audits. Moreover, depending on each case, recommended actions to improve unsustainable practices (e.g., road maintenance, improvement of workers' job conditions, and waste management in mills) may represent additional costs or investments on the order of US$10,000–25,000.

Bank supervision

The Bank will supervise safeguard issues for three years from the time of ERPA signature. Should any issue arise during supervision, the costs would be covered by the Bank's Carbon Finance Unit (ENVCF). If Bank safeguard policies are violated by the project, carbon payments would be halted immediately and the necessary actions would be taken to reinstate them.

DOE validation and registration

The project sponsor may assign a CDM–accredited DOE and pay directly for the validation of the project. Alternatively, the BCF may pay and deduct the cost from carbon fund payments. Once the project is validated the DOE verifies emission reductions, certifies them as appropriate, and requests the CDM Board to issue Certified Emission Reductions accordingly. The verification will be performed periodically until the end of

payments. These costs are considered part of the supervision costs and will be paid directly by the project sponsor or by the BCF and deducted from carbon fund payments.

3. Critical risks and possible controversial aspects

There are no controversial aspects in the Project. Annex 8 includes a general Carbon Finance Risk Assessment. However, the following risks that could potentially reduce the achievement of the project's objectives have been identified along with their mitigating measures:

Risks	Mitigating Measure
In the project region, there is substantial risk of forest fire during the dry season.	Fire is commonly used as a land clearing tool. However, appropriate measures are taken to prevent forest fires; for example, firebreaks and the establishment of fire control brigades by COOPEAGRI and MINAE.
Diseases or pests may be a potential danger.	Pest and disease management control is included in COOPEAGRI's operational manuals which are FSC compliant.
Illegal logging.	This will be prevented by COOPEAGRI members and by FONAFIFO's regular verification and audits.
COOPEAGRI members' decreased interest due to lack of understanding of the project or to apparent cumbersome requirements to participate.	COOPEAGRI and FONAFIFO will continuously provide information on requirements and training on project procedures to participating and interested farmers.
Connectivity of reforested areas may not be achieved due to distant location of the selected farms.	Additional emphasis to promote connectivity will be placed when selecting participants.
Dominance of grasses such as jaragua (*Hyparrhenia rufa* [Nees]) in the Valley and Southern Hillsides subregions slow tree growth on pasture lands.	Because jaragua is a pyrophyte species, fire prevention and control will be a recommended practice. This grass prospers with annual agricultural burning practices.

4. ERPA conditions and covenants

Carbon finance is not part of the World Bank's lending program. There will be no regular loan or grant disbursement. Direct payments will be made as per the ERPA by the Bank as a trustee for the BioCarbon Fund. The ERPA format is included as Annex 7.

D. APPRAISAL SUMMARY

1. Financial analyses

Overview

Costa Rica is presently implementing through FONAFIFO the Payment for Environmental Services Program (PSA). The proposed project will allow FONAFIFO to expand the scope of the PSA program in southern Costa Rica. The additional incomes from the sales of Emission Reductions (ERs) to the World Bank BioCarbonFund (BCF) will allow FONAFIFO to: (i) create a new PSA modality: reforestation of deforested lands through human-induced promotion of natural seed sources (natural regeneration); and (ii) improve the cash flow pattern typical of forestry activities, making it appropriate for small and medium landowners' needs.

The project will promote the development of a diverse range of land uses within COOPEAGRI's area of influence. COOPEAGRI is a local cooperative consisting of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle ranching. The project will have a total of 4,140 ha distributed among three different reforestation activities: Natural Regeneration, Forest Plantations, and Agroforesty Systems.

Assumptions

The project area is located in Pérez Zeledón County, San José, Costa Rica. It covers three different geographic locations of the county: the Northern Hillsides, the Southern Hillsides, and the Valley. The project activities that will be promoted in the Northern and Southern Hillsides subregions are Natural Regeneration and Agroforestry Systems. Forest Plantations and Agroforestry Systems will be promoted in the Valley area. The project entity is FONAFIFO, and as the project will not generate financial revenues to FONAFIFO, an economic analysis is required. Farmers associated with COOPEAGRI will introduce forestry activities on their privately owned farms, supported by the PSA program. The payments that the farmers will receive are presented in Table 2 below. The financial analysis will assess the rate of investment from the small and medium farmers' perspective.

Table 2. Payment amounts and schedules for the project activities through the PSA Program

Project activity	Payment	Payment distribution
Natural regeneration[10]	$41.00/ha	Per year for 5 years (renewable every 5 years up to a total of 20 years)

[10] This type of reforestation activity is not presently included in the PSA program. It will be introduced in the program through the proposed project.

Forest plantations	$816.00/ha	In 10 years as follows: 1st year 46% ($375.36/ha), 2nd to 9th year 6% ($48.96/ha)
Agroforestry systems	$1.30/tree	In 3 years as follows: 1st year 65% ($0.85/tree), 2nd year 20% ($0.26/tree), 3rd year 15% ($0.19/tree)

Without Project Scenario

The present land use alternatives for the farmers in the project region are limited to agriculture and cattle ranching (see Table 3). Comparing the financial analysis of both, the land use alternatives in the project area, and project reforestation without carbon financing (see Table 4.1 and 4.2 of Annex 4), it is evident that pineapple and sugarcane are the most attractive land uses in the Valley subregion, blackberry is the most attractive land use in the Northern Hillsides,
and cattle is the most attractive land use in the Southern Hillside subregion.

Table 3. Present land use alternatives by project subregion

Land Uses Alternatives	**Subregions**		
	Northern Hillsides	**Valley**	**Southern Hillsides**
Pineapple		X	
Sugarcane		X	
Coffee	X	X	X
Blackberry	X		
Cattle	X	X	X

Natural Regeneration does not compete with any of the land use alternatives. Natural regeneration shows a negative net annual income throughout the three crediting periods; this activity, without carbon financing, is therefore definitely not attractive to farmers. Agroforestry systems in the hillsides are financially possible, but do not replace land uses such as cattle ranching or coffee because they become integrated with these activities, making them even more economically attractive.

Forest Plantations without sales of Emission Reductions (ERs) are not a financially attractive alternative in the Valley subregion. They do not compete with agricultural activities such as sugarcane or pineapples, but they might occur on marginal pastures and coffee plantations in the steepest lands of the Valley, if the irregular cash flow observed in the Forest Plantation activity is stabilized with the carbon financing. Forest Plantations (FP) and Agroforestry Systems (AF) are profitable activities according to their NPV (FP = US$862; AF = US$348) and IRR (FP = 14.4%; AF = 15.1%), but they are not as profitable as sugarcane (NPV = US$2,506) and pineapples (NPV = US$7,201) in the Valley, and blackberries on the Northern Hillsides (NPV = US$2,598). Therefore, farmers will tend to convert existing forest, forest plantations, coffee plantations, or pastures to the latter two land use activities. In the case of Natural Regeneration (NR), Table 4.2 in Annex 4, shows that at least for the first 20 years, farmers will not receive incomes from this type of forestry activity; therefore, farmers will not adopt this activity in the absence of carbon financing.

Project scenario

Financial analysis evaluates the project scenario (with carbon financing) at 20-year, 40-year, and 60-year periods to coincide with project crediting periods. Financial analysis is conducted in two steps. In the first step, performance of forestry activities on one hectare of land is assessed. In the second step, performance of the overall project area is assessed.

Performance at 20 years (1st crediting period)

The net annual income of the cash flow of project forestry activities under the project scenario is shown in Table 4.3. This cash flow assumes that farmers will receive incomes from Emission Reduction sales through the PSA program. In the case of Natural Regeneration, the cash flow is significantly improved with carbon financing. For example, it shows a positive accumulated net income. The NPV (US$173) is positive and the IRR is 52.0%; however, the estimated annual rent is lower than the estimated annual rent from cattle ranching. It is expected that with the incorporation of carbon financing, Natural Regeneration activities will compete with extensive cattle ranching in the less productive and marginal areas of the project's Northern and Southern Hillsides subregions.

Forest plantations do not compete with sugarcane and pineapples in the Valley, nor with blackberries in the Northern Hillsides subregion. However, they do compete with coffee and cattle in all three subregions. The accumulated net annual income of Forest Plantations under the baseline scenario is negative during most of the project period. This project activity without carbon financing has a very irregular distribution of annual incomes for the farmers, which makes it unaffordable for them. On the other hand, the net annual income of the cash flow for Forest Plantations under the project scenario (with carbon financing) is positive for most of the project period, providing the farmers with a more regular net annual income to support their needs (see Table 4.3 of Annex 4).

Performance at 40 years (2nd crediting period) and 60 years (3rd crediting period)

Project performance analysis shown in Table 4 reveals that the carbon financing can play a significant role in influencing farmers' investment decisions. Without sales of Emission Reductions, Natural Regeneration will never occur because this activity will not provide regular incomes to farmers. With and without carbon incomes, Forest Plantations are an economically and financially attractive activity. Carbon financing, however, improves household financial conditions by providing farmers with annual incomes. That is, farmers will not face a negative net annual income for most of the forest plantation rotation (see Table 4.2 in Annex 4). In the case of Agroforestry Systems, although both NPVs (without and with carbon incomes) are positive for all three crediting periods, carbon financing more than doubles the NPV of the activity. This makes Agroforestry Systems with carbon financing the most economically attractive course of action for the participating farmers.

Table 4. NPV (values in US$) and IRR of project reforestation activities for different time horizons and two project scenarios

Reforestation Activity	Without Sales of ERs		With Sales of ERs	
	NPV (10%)	IRR (%)	NPV (10%)	IRR (%)
	20 YEARS			
Natural Regeneration	(99)	NA	173	52.0
Forest Plantations	862	14.4	1,550	21.0
Agroforestry	348	15.1	882	NA
	40 YEARS			
Natural Regeneration	(113)	NA	185	52.0
Forest Plantations	1,080	14.6	1,870	21.2
Agroforestry	400	15.1	1,013	NA
	60 YEARS			
Natural Regeneration	(116)	NA	186	51.8
Forest Plantations	1,112	14.6	1,917	21.2
Agroforestry	408	15.1	1,033	NA
	PROJECT AVERAGE*			
At 20 years	528	14.7%	1,050	26.4
At 40 years	660	14.8%	1,260	26.5
At 60 years	680	14.8%	1,291	26.5

* Weighted average based on the number of hectares established for each project activity.
NA = Not applicable because the investment is recovered during the first year of establishment.

A sensitivity analysis was conducted to examine the influence of changes in timber prices and labor costs on each reforestation activity, without including sales of ERs. This analysis is presented in Annex 4 and shows that the financial attractiveness of the project activities is robust with reasonable variations in the critical assumptions. Forest Plantations and Agroforestry Systems in the Valley do not compete with sugarcane and pineapple, even in the best-case scenario. Likewise, Natural Regeneration without carbon financing in the Hillsides subregions is still the less attractive option for small and medium farmers. Forest Plantations in the Valley are financially more attractive than cattle ranching; however, without carbon financing it is not attractive to farmers due to the negative cash flows they face during the rotation period of the plantations. In summary, without the financial benefits from the sales of ERs the project is not feasible, because it is unlikely that farmers will adopt the proposed reforestation activities. The proposed project will alleviate the financial hurdles of the proposed reforestation activities, as well as the other identified barriers. The financial benefits from selling the ERs will generate incomes that, when transferred to small and medium farmers, will make forestry activities one of the most attractive land use options; in this sense, the ERs will be a new "cash crop" that has a guaranteed price and generates annual incomes to the farmers.

2. Technical

It is estimated that the actual net anthropogenic GHG removals by sinks of the proposed project will be 895,465 t CO_2e over a period of 20 years (starting in 2006). The Work

Bank–BCF will purchase ERs from 2006 to 2017 (inclusive), totaling approximately 588,565 t CO_2e.

Baseline and Additionality

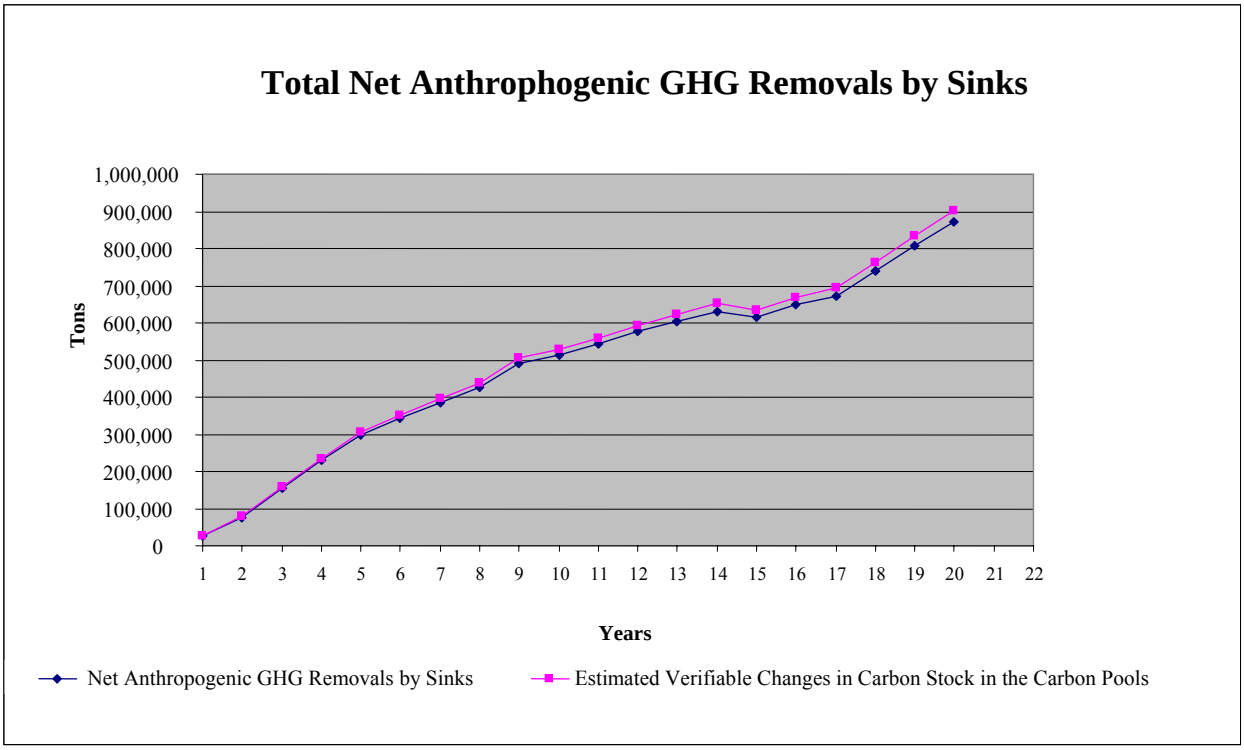
The barrier and historical trend analyses indicate that land uses in the project area may change from pastures to crops and vice versa, depending on the market price fluctuations of cattle and crops. This represents the baseline scenario in the project area and is very likely to continue into the future in the absence of the proposed project activities (see Annex 1, Project Design Document, section B). Barrier analysis indicates that the most attractive land uses for small and medium farmers in the Northern and Southern Hillsides subregions are coffee, subsistence farming (grains), forest conservation (due to the PSA program), and cattle farming (meat); the less attractive options are commercial horticulture, agroforestry systems, forest plantations, and mining. Likewise, the most attractive land uses for small and medium farmers in the Valley Subregion are, in order of priority, coffee, cattle farming (meat), and forest conservation. The less attractive options are cash crop agriculture (grains), agroforestry systems, forest plantations, and mining. Historical trend analyses indicate that 100 percent of the pasture and crop sample areas have maintained their current land use over the last 11 years, and that 90.7 percent of the areas have maintained pastures or crops for more than 20 years.

The application of the additionality test to the proposed project shows that it is not the baseline scenario. The main conclusions in the application of the test are:

i. The project will start on May 2006; therefore, it is eligible for CDM registration.
ii. Land eligibility can be verified by locating farmers' parcels on 1960 to 1980 topographic maps with land cover information, and on georeferenced aerial photos from 1992, 1997, and 2003.
iii. The proposed project activity is not the only alternative that is in compliance with all country regulations; thus, the proposed reforestation activities are additional.
iv. The project reforestation activities without the financial benefits from sales of ERs are not financially attractive for small and medium farmers.
v. Sensitivity analysis shows that project activities without the financial benefits from the sales of ERs are unlikely to be financially attractive for the farmers.
vi. The additional incomes from the sales of ERs to the BioCarbon Fund will alleviate economic and financial hurdles shown in the financial analysis of the project activities, as well as other identified barriers, and will thus enable the proposed project activities to be undertaken.

Calculation of ERs

The estimate of the actual net GHG removals by sinks for the proposed project includes the estimated verifiable changes in carbon stocks (only above- and belowground biomass of additional trees) and the estimated emissions due to the implementation of project activities. Carbon stock changes in soil organic matter, dead wood, and litter carbon pools are not considered a significant source of CO2e emissions for this project; therefore, they will not be measured or monitored. The results of the calculation of Total Net Anthropogenic GHG in a 20-year period are illustrated below.



3. Economic

The economic analysis assesses the rate of investment from the FONAFIFO perspective, considering that it is a relatively autonomous or deconcentrated body within the structure of the State Forestry Administration (a general superstructure within MINAE that includes SINAC). The economic analysis shown in Table 4.8 of Annex 4 includes the adjustment of prices and the positive externalities generated by the increased forest cover in the project area. The proposed project with or without carbon incomes represents a good investment for the country. However, the financial analysis shows that the proposed project activities without carbon financing are not feasible, because farmers will not be able to adopt the proposed reforestation activities. Natural Regeneration without carbon incomes is the less attractive option for the country, but when the carbon incomes are taken into account it becomes one of the most attractive options. This attractiveness comes from the many positive externalities derived from the establishment of a natural forest, especially on the hillsides of the project area. Forest Plantations have some positive externalities (e.g., soil conservation, habitat for wildlife, and increased water quality and flow regulation), and when they are considered in the economic analysis the NPV and IRR increase slightly (e.g., NPV at 10% for the first crediting period increases from US$862 to US$886).

4. Social

Negative social impacts have not been identified. The project activities are integrated with the productive activities of farmers who will voluntarily dedicate part of their farms to reforestation or agroforestry activities. In this way, the CDM project is developing a

balanced carbon sequestration project that creates a diverse landscape, and at same time allows local farmers to maintain food security and their present incomes. In addition, downstream communities will benefit from the environmental benefits produced by upstream farmers when they adopt forest production activities, such as water protection (quality and flow regulation), flood mitigation, protection of air quality, scenic beauty, etc.

The likely socioeconomic impacts of project implementation have been assessed through a socioeconomic study and the findings support the project's positive impacts. When all the effects are summarized and linked, four highly relevant, positive impacts result:

i. Improved family welfare.
ii. Increased social capital.
iii. Improved water quality.
iv. Increased biodiversity.

5. Environment

Although the project will have a positive environmental outcome (carbon sequestration as well as benefits to ecological, wildlife, and landscape diversity), in line with the Bank's Operational Policy (OP) 4.01, an EA was prepared and presented as Annex 5. In particular, the EA addresses two environmental issues: forest and pest management. These issues are summarized below. Since the project will be implemented on community lands that are used and owned by COOPEAGRI members, social safeguard policies are not triggered.

Forests

This project is fully compatible with the Forests OP/BP 4.36. It would not support any clearing or degradation of forests or other natural habitats. Instead, it is intended to promote the conservation and restoration of forests and other natural vegetation, through reforestation and agroforestry PSA modalities. Compliance with the Bank's Forests Policy will be ensured through FONAFIFO's operating rules, as described in the PSA program's Operational Manual.

Moreover, COOPEAGRI is now Forest Stewardship Council (FSC) certified. It was inspected and the FSC's ecological, social, and economic principles and criteria were found to be fully implemented for round wood. The certification was issued on June 16, 2005.

Pest Management

While the project does not finance the purchase of pesticides or pest control equipment, pesticides (specifically Glyphosate-based pesticides) will be used by the project's participating farmers. Prior to tree planting, in the case of Forest Plantations and Agroforestry Systems, site preparation will be manual and with minimum soil disturbance. This will be limited to making a hole with a tree planting shovel and keeping free of weeds a circle around the seedlings (35 cm radius). The use of pesticides may be

required at one stage during the life cycle of the plantations to control weed competition in the first two to three months after planting. In such cases, trained COOPEAGRI farmers may apply a small amount of the pesticide in a small circle around each tree seedling.

Glyphosate is listed on the *WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2004* as unlikely to present acute hazard in normal use. Thus, it is not classified as Type IA, IB, or II (pesticides with hazardous active ingredients) or subject to Prior Informed Consent (PIC) procedures. Since Glyphosate is not persistent it is also allowed under the FSC. After plantation establishment, weed control is carried out only manually with machetes and no further pest control is required. The project does not lead to substantially increased pesticide use and subsequent environmental problems, and COOPEAGRI farmers will use only Glyphosate or a Type III or IV in the WHO classification. This commitment will be reflected in the Emission Reduction Purchase Agreement (ERPA). Farmers will not be allowed to mix herbicides by hand or to reuse old pesticide containers, and they will be required to use protective equipment when applying herbicides.

In compliance with Costa Rica's regulatory framework for safe, effective, and environmentally sound pest management, the project will apply commonly accepted procedures for procurement, handling, application, and disposal of pesticides. This is reflected in the COOPEAGRI pesticide manual, which is available to all persons involved with pesticide application in their projects. COOPEAGRI has the capacity to manage the procurement, handling, application, and disposal of pest control products; to monitor the precision of pest control and the impact of pesticide use; and to develop and implement ecologically based pest management programs. COOPEAGRI offers training to those who are responsible for pesticide application.

More information on the above as well as details on the physical characteristics, climate, land use, and biological communities of the project area are presented in Annex 5.

6. Safeguard Policies

As indicated above, the project is likely to have strong positive environmental outcomes, as it aims to reforest 600 ha of degraded former pasture lands to achieve carbon sequestration and a sustainable source of wood for future harvesting. However, the project triggers the Bank's OP 4.01, OP 4.36, and OP 4.09.

Table 5. Applicability of Safeguard Policies to the Precious Woods Project

Policy	Applicability
Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	Yes
Natural Habitats (OP 4.04, BP 4.04, GP 4.04)	No
Forestry (OP 4.36, GP 4.36)	Yes
Pest Management (OP 4.09)	Yes
Cultural Property (OPN 11.03)	No

Policy	Applicability
Indigenous People (OD 4.20)	No
Involuntary Resettlement (OP/BP 4.12)	No
Safety Dams (OP 4.37, BP 4.37)	No
Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	No
Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)	No

OP = Operational Policy, BP = Best Practice, GP = Good Practice, OPN = Operational Policy Note, OD = Operational Directive

The safeguard screening category of the project is S2. The project is classified as category B, requiring an Environmental Analysis but not a full-scale Environmental Assessment study. The project has taken measures to comply with OP 4.01 on Environmental Assessment, carrying out an EA focused on forestry and pest management issues (OP 4.36 and OP 4.09). The project complies with the World Bank's environmental and social safeguard policies.

E. COMPLIANCE WITH BANK POLICIES

This project complies with all World Bank policies.

Armando E. Guzmán
Task Manager

Laura Tuck
Sector Director

Jane Armitage
Country Director

ANNEX 1: PROJECT DESIGN DOCUMENT (PDD)

This is a summary of the draft PDD to be presented to the CDM by Precious Woods. The annexes of the PDD are not included. It is expected that a final version of the PDD will be available in January 2006.

CONTENTS

SECTION A. General description of the proposed A/R CDM project activity:

A.1. Title of the proposed A/R CDM project activity:

>> Carbon Sequestration in Small and Medium Farms in the Brunca Region, Costa Rica (COOPEAGRI Project)

A.2. Description of the proposed A/R CDM project activity:

>> Costa Rica is presently implementing a Program of Payments for Environmental Services (PSA), mainly using its own resources. Through the implementation of the PSA program, FONAFIFO has developed technical and administrative capacity to promote reforestation projects in the country. Through the COOPEAGRI Project, FONAFIFO proposes to expand the scope of the PSA program in a specific area of the country (Pérez Zeledón County). The additional incomes from carbon sales will allow FONAFIFO to:

i) Create a new PSA modality: reforestation of deforested lands through human-induced promotion of natural seed sources (natural regeneration).
ii) Improve the cash flow pattern typical of forestry activities, making it appropriate for small and medium landowners' needs.

At least 300 farmers associated with COOPEAGRI will introduce forestry activities in their privately owned farms, through the PSA program. COOPEAGRI is a cooperative composed of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle. The project will have a total of 4,140 ha distributed in three different project activities, which will be established within a period of three years (see Table 1).

Table 1. Project area or number of trees allocated for each forestry activity

Reforestation Activity	Total area (ha)	Area per year (ha/year)
Natural regeneration	1,200	400
Forest plantations	2,490	830
Agroforestry systems	450[11]	150[12]
Total	4,140	

The proposed forestry activities will be established with 50% native species, such as Amarillon (*Terminalia amazonica*), Botarrama (*Vochysia ferruginea*), Cebo (*Vochysia guatemalensis*), Pilon (*Hieronyma alchorneoides*), and 50% non-native species: Melina (*Gmelina arborea*) and Teak (*Tectona grandis*). The

[11] Equivalent to planting 180,000 trees in agroforestry systems.
[12] Equivalent to planting 60,000 trees per year in agroforestry systems.

project is expected to generate a total net anthropogenic GHG removal of approximately 895,465 t of CO_2e in a period of 20 years, or 588,565 t of CO_2e until project year 12 (2017), which would not occur in the absence of the proposed project. As suggested by Pearson et al. (2005),[13] in order to facilitate the fieldwork, increase the accuracy and precision of measuring/estimating carbon, and reduce monitoring costs the project area was divided in three relatively homogenous subregions: Northern Hillsides, Valley, and Southern Hillsides.

The Valley is presently covered by pastures, coffee, sugarcane, and small forest patches. The major cities are located in this area. The terrain is formed by rolling hills, with a slope ranging from 0 to 30%, and an elevation between 400 and 800 m. The forestry activities that will be promoted in these areas are manmade forest plantations and agroforestry activities such as small forest blocks, trees mixed with crops, windbreaks, and tree planting in rows and fences.

The Northern and Southern Hillsides are presently covered by pastures and a few crops such as coffee plantations. The elevation varies from 700 to 2200 m, with slopes greater than 60%. The proposed land uses to be promoted in this area are agroforestry and reforestation through natural regeneration.

The cost of project implementation during the first 20 years is estimated at US$4.140 million. FONAFIFO will cover US$0.739 million, COOPEAGRI will cover US$0.120 million, and the remaining US$3.281 million will come from carbon credit sales, at least US$2.207 million of which are from the World Bank BioCarbon Fund.[14]

A.3. Project participants:

>> ***The National Forest Financing Fund (FONAFIFO)*** is the project entity responsible for implementing and monitoring the project. Small and medium farmers in the project area will sign a contract with FONAFIFO to participate in the project.

A.4. Technical description of the A/R CDM project activity:

>> The project area is located in Pérez Zeledón County, San José, Costa Rica. It covers three different geographic locations of the county: the Northern Hillsides, the Southern Hillsides, and the Valley.

Farmers will dedicate part of their farmland (under private ownership) to commercial reforestation (forest plantation), reforestation through natural regeneration, and agroforestry activities. ***Agroforestry*** will be promoted on lands presently used for agriculture or cattle located in the Valley or the foothills. Agroforestry systems included in the project are windbreaks, plantation in small blocks (less than 1 ha), plantation of trees in rows and fences, and trees mixed with crops. ***Reforestation by induced natural regeneration*** will be recommended on deforested hillside areas. The project relies on the supply of seeds from two sources: the existing forest patches and the seed-soil bank. Natural regeneration is frequently observed in the field. It occurs when farmers stop burning or clear cutting the vegetation that grows naturally on pastures. The proposed CDM project aims to mimic this process by allowing the development of a new natural forest. This project activity includes the identification of areas, the establishment of wire fences around them to exclude cattle (if needed), the prevention of forest fires by establishing firebreaks, the sign marking of the area, and the control of hunting/poaching. Finally, ***manmade forest plantations*** will be promoted on medium to high quality sites presently covered with pastures in the Valley area.

Site preparation varies depending on the proposed forestry activity. In the case of reforestation through natural regeneration, no major site preparation will be done except for establishment of wire fences and firebreaks around the project activity area, as well as proper sign marking. In the case of agroforestry and forest plantations, site preparation will be manual and limited to making the hole for seedling planting with a tree planting shovel. In addition, a radius of 35 cm around each seedling will be kept free of weeds to allow seedling growth. The use of herbicides may be required in sites with aggressive grasses, but probably only during the first year. The project proposes the use of approved herbicides and the utilization of

[13] Pearson et al. 2005. Sourcebook for LULUCF Projects. WINROCK International. Putting Ideas to Work. Arlington, VA. 45 pp.

[14] A Letter of Intention (LoI) was already signed between FONAFIFO and the WB-BCF. The WB-BCF will acquire the carbon credits produced by the project during the first 12 years.

approved practices in the use of these herbicides (see list in Section A4.8). Seedling production will take place at COOPEAGRI's nursery with certified seed or seeds from seed stands already established in the area. Foliage fertilization (one time) will be applied during the nursery stage. Seedlings will be transported by the property owners to the project sites, and a second fertilization will be applied prior to planting. After tree planting and at least during the first three years, a radius of 35 cm around the trees will be manually maintained free of weeds to favor seedling growth.

Pruning will be done according to the species manuals, while thinning and harvesting have been standardized among the species to facilitate monitoring of tree biomass carbon pools:

- Native species and Teak will be thinned when the stands are 5, 10, and 15 years old and harvested when they are 20 years old.
- Melina will be thinned when the stands are 5 and 8 years old and harvested when they are 12 years old.

After the first 20-year period the project will be resubmitted for renewal and another cycle of project activities will be initiated.

A.4.1. Location of the proposed A/R CDM project activity:

>> The proposed CDM Project is within the administrative limits of Pérez Zeledón County, which belongs to San José Province, Costa Rica. The project boundary is clearly defined and stored as a shape file in the project Geographic Information System (GIS).

A.4.1.1. Host Party(ies):

>> Republic of Costa Rica

A.4.1.2. Region/State/Province etc.:

>> Province: San José.

A.4.1.3. City/Town/Community, etc:

>>The CDM project includes 10 districts of Pérez Zeledón County.

A.4.1.4. Detail of geographical location and project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:

>> The geographic location of the project is Latitude North: 9.22° to 9.40° Longitude West: 83.28° to 83.81° (Datum WGS84). It covers 4,140 ha, spread over 10 districts, 194 towns, and one municipality.

A.4.2. Species and varieties selected:

>> The selection of species for Forest Plantations or Agroforestry Systems *was based on the country's accumulated experience. The selected species grow well in plantations, have good seed supply, and will provide additional incomes to the farmers. In addition these species have a good market; they are fast growing and well known by the farmers.*

Forest species from *Natural Regeneration* will be all native species. The natural regeneration process allows the recovery of the original forest type; therefore, it will be promoted in the project's Hillsides areas (Northern and Southern), where there are remaining forest patches that will function as seed sources.
In the case of *Agroforestry Systems* the project proposes to plant 180,000 trees of native species in association with crops and pastures.

In the case of man-made *Forest Plantations* the project will promote the use of four native species (50% of trees), and two non-native species (50% of trees). Because man-made plantations will be established in the Valley subregion, and the estimated area of this subregion is 31,352 ha, the expected percentage of non-native plantations at the end of the project for this subregion will be around 4.0%.

A.4.3. Specification of the greenhouse gases (GHG) whose emissions will be part of the proposed A/R CDM project activity:

>> Project GHG emissions include emissions from fuel used in activities such as the transportation of seedlings, forest products, and monitoring staff, as well as fuel used during thinning and harvesting of project activities, and GHG emissions due to seedling fertilization at the tree nursery and during tree planting. The total project GHG emissions by sources are estimated at 5,823 t CO_2e.

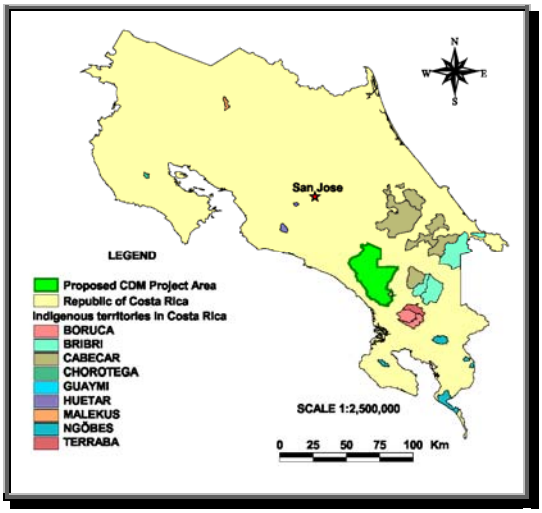
A.4.4. Carbon pools selected:

>> Selected carbon pools for all three project activities are vegetation carbon pools, but including only above- and belowground tree biomass. These carbon pools were selected because they are the main sinks of CO_2. Soil, litter, and dead wood carbon pools will not be accounted or monitored; they will increase the expected net anthropogenic GHG removals by sinks, but they cannot be considered a significant source of emissions. Instead, these pools will tend to increase; therefore, the project's net anthropogenic GHG removals by sinks will be very conservative.

A.4.6. A description of legal title to the land, current land tenure and land use, and rights of access to the sequestered carbon:

>> The project includes a total of 4,140 ha privately owned by small and medium farmers affiliated with COOPEAGRI, a cooperative composed of 10,162 farmers currently dedicated to agricultural activities such as coffee, sugarcane, and cattle. It is estimated that about 300 of the cooperative's associates will participate in this project; each of them must have a registered land title and a cadastral map. It is also important to mention that there are no large indigenous areas within Pérez Zeledón County (see Map 1). Project activities will not result in any resettlement or limit access to previously used lands by indigenous people.

Map 1. Indigenous territories in Costa Rica and CDM project area



Farmers will sign a contract with FONAFIFO for the payment of environmental services. This contract establishes that farmers give rights of access of the sequestered carbon to FONAFIFO, and that in exchange, the farmers will receive from FONAFIFO annual payments for the environmental forestry services produced by them, including carbon sequestration.

In agreement with Article 45 of the Costa Rican Constitution,[15] property rights cannot be violated. No one can be deprived of his property if it is not legally proven for public interest, and through previous compensation according to the law.

[15] Republic of Costa Rica, Political Constitution, 1949. Title IV, Individual Rights and Guarantees.

A.4.7. Type(s) of A/R CDM project activity:

>> The project falls under the afforestation/reforestation category of the Land Use and Land Use Change and Forestry, and proposes three types of activities: Forest Plantations, Natural Regeneration, and Agroforestry Systems.

A.4.8. Technology to be employed by the proposed A/R CDM project activity:

>> The seedlings for all project activities, with the exception of reforestation by induced natural regeneration, will be produced at COOPEAGRI's nursery, located at La Presa farm in the Daniel Flores District, with certified seed (from CATIE's seed bank when available) or from previously selected trees to guarantee seedling quality. Seedling production at the nursery varies depending on the species. In general, Teak needs about three months in the nursery, Amarillon and Pilon need about six months, Cebo and Botarrama three to five months, and Melina about two and a half months. The planting stock will be produced in jiffy pellets or black polyethylene bags. Foliage fertilization (one time at 0.0043 gr/tree of complete fertilizer formula, equivalent to 18% of nitrogen/tree) will be applied at the tree nursery. The project will follow modern nursery practices for the production of all planting stock.

Prior to tree planting, in the case of Forest Plantations and Agroforestry Systems, site preparation will be manual and with minimum soil disturbance. It will be limited to making a hole with a tree planting shovel and keeping free of weeds a circle around the seedlings (35 cm radius). The use of herbicides may be required in sites with aggressive grasses, but probably only during the first year. The project proposes the use of approved herbicides as shown in Table 6. Farmers will not be allowed to mix herbicides by hand or to reuse old pesticide containers, and they will be required to use protective equipment when applying herbicides.

Table 2. List of approved herbicides from the World Bank[16]

PRODUCT NAME (Herbicides)	ACTIVE INGREDIENT	WHO CLASS
Polaris	Isopropylamine glyphosate	-
Roundup 480 AS	Isopropylamine glyphosate	-
Roundup 75 WSG	Monoammonuim glyphosate	-

Note: Classification of active ingredient based on WHO's hazard classification system.

A second fertilization (50 gr/tree of 10-30-10 complete fertilizer formula, equivalent to 5 gr of nitrogen/tree) will be applied during tree planting. Weed control will be done manually three times a year for the first two years for all species.

Reforestation by induced Natural Regeneration will be recommended on deforested hillside areas with the highest slopes, in both the Northern and Southern subregions. The remaining forest patches and the seed-soil bank will function as seed sources. Forest species from natural regeneration will be all native species. The natural regeneration process allows the recovery of the original forest type. This project activity includes the identification of the areas, the establishment of wire fences around them to exclude cattle (if required), the prevention of forest fires by establishing firebreaks, the sign marking of the area, species enrichment if necessary, and the control of hunting/poaching.

Agroforestry Systems will be promoted in all three subregions. On the hillsides this activity will be limited to the lower slopes. The systems included in the proposed CDM project are windbreaks, plantation in small blocks, plantation of trees in rows and fences, and trees mixed with crops. The species selection will be based on site conditions and farmers' preferences. The species spacing will vary depending on the agroforestry system technique selected by the farmer. The average number of trees planted is estimated at 400 trees/ha.

[16] Ishii-Eiteman, M and Ardhianie, N. 2002. Community Monitoring of Integrated Pest Management versus Conventional Pesticide Use in a World Bank Project in Indonesia. International Journal of Occupational Environmental Health, 8: 200–231.

Reforestation through Forest Plantations will be recommended on medium to high quality sites presently covered with pasture in the Valley area. The species spacing will be 3 x 3 m for a total of 1,111 trees/ha. Pruning in Forest Plantations will vary depending on the recommended silvicultural practices for the species. Thinning of native species and Teak will be done at ages 5, 10, and 15, while harvesting will be done at age 20. In the case of Melina, thinning will be done at ages 5 and 8, while harvesting will be done at age 12.

A.4.9. Approach for addressing non-permanence:

>> The major objective of the project is to increase the forest cover of Pérez Zeledón County through reforestation and agroforestry system activities. The adoption of a 20-year crediting period, with renewals up to two more periods (for a total period of 60 years) and to generate long-term Certified Emission Reductions (CERs), reflects the project entity's commitment to keep the project lands under permanent vegetation. Because the country has programs such as Payments for Environmental Services (PSA) (Web site: www.fonafifo.com), which give value to land covered with forests, the logical decision of the farmers is to conserve the forest. Consequently, the project design, the crediting period, and the institutional and legal arrangements effectively address the non-permanence issue.

A.4.10. Duration of the proposed A/R CDM project activity/Crediting period:

>> The crediting period chosen for the project is 20 years, with renewals of up to two further periods of 20 years each, for a total crediting period of 60 years.

A.4.10.1. Starting date of the proposed A/R CDM project activity and of the (first) crediting period, including a justification:

>> The starting date of the proposed A/R CDM project activities will be May 2006 and will continue up to 2008. Project implementation began on October 2005 with the identification and geo-referencing of the project sites. Establishment of Natural Regeneration parcels began in November 2005 and will continue up to December 2008. Forest Plantations and Agroforestry Systems will begin in May 2006 and continue up to November 2008. Therefore, the starting date of the first crediting period is November 1, 2005.

A.4.10.2. Expected operational lifetime of the proposed A/R CDM project activity:

>> The expected operational lifetime of the project is 60 years.

A.4.10.3. Choice of crediting period and related information:

>> The crediting period chosen for the project is 20 years, with the renewals of up to two further 20-year periods for a total crediting period of 60 years.

A.4.10.3.1. Renewable crediting period, if selected:

>> Twenty-year crediting period, with renewals of up to two further 20-year periods, for a total crediting period of 60 years.

A.4.10.3.1.1. Starting date of the first crediting period:

>> Starting date of crediting period is November 1, 2005.

A.4.10.3.1.2. Length of the first crediting period:

>> 20 years.

A.4.11. Brief explanation of how the net anthropogenic GHG removals by sinks are achieved by the proposed A/R CDM project activity, including why these would not occur in the absence of the proposed A/R CDM project activity, taking into account national and/or sectoral policies and circumstances:

>> Net anthropogenic GHG removals by sinks will be achieved by promoting and establishing three types of forestry activities: reforestation through Natural Regeneration (1,200 ha), tree planting in Agroforestry Systems (180,000 trees), and reforestation through Forest Plantations (2,490 ha).

The reforestation rate in Costa Rica through Forest Plantations is decreasing. Lack of progress in reforestation is highlighted by the declining trend in reforestation from 1997 to the present time (see Table 3). Without carbon incomes the cash flow of forestry activities is negative throughout the project's lifetime, that is, this type of activities does not provide the farmers with a regular annual income to support their needs (see Section B.3). This characteristic of forestry activities limits their participation in reforestation projects. Budget limitations do not allow the concentration of available resources from the existing PSA program (implemented in Costa Rica by FONAFIFO) in a specific area, or the increase and extension of the payments beyond the fifth year.

Table 3. Reforestation in Costa Rica from 2000 to 2005

YEAR	REFORESTED AREA (HA)/YEAR
2000	2,050.50
2001	2,085.55
2002	1,627.56
2003	3,040.60
2004	1,935.10
2005*	32.27
Total	10,771.58

Note: * Reported area until September 2005.
Source: FONAFIFO 2005.

A.4.11.1. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

>> The expected net anthropogenic GHG removals by sinks during the first crediting period of 20 years are estimated at 895,465 t of CO_2e (Figure 11) or 588,565 t of CO_2e until project year 12 (2017). These calculations are already conservative because they include only above- and belowground tree biomass. These estimated net anthropogenic GHG removals by sinks were used in conducting financial and economic analyses. It is recommended that at each monitoring interval the estimated net anthropogenic GHG removals be checked and adjusted, taking into account the monitoring data.

A.4.12. Public funding of the proposed A/R CDM project activity:

>> The total cost for the proposed A/R CDM project is estimated at US$4.140 million. It will be financed by the BioCarbonFund (at least US$2.207 million in carbon credits sales), FONAFIFO (with US$0.739 million in counterpart funds), COOPEAGRI (with US$0.120 million in counterpart funds), and incomes from other carbon sales.

The value of carbon credits alone is not able to cover all project costs, since 87.0% of the project costs are payments to farmers; consequently the project's success depends on having additional funds. In the case of the COOPEAGRI project, it is tied to the Payments for Environmental Services (PSA) program implemented by FONAFIFO. The carbon credits value represents 81.0% of project costs; therefore, FONAFIFO and COOPEAGRI must invest additional funds in the project to pay for the other environmental services: biodiversity protection, water protection, soil protection, and scenic beauty generated by forestry activities.

No funding is expected from the Official Development Assistance and the Parties to the Annex I of the Kyoto Protocol for undertaking the project.

SECTION B. Application of a baseline methodology

>> There is no approved baseline methodology that can be applied to this project. Therefore, a new baseline methodology is proposed to assess the project baseline, the baseline carbon stocks, and the

project's GHG removals, and to evaluate the additionality of emission reductions due to the project scenario.

B.1. Title and reference of the approved baseline methodology applied to the proposed A/R CDM project activity:

>>Baseline methodology for carbon sequestration through afforestation/reforestation activities on lands without forest cover before December 31, 1989, which are part of small and medium farms in the tropical regions.

B.1.1. Justification of the choice of the methodology and its applicability to the proposed A/R CDM project activity:

>> Existing or historical (as applicable) changes in carbon stocks in the carbon pools within the project boundary.

Changes in carbon stocks in the carbon pools within the project boundary from a land use that represents an economically attractive course of action, taking into account barriers to investment.

Changes in carbon stocks in the pools within the project boundary from the most likely land use at the time the project begins.

Baseline approach 22(c) is relevant to the project context. This approach is appropriate for the proposed A/R CDM project activity because in the selected area, reforestation and agroforestry activities must compete with alternative land uses that have fewer barriers. This approach highlights the factors contributing to maintain the current land use in project area in the absence of the CDM project. Since the stakeholders in the project area are small-l and medium-sized property owners, the most economically attractive land use will be the one with fewer barriers.

B.2. Description of how the methodology is applied to the proposed A/R CDM project activity:

>> The methodology used for this analysis was first proposed by Eco-securities[17] in 2003. It is called: "Afforestation or reforestation on non-forest lands that have been without forest cover before December 31, 1989." This methodology was reviewed to include a precise definition of barriers, and a cartographic test of the historical land use trend. The proposed methodology is transparent and conservative, and it is congruent with option 22(c) of Decision 19/CP.9. It is based on the identification of the most attractive land use for small and medium farmers through the analysis of the socioeconomic dynamic observed in the region. This methodology not only identifies the barriers to investment that farmers must take into account when they decide which land use they will apply in their farms, but also identifies the historical land use trend using cartographic and photographic records. After identifying the land use, which represents the most attractive course of action for small and medium farmers, it is possible to determine expected changes in carbon stocks in the carbon pools within the project boundary. The proposed new baseline methodology uses a step-by-step approach outlined below:

Step 1: Identification of the most attractive land use for small and medium farmers.

- 1.1 Identification of possible land use alternatives.
- 1.2 Identification of barriers affecting the selection of alternative land uses.
- 1.3 Determination of barrier levels for each land use alternative.
- 1.4 Ranking of alternative land uses based on the overall barrier level.

Step 2: Identification of the historical land use trend within the project boundary.

Step 3: Identification of the land use baseline scenario within the project boundary.

Step 4: Estimation of the changes in carbon stocks in the carbon pools within the project boundary on the baseline scenario.

[17] FAO–CCAD. 2003. Taller Regional "Inicio del Proceso de Preparación de Proyectos Forestales bajo el Mecanismo de Desarrollo Limpio" del 20 al 24 de octubre de 2003, Managua, Nicaragua.

Identification of the land use baseline scenario within the project boundary.

The barrier and historical trend analyses indicate that land uses in the project area may change from pastures to crops and vice versa, depending on the market price fluctuations of cattle and crops. This represents the current scenario in the project area and it has a strong probability to continue into the future in the absence of the proposed project activities. The historical land use in the area and the market prices of cattle and crops during the last five years (see Table 4) support this trend as the baseline scenario within the project boundary.

Estimation of the changes in carbon stocks within the project boundary on the baseline scenario.

Under the baseline scenario, i.e., that land use in the project area varies from pastures to crops and vice versa, depending on the market price fluctuations for cattle and crops, and because project activities will be developed on parcels without forest cover, it is reasonable to assume that changes in the carbon stocks within the project boundary will be equal to zero.

However, because small and medium property owners often have few trees mixed with pasture or crops on their farms; it is highly likely that the project activity parcels will have pre-existing trees growing on them. These trees are part of the baseline carbon pools but it is assumed that the biomass increment due to pre-existing trees in the parcels is equal to zero.

Table 4. Market prices in Costa Rica for cattle, coffee, and other crops.

ACTIVITY / YEARS	CATTLE[i] ($/head)	COFFEE[ii] ($/quintal)	SUGAR CANE[iii] ($/quintal)	PINEAPPLE[iv] ($/unit)	BEANS[v] ($/tm)	CORN[vi] ($/tm)
2001	562.31	50.70[•]	8.78	0.85	886.79	**74.08**
2002	710.00	43.16[•]	6.06	1.07	956.83	**98.25**
2003	367.95	57.35[*]	7.88	1.09	539.98	**98.25**
2004	366.20	68.65[*]	6.49	0.93	596.88	**95.38**
2005	421.12	57.00[⊥]	8.91	0.90	764.43	78.24

[i] Weighted average price of cattle in Costa Rica.[18]
[ii] For years 2001 and 2002: average international coffee prices.[19] For years 2003 and 2004: international coffee prices in March according to the New York Stock Exchange.[20] For year 2005: international coffee prices in March according to the New York Stock Exchange.[21]
[iii] Sugar prices for the month of March according to the New York Stock Exchange.[22]
[iv] Pineapple prices per unit for the middle of March at farmers' trading places in Costa Rica.[23]
[v] Average international bean prices.[35]
[vi] Average international corn prices.[35]

B.3. Description of how the <u>actual net GHG removals by sinks</u> are increased above those that would have occurred in the absence of the registered <u>A/R CDM project activity</u>:

The approval and registration of the proposed A/R CDM project activity will alleviate economic and financial hurdles shown in the financial analysis of the project activities, as well as the other identified barriers, and thus enable the proposed A/R CDM project activity to be undertaken. The proposed A/R CDM project activity will generate the following benefits:

[18] http://www.mercanet.cnp.go.cr
[19] Flores, M. et al., 2002. Centroamérica: Impacto de la caída de los precios del café. CEPAL, Naciones Unidas. pp. 77.
[20] http://www.icafe.go.cr/newsite.nsf
[21] http://www.nacion.com/In_ee/2005/marzo/03/pais16.html
[22] Data provided by Carolina Segura from Agricultural and Industrial League for Sugar Cane (LAICA), 2005.
[23] http://www.infoagro.go.cr/Agricola/mercados_nac.htm

- In the absence of the A/R CDM project activity, carbon stocks in the project area are expected to decrease or remain steady.
- The financial benefits from selling the CERs will generate incomes which, when transferred to small and medium farmers, will make forestry activities the most attractive land use option.
- The proposed A/R project is replicable in other areas inside and outside the host country. It will attract other entities that will see it as a testing ground for future carbon finance activities, including the participation in "learning by doing" exercises regarding carbon monitoring, verification, and certification.
- Financial benefits from the A/R CDM project activity will reduce the perceived investment risks of forestry activities by providing a more steady (timing) and guaranteed (fixed purchase price of CO_2) income stream. The CERs sequestered by the growing trees will be a new "cash crop" that has a guaranteed price and generates annual incomes to small and medium farmers.

B.4. Detailed baseline information, including the date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:

>> The detailed baseline information is presented in Annex 3.

Data of completion of Baseline Study: 10/16/2005
Name(s) of person(s)/entity(ies) determining the baseline: Edgar Ortíz (Team Leader, FONAFIFO), María Elena Herrera (Forest Eng., FONAFIFO), Ana E. Gómez (independent GIS specialist), Ronald Mejías (independent Environmental Economist).

SECTION C. Application of a monitoring methodology and of a monitoring plan

There is no approved monitoring methodology that can be applied to this project. Therefore, a new methodology is proposed to calculate the project's GHG removals. The methodology outlines the procedures for monitoring carbon projects, in which many small and medium farmers participate. It allows the determination of GHG removals from one or more of the following three A/R activities: Forest Plantations, Natural Regeneration, and Agroforestry Systems. It is the basis for implementing the monitoring plan, and it facilitates the verification and preparation of reports for evaluating project performance.

C.1. Title and reference of approved monitoring methodology applied to the project activity:

>>Methodology to monitor CO_2 increments due to afforestation/reforestation activities on lands without forest cover before December 31, 1989, which are part of small- and medium-sized farms in tropical regions.

C.2. Justification of the choice of the methodology and its applicability to the proposed A/R CDM project activity:

>> There is no approved monitoring methodology for the proposed afforestation/reforestation activities. The proposed monitoring methodology is applicable for any combination of the following A/R activities: Forest Plantations, Natural Regeneration, and Agroforestry Systems. The objective of the methodology is to provide the project entity with information to accurately estimate the net anthropogenic GHG removals by sinks due to the selected project activities. It is calculated by subtracting from the actual net removals by sinks, any change in the baseline removals and any leakage emissions during a given measurement period. The actual net removals by sinks are equal to the verifiable changes in carbon stocks in the selected carbon pools minus the GHG emissions by sources due to the implementation of the proposed A/R CDM project activities.

The sampling universe for the estimation of actual net GHG removals by sinks is the project implementation areas (parcels within farms). It is stratified, sampled, and measured to estimate total changes in carbon stocks in the selected carbon pools due to the three project activities. The location and the silvicultural management techniques of the new trees in the parcels were used to define monitoring procedures for the GHG emissions by sources due to the implementation of the proposed A/R CDM project activities. These procedures include how to monitor and estimate GHG emissions due to fertilization,

seedling transportation, use of machinery in silvicultural activities, etc. Finally the methodology also includes monitoring of leakage sources. It describes the procedures to monitor unexpected leakage sources such as: diversion of pre-existing A/R activities, activity shifting, market effects, and super-acceptance.

In order to assess the impact of the proposed project in the region, the methodology recommends monitoring the socioeconomic and environmental benefits of the project. The socioeconomic indicators to be monitored are: property owner's income, time used to work in and outside of the farm, use of carbon incomes, and creation of job opportunities related to the project. The environmental benefits to be monitored are: biodiversity, landscaping, and soil conservation variables related to water quality.

C.3. Monitoring of the baseline net GHG removals by sinks and the actual net GHG removals by sinks:

>> **Monitoring of the baseline net GHG removals by sinks**

This new methodology assumes that the baseline net GHG removals by sinks remains unchanged through the first crediting period, because project implementation areas (parcels within farms) are pastures or crop lands. Under the baseline scenario and in the absence of the project activities the current land uses are expected to remain unchanged, or if there were changes these would be from pastures to crops or vice versa, depending on market price fluctuations. Moreover, a typical pasture or crop area on small or medium farms often has some (pre-existing) trees, they are part of the baseline carbon pools, and their biomass need to be measured and monitored. Therefore, the monitoring of the baseline has two components: monitoring of the baseline land uses in the project area, and the monitoring of the baseline carbon stocks in the project parcels. The project design assumes that baseline carbon increments are zero, but the proposed monitoring system will keep track of this hypothesis, and the results will be used to adjust the estimation of the net anthropogenic GHG removals by sinks.

Monitoring of the baseline land uses in the project area:

No major changes in the current land uses are expected in the region, except for the project areas; however, current land uses (without project activities) will be monitored using aerial photos or satellite imagery. Any observed changes will be quantified and recorded in the project GIS to collect data for a possible reassessment of the baseline net GHG removals by sinks at the end of the first crediting period.

The forestry activities under the project scenario are additional to the current annual rate of afforestation/reforestation in the region. The methodology assumes that the existing level of reforestation and agroforestry activities will remain unchanged during the implementation of the project activity (i.e., during the planting phase). If this assumption does not remain true during project implementation, the methodology treats any shortfall as leakage, and corrects the estimation of anthropogenic net GHG removals accordingly.

Monitoring of actual net removals by sinks

Actual net removals by sinks are equal to the verifiable changes in carbon stocks in the selected carbon pools minus the GHG emissions by the sources due to the implementation of the proposed A/R CDM project activities. The verifiable changes in carbon stocks in the selected carbon pools will be monitored in permanent sample plots (circular or rectangular 500 m^2), which will be established within the farm parcels of a specific project activity. Plot data can be used to assess the changes of the increments in the carbon pools between monitoring intervals. Mean current increments and total parcel area by project activity will allow estimating total verifiable changes in carbon stocks in the selected carbon pools. The parcel area for each project activity within a stratum will be surveyed using GPS, compass, distance tape, and clinometers. GPS location of the parcel will be used to test land eligibility. GHG emissions by the sources due to the implementation of the proposed A/R CDM project activities procedures are presented in sections 3.1.2 and 3.1.3.2. In the context of the project activities, the most likely GHG emissions by the sources include: a) the emissions from the use of fuel in the transportation of seedlings, monitoring staff, and forest products; b)

the emissions from the fuel used by machinery during thinning and harvesting activities, and c) the emissions from the use of fertilizer at the tree nursery and during tree planting.

Monitoring frequency

A five-year monitoring frequency is considered adequate for vegetation pools for detecting the changes in carbon pools. To ensure that the monitoring frequency adequately represents the changes in the carbon pools, periodic assessment through field visits will be undertaken. The measurement verification at the beginning of the project will serve to establish the initial conditions of the project. The subsequent measurement events every five years will ensure that the project has accrued credits against the payment received and that the monitoring results are able to verify the credits.

Third-party verification every five years will be contracted by the World Bank BioCarbon Fund. The monitoring of project benefits such as biodiversity and soil conservation will be done every six years, while socioeconomic benefits will be done every year by COOPEAGRI staff. Table 5 presents the schedule for project establishment, third party verification activities, and monitoring of baseline, project activities, biodiversity, soil conservation, and socioeconomic indicators. All monitoring or verification events will be done prior to any thinning or harvesting activities.

Table 5. Schedule for project establishment, monitoring (baseline, project activities, biodiversity, soil conservation and socioeconomic indicators), and third party verification activities.

YEAR No.	YEAR	MONITORING &VERIFICATION EVENTS (BL, PA, Bio, SC, SI)[24]	PROJECT STAGES
1	2006	M, V-BL, Bio, SC, SI	Beginning establishment of project activities.
2	2007	M, V-BL, SI	
3	2008	M, V-BL, SI	Completing establishment of project activities.
4	2009	SI	
5	2010	SI	
6	2011	M, V-BL, PA, Bio, SC,SI	
7	2012	SI	
8	2013	SI	
9	2014	M, V-BL, PA, SI	
10	2015	SI	
11	2016	SI	
12	2017	M, V-BL, PA, Bio, SC,SI	
13	2018	SI	Replanting Melina
14	2019	SI	Replanting Melina
15	2020	M, V-BL, PA, Bio, SC,SI	Replanting Melina
16	2021	SI	
17	2022	SI	
18	2023	M, V-BL, PA, Bio, SC,SI	
19	2024	SI	
20	2025	SI	
21	2026	M, V-BL, PA, SI	
22	2027	SI	

[24]M= Monitoring events, V= Verification events, BL= Baseline, PA = Project Activities, Bio = Biodiversity, SC = Soil Conservation, SI = Socioeconomic indicators.

C.3.1. Actual net GHG removals by sinks data:

>> **Sample frame**

The project implementation units are the parcels within farms. These areas are presently without forest cover, but they will be dedicated to a specific project activity. There will be three types of parcels: Forest Plantations (FP), Natural Regeneration (NR), and Agroforestry (AF). They are located in three different subregions: Northern Hillsides, Valley, and Southern Hillsides. The sum of the areas of all the parcels is the sampling universe. Sampling units will be established in these parcels.

Stratification

The project area was stratified into three subregions: Northern Hillsides, Southern Hillsides and Valley, based on their different geographic location and land use capacity, which are mainly determined by topographic factors. A stratified sampling design will be used in order to estimate the verifiable changes in carbon stocks in the selected carbon pools for the entire project in a given year, and its corresponding sampling error. The sample frame is therefore:

1. Strata: these are the geographic subregions: Northern Hillsides (NH), Valley (V), Southern Hillsides (SH).
2. Farms: these are the properties of the stakeholders in the project area. They are located in the three geographic locations. These farms will be identified and GPS located within each stratum during project establishment.
3. Parcels: these are the areas dedicated to a specific project activity within the participating farms. The parcels will be GPS located, and their area will be measured using tape, clinometers and compass. There are three possible types of parcels in a farm: forest plantation (FP), natural regeneration (NR) and agroforestry (AF).
4. Substrata: these are the possible combinations of subregion (NH, V, and SH) and parcel types (FP, NR, and AF). Because some project activities will not be promoted in some geographic locations there are only six possible substrata (see table 27). The area of each substratum is equal to the sum of the areas of all the parcels types in the substratum.
5. Sampling units: these are 500 m^2 permanent plots. In the case of FP and NR parcels, the sample plots will be circular, but for AF parcels, the sample plots may be rectangular or circular depending on the layout of the planted trees. The sample plots will be randomly established within the parcels. The sampling population (N) is the sum of all the possible plots that can be established in a given substratum. (N=N1+N2+N3+N4+N5+N6).
6. *A Total CO_2e* **carbon stock** and its corresponding sampling error will be calculated for each substratum. The sum of these totals is equal to the *Total CO_2e* **carbon stock** due to the project activities in a given year.
7. *The total increment or* **verifiable change in carbon stock** in a given year is calculated by subtracting from the current *Total CO_2e* **carbon stock,** the estimate of the same parameter during the previous measurement**.**

Sample size

The selected carbon pools are above- and belowground biomass of trees; therefore, Tree Biomass is equivalent to Aboveground Biomass (AGB) plus Belowground Biomass (BGB) of trees. Considering the large covariance in the observations of successive sampling units, the permanent sample plots are efficient to estimate the changes in the selected carbon pool of the project scenario. The plot size was set to 500 m^2 to facilitate plot establishment and reduce measurement error.

To achieve the desired precision at minimal cost, a precision level of +/-10% and a confidence level of 95% are recommended in the estimation of the total carbon removals by the project activities. The number of

plots needed to meet the sampling error in the project area was calculated using the following equations (Loetsch and Haller 1964[25]):

$$n = \frac{t^2 * (CV\%)^2}{(E\%)^2 + t^2 * (CV\%)^2 / N} \qquad \text{with } N = A_T / a_p$$

Where

n = sample size for the project area.
N= population size, which is equal to the number of possible plots that can be established in the project area.
A_T = Total area under project activities in the project area (ha).
a_p = sample plot area (ha) (0.05)
CV%= The highest coefficient of variation (%) reported in the literature from different tree inventories in agroforestry, forest plantation, and natural regeneration activities.
E%= percentage of error (10)
t = T-student for a 95% confidence level

This equation was chosen because it works with percentages rather than absolute units (biomass, carbon, or CO_2) and facilitates finding data or information to estimate total sample size. The allocation of the total sample size to the substratum (see Table 27) was proportional to the substratum size through the use of the following equation:

$$n_i = N_i / N * n \qquad \text{with } N_i = A_i / a_p$$

Where
ni = sample size in each substratum.
Ni = substratum population size, which is equal to the number of possible plots that can be established in the substratum area.
A_i = Total area under project activities in each substratum.
a_p = sample plot area (ha) (0.05)
N = population size, which is equal to the number of possible plots that can be established in the project area.
n = sample size for the project area.

Data collection

Data collection will be organized taking into account the selected sample frame, number of plots to be monitored, and selected carbon pools. Data will be collected on the project scenario in order to monitor the verifiable changes in carbon stock in the selected carbon pools. It is recommended to undertake frequent checks of the data collected to verify data consistency. Electronic spreadsheet formats will be used to archive the plot and carbon pool data. Errors will be corrected and the measurement error will be assessed. Monitoring data will be archived for two years following the end of the last crediting period.

[25] Loetsch, F. and Haller, K. 1964. Forest Inventory. Volume 1. BLV-VERLAGS GESE LLSCHAFT, München. 435 pp.

C.3.1.3. Description of formulae and/or models used to monitor the estimation of the actual net GHG removals by sinks:

>> Actual net GHG removals by sinks are equal to the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity, minus the GHG emissions by the sources (GHG_{ES}) generated by the implementation of the project activities. The changes in the carbon pools under the project scenario are equal to the Total CO_2e Current Increment for the project in a given year. The GHG emissions by the sources comprise the emissions due to fertilization, and fuel used in transportation and machinery. The actual net GHG removals by sinks under the project scenario are calculated as follows:

$$ANR_{period} = TCI_{CO2\ pools} - GHG_{ES}$$

Where

ANR_{period} = Actual net GHG removals by sinks due to project activities for a given monitoring period (in CO_2e tons).
$TCI_{CO2\ pools}$ = Total current CO_2e increment in project scenario (in CO_2e tons).
GHG_{ES} = GHG emissions by the sources generated due to the implementation of the project activities (in CO_2e tons).

C.3.1.3.1. Description of formulas and/or models used to monitor the estimation of the verifiable changes in carbon stock in the carbon pools within the project boundary (for each carbon pool in units of CO_2 equivalent):

>> **Tree (T)**

The selected carbon pool is tree biomass, which is equal to the sum of above- and belowground biomass of each tree. Tree biomass will be monitored by measuring the individual trees in the permanent plots or sample units. Given the conditions of small and medium farmers in the tropical regions, who often combine few trees with pastures or crops, it is highly probable that there will be two types of trees (pre-existing[26] and additional[27]) growing on the sampling units. Pre-existing trees will not be included in the estimation of carbon increments, but they will be measured to monitor any carbon changes in the baseline carbon pools in the parcels (see section C.3.2). Only additional trees will be used to estimate the changes in carbon stock in the carbon pools within the project boundary.

A sample plot size of 500 m^2 was selected to facilitate plot establishment in the field and reduce measurement error due to changes in slope. For Forest Plantation and Natural Regeneration activities the plots will be circular, and for Agroforestry Systems activities the plots will be also rectangular to cover all possible types of agroforestry systems. In case of circular plots, a central point will be GPS located and marked in the field during plot establishment. In the case of rectangular plots, a reference corner will be GPS located and marked in the field during plot establishment.

Aboveground biomass (AGB)

A separate "Aboveground Biomass" (ABG in t/ha) per plot will be calculated for pre-existing and additional trees by adding above ground biomass of each individual tree (ABGTx) in the sampling plot (in kg/tree). This result will be multiplied by the area/plot expansion factor, and the result divided by 1000 to obtain aboveground biomass in tons per hectare. The area/plot expansion factor is equal to one divided by the plot area in hectares, that is, Aexp= 1/(plot area in hectares) = 1/ (0.05) =20. For each individual tree, aboveground biomass will be calculated using the biomass equations presented in Table 28. For species without biomass equations, it will be calculated using a stem volume equation, wood density, and an aboveground biomass/stem biomass expansion factor (see Table 28). Pre-existing trees in the plots will not be included in this estimation. They will be used only to monitor the CO_2e changes in the baseline carbon pools.

[26] Pre-existing trees are those that were there before the project activity and are part of the baseline scenario.
[27] Additional trees are those planted as a result of the project activity.

$AGB = [\sum (AGBT_x)]* [1/ap]*[1/1000]$

AGB = Aboveground tree biomass in a given plot (in t/ha).
$AGBT_x$ = The aboveground biomass of each individual tree species in the sampling plot (in kg/tree)
ap = the plot area in hectares, for this project ap = 0.05 ha

Belowground biomass (BGB)

Belowground Biomass (t/ha) in a given plot will be calculated using the equation proposed by Cairns et al. (1997), presented in Table 29. Note that this equation uses aboveground biomass (ABG) in Mg/ha, and the BGB calculated is also in Mg/ha. Therefore, the result should be transformed to tons per hectare.

Tree CO_2e/ha in a sampling unit

Tree CO_2e/ha for each sampling plot will be calculated by adding aboveground biomass (AGB) and belowground biomass (BGB) calculated for each plot (both in t/ha). This result should the converted to CO_2e/ha by multiplying by the IPCC (1996) carbon content constant (0.5), and by the carbon to CO_2e constant (3.67). The formula is as follows:

$\text{Tree } CO_2e_h = (AGB + BGB)_h * C * FC_{CO2e}$

Where
$\text{Tree}CO_2e_h$ = Total tree CO_2e in a given plot (h= 1, 2, 3… ni) (t CO_2e /ha).
AGB = aboveground tree biomass in the plot (in t/ha).
BGB = belowground tree biomass in the plot (in t/ha).
C = IPCC carbon content for biomass unit (0.5).
FC_{CO2} = IPCC conversion factor to convert carbon into CO_2e (3.67).

C.3.1.3.2. Description of formulas and/or models used to monitor the estimation of GHG emissions by the sources, measured in units of CO_2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary (for each source and gas, in units of CO_2 equivalent):

>> The GHG emissions by the sources represent the emissions due to the development of the project activities, and they will be identified and accounted. In the context of the project activities, the most likely GHG emissions by the sources include the emissions from the use of fuel in the transportation of seedlings, monitoring staff, and forest products. It also includes emissions from the fuel used by machinery during thinning and harvesting activities, as well as the emissions from the use of fertilizer at the tree nursery and during tree planting. The general formula to estimate GHG emissions by sources is:

$GHG_{ES} = [F + T + M]$

Where
GHG_{ES} = GHG emissions by the sources, measured in units of CO_2 equivalent (t CO_2e).
F = GHG_{ES} from fertilization at the tree nursery and during tree planting (t CO_2e).
T = GHG_{ES} due to the transportation of seedlings, monitoring staff, and products generated by the project activities
(t CO_2e).
M = GHG_{ES} generated by the use of motorized equipment during thinning and harvesting activities of the CDM project (t CO_2e).

Fertilization:

$F = [(F_{SN} * EF_1) * CO_2EF_N]/1000$

Where
F = GHG_{ES} from fertilization at the tree nursery and during tree planting (t CO_2e).

F_{SN} = Annual amount of synthetic fertilizer (nitrogen) applied to trees (kg).
EF_1 = Emission factor for GHG_{ES} from fertilization in unit of N- IPCC default value = 1.25%.
CO_2EF_N = CO_2 equivalent factor (296).

Transportation:

$T = [TDdv*EF_D] /1000 + [TDgv*EF_G]/1000$

Where
T = GHG_{ES} due to the transportation of seedlings, monitoring staff, and products generated by the project activities
(t CO_2e).
TDdv = total traveled distance by diesel vehicles (km).
EF_D = Emission factor for diesel (0.579 kg CO_2/km) [28].
TDgv= total traveled distance by gasoline vehicles (km).
EF_G = Emission factor for gasoline (0.415 kg CO_2/km) [56].

Machinery:

The GHG_{ES} generated by machinery include the fuel used during cutting, trimming, and hauling of the additional trees in the project parcels. The GHG_{ES} generated by machinery will be calculated using the following formula:

$M = [D * EF_D]/1000 + [G * EF_G]/1000$

Where
M = GHG_{ES} generated by the use of motorized equipment during the harvest of products in the project activity
(t CO_2e).
G = Gasoline used in liters.
D = Diesel used in liters.
EF_D = Emission factor for diesel (2.73 kg CO_2/l).[56]
EF_G = Emission factor for gasoline (2.40 kg /l).[56]

C.4. Treatment of leakage in the monitoring plan:

>> Leakage is considered as an increase of GHG emissions or the loss of carbon pools outside of the project area as a consequence of the project activity. No major leakages associated with the proposed A/R CDM project are expected; however, the methodology considers and monitors four forms of leakage: diversion of pre-existing A/R activities, and activity shifting.

Diversion of pre-existing A/R activities refers to the reduction of annual A/R activities in the region due to the project activities. From all four forms of leakage, this is the most likely to occur since the current reforestation/agroforestry programs (Tropical Science Center and COOPEAGRI through FONAFIFOS' regular PSA Program) in the region might be affected by the proposed project activities. The methodology accounts for this possibility through:

(a) Monitoring of annual reforestation or agroforestry activities in the region during project establishment through FONAFIFOS' records and the use of aerial photos or satellite imagery.
(b) If the annual reforestation or agroforestry rates do not decline compared to the rates from previous years, this leakage is set to zero. However, if they do decline the estimated leakage will be calculated by determining the reduced area of reforestation or agroforestry activities, as well as the estimated biomass increment that was expected from those areas.

[28] Personal communication: Ana Rita Chacón. September, 2005. National Meteorological Institute.

Activity shifting refers to the displacement of activities that cause emissions (cattle or crops) to other forested areas outside the project area. For example: if an area within the project boundary is set aside for natural regeneration, the property owners who were producing on this area might deforest an alternative area outside the project boundary to replace their loss of production land. The methodology accounts for this possibility through:

(a) Monitoring and recording of deforestation areas in the country through the use of FONAFIFO's forest cover maps. FONAFIFO has been conducting forest cover maps for the entire country since 1997 and it will continue doing so in the following years (approximately every two years). Aerial photos or satellite imagery will also be used to monitor the land uses in the region.

(b) Monitoring of the SINAC–SEMEC (National System of Conservation Areas–System of Continued Quality Improvement) statistics on tree cutting permits during project establishment.

(c) Calculation of the area of deforestation due to activity shifting. If the area of deforestation is zero this leakage is also zero. However, if it is not zero the estimated leakage will be calculated using reported factors of accumulated biomass by forest type or ecological zone from the CR-PAP[29] project that was SGS certified, the IPCC carbon content ratio to convert biomass into carbon (0.5), and the IPCC conversion factor to convert carbon into CO_2e (3.67).

C.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

>>FONAFIFO is the project operator. The operational and management structure for the monitoring of actual net GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity includes the following elements:

1. A Project Implementation Unit (PIU) will be formed within FONAFIFO. This unit will be responsible for day-to-day activities of project implementation and coordination of the project monitoring plan, including verification and reporting. The PIU will ensure the implementation of the Monitoring Plan (EMP) and will annually monitor the project progress and measure the impact of project activities against the baseline scenario. The PIU will take on a systematic analysis of the project activities and the results of the monitoring activities will be fed back into the implementation process. The PIU will be responsible for the following activities:

    - Coordinating project implementation.
    - Requesting PSA annual payments to farmers after field verification of tree and forest growth in project parcels.
    - Verifying the application of recommended techniques for development of the selected A/R activities.
    - Establishing, maintaining, and monitoring permanent plots and subplots in the farmers' parcels.
    - Maintaining and updating the project's GIS system.
    - Maintaining project files for future verification including data collection and storage in digital format.
    - Preparing annual project implementation reports.
    - Estimating net anthropogenic GHG removals by sinks to report to WB-BCF.
    - Facilitating verification of project progress.
    - Assisting COOPEAGRI in implementing training programs for participating farmers.

2. FONAFIFO will have a Project Coordinator who is responsible for coordinating project implementation.

[29] SGS Forestry, 1997. Certification of "The Protected Area Project" (PAP) in Costa Rica for OCIC (in Costa Rica Office for Joint Implementation). Carbon Offset Verification Report. United Kingdom. pp. 90.

3. FONAFIFO will also form a Project Steering Committee responsible for coordinating the activities with COOPEAGRI. The Project Coordinator will serve as the secretary for the Committee. The tasks of the committee would include dissemination of information on project implementation and best practices, and coordination between COOPEAGRI and FONAFIFO on project financing and supervision.

SECTION D. Estimation of net anthropogenic GHG removals by sinks:

D.1. Estimate of the actual net GHG removals by sinks:

The estimate of the actual net GHG removals by sinks for the proposed CDM project include the estimated verifiable changes in carbon stocks (only above- and belowground biomass of additional trees) and the estimated GHG_{ES} emissions due to the implementation of project activities. As described in sections B and C, carbon stock changes in soil organic matter, dead wood, and litter carbon pools are not considered a significant source of CO_2e emissions for this project; therefore, they will not be measured or monitored.

Estimated verifiable changes in carbon stocks in the carbon pools within the project boundary for a 20-year period:	901,287 t of CO_2e (or 591,848 in 12 years).
Estimated GHG_{ES} emissions within project boundary as result of the proposed A/R project activity in 20 years (GHG_{ES}):	5,823 t of CO_2e (3,283 in 12 years)
Estimated actual net GHG removals by sinks:	895,465 t of CO_2e (or 588,565 in 12 years)

D.2. Estimated baseline net GHG removals by sinks:

>>The project design assumes that baseline net GHG removals by sinks are zero, but the proposed monitoring system will keep track of this hypothesis by following the procedure described in section 3.2. The monitoring results will be used to adjust the net anthropogenic GHG removals by sinks if necessary, as shown in section 3.2.1.

$$C_{BL} = 0$$

This new methodology assumes that any observed change in the present reforestation or deforestation rates in the area will be treated as leakage. The methodology proposes to monitor changes in pasture, forest, and crop lands in the region through the use of aerial photos or satellite imagery. Any observed changes will be quantified and recorded in the project GIS to collect data for a possible reassessment of the baseline net GHG removals by sinks at the end of the first crediting period.

D.3. Estimated leakage:

>> Leakage is considered the increase of GHG emissions or the loss of carbon pools outside of the project area as a consequence of the project activity. This methodology identifies four possible sources of leakage for the proposed project activities: diversion of pre-existing A/R activities, and activity shifting.

$$\mathbf{CO_{2\ leaks} = L_{DA/R} + L_{AS}}$$

Where
$CO_{2\ leaks}$ = CO_2e leaks due to increased GHG emissions or loss of carbon pools outside the project scenario (t CO_2e)
$L_{DA/R}$ = leakage due to diversion of pre-existing A/R activities (t CO_2e).
L_{AS} = leakage due to activity shifting (t CO_2e).

Although no major leakage associated with the proposed A/R CDM project is expected, this methodology considers that the leakage most likely to occur due to the proposed CDM project is the diversion of pre-existing A/R activities. Until now, only two reforestation/agroforestry projects (COOPEAGRI and TSC)

were identified in the region prior to the proposed project. Both projects use FONAFIFO's regular PSA program to establish their activities. They have been establishing an average of 30 ha/year in reforestation and an average of 7,514 trees/year in agroforestry. These annual rates of reforestation and agroforestry will be monitored through FONAFIFO's records to detect any possible leakage due to diversion of pre-existing A/R activities during project establishment.

D.4. The sum of D.1 minus D.2 minus D.3 representing the net anthropogenic GHG removals by sinks of the proposed A/R CDM project activity:

>> The net anthropogenic GHG removals are calculated as the difference between actual net GHG removals by sinks, net baseline GHG removals, and leakage. In order to account for the variation in site productivity, species characteristics, growth behavior, and risks to the project, two scenarios are constructed to show the variation in the estimation net anthropogenic GHG removals. The two scenarios are:

- **Normal Scenario**: represents the project scenario (baseline removals are zero, no-leakage sources)
- **Worst Scenario**: project scenario with leakage sources due to 30% diversion of pre-existing A/R activities.

Estimated Actual net GHG removals by sinks:

$EANR_{CDM} = ETCI_{CO2\ poolsCDM} - EGHG_{ESCDM}$

Baseline GHG removals: $C_{BL} = 0$

Leakage: $CO_{2\ leaks} = 0$ (normal scenario) $CO_{2\ leaks} = L_{DA/R}$ (worst scenario)

Estimated Net anthropogenic GHG removals by sinks of the proposed project activity:

$$\mathbf{ENACA/R\text{-}CDM_{period} = EANR_{CDM} - C_{BL} - CO_{2\ leaks}}$$

Where

$ENACA/R\text{-}CDM_{period}$ = Net anthropogenic GHG removals by sinks for the proposed forestry activities (t CO_2e) for a given monitoring period.

$EANR_{period}$ = Estimated actual net GHG removals by sinks during the 20-year period of the CDM project (t CO_2e).

C_{BL} = baseline net GHG removals by sinks (t CO_2e).

$CO_{2\ leaks}$ = CO_2e leaks outside the project scenario (t CO_2e).

D.5. Table providing values obtained when applying formulas above:

Estimated net anthropogenic GHG removals by sinks

Table 6. Estimated annual and cumulative net anthropogenic GHG removals by sinks for the proposed CDM project (normal scenario)

Year No.	Year	Estimated annual net anthropogenic GHG removals by sinks (t CO_2e/ha)	Cumulative net anthropogenic GHG removals by sinks (t CO_2e/ha)
1	2006	26154	26154
2	2007	52359	78513
3	2008	78564	157076
4	2009	78613	235690
5	2010	69883	305573
6	2011	44190	349763
7	2012	44190	393953
8	2013	41656	435609

Year No.	Year	Estimated annual net anthropogenic GHG removals by sinks (t CO_2e/ha)	Cumulative net anthropogenic GHG removals by sinks (t CO_2e/ha)
9	2014	67350	502959
10	2015	21104	524063
11	2016	32367	556430
12	2017	32136	588565
13	2018	29432	617998
14	2019	29432	647430
15	2020	-15777	631654
16	2021	33174	664828
17	2022	24586	689414
18	2023	70027	759441
19	2024	70027	829467
20	2025	65997	895465

Sensitivity analysis of the proposed project carbon sequestration under two scenarios

Estimated net anthropogenic GHG removals by sinks (normal scenario):

Estimated verifiable changes in carbon stocks in the carbon pools within the project boundary for a 20-year period:	901,287 t of CO_2e (or 591,848 in 12 years).
Estimated increase in CO_2 emissions within project boundary as result of the proposed A/R project activity in 20 years (GHG_{ES}):	5,823 t of CO_2e (3,283 in 12 years).
Estimated net GHG removals of the baseline:	0 t of CO_2e
Expected CO_2 emissions due to leakage effects:	0 t of CO_2e
Estimated net anthropogenic GHG removals by sinks (normal scenario):	895,465 t of CO_2e (or 588,565 in 12 years)

Estimated net anthropogenic GHG removals by sinks (worst scenario):

Estimated verifiable changes in carbon stocks in the carbon pools within the project boundary for a 20-year period (reduced by 25%):	675,965 t of CO_2e (or 443,886 in 12 years).
Estimated increase in CO_2 emissions within project boundary as result of the proposed A/R project activity in 20 years (GHG_{ES}):	5,823 t of CO_2e (3,283 in 12 years).
Estimated net GHG removals of the baseline:	0 t of CO_2e
Unexpected CO_2 emissions due to leakage effects (30% reduction in current reforestation activities):	22,376 t of CO_2e
Estimated net anthropogenic GHG removals by sinks (worst scenario):	647,766 t of CO_2e (or 418,227 t of CO_2e)

SECTION E. Environmental impacts of the proposed A/R CDM project activity:

E.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

>> The analysis of the environmental impacts of the proposed project activities highlights the positive impacts of this project.

The expected environmental impacts of the project are:

Soil conservation:

- Conservation of topsoil and reduction of soil erosion.
- Improved soil conditions such as water infiltration.
- Increased soil organic matter accumulation.

Biodiversity:

- Increased forest cover (this contributes to the connectivity of forest patches).
- Increased habitats for birds and small mammals.
- Increased flora diversity in the project areas through reforestation by natural regeneration and planting of native species.

Water resources:

- Increased water quality derived from higher water infiltration rates.
- Flow regulation derived from improved water infiltration.

In order to derive the positive environmental impacts of the project, suitable measures should be implemented as part of the project. The following measures are illustrative of the actions needed to enhance the positive impacts.

- Forest fires may occur. Proper fire protection measures such as firebreaks around the parcels of natural regeneration and forest plantations.
- Cattle may enter the project areas. Proper measures such as fences around the parcels are included in the plantation design.

Scoring the environmental impacts

The environmental impacts of the baseline and project scenarios are scored on a scale of -3 to 3 in order to compare the baseline and project scenarios regarding the environmental criteria. The comparative assessment of environmental impact scores of the baseline and project scenarios helps to implement the specific measures that can enhance positive impacts and minimize negative impacts.

Baseline environmental impacts

The environmental impacts of the baseline scenario are summarized in Table 7. It shows that the baseline scenario has significant negative impacts on soil and water. In the absence of the CDM project, negative impacts such as unsustainable land use are expected to continue and can result in more adverse impacts on soil and water resources.

Table 7. Environmental impacts of the baseline scenario

LAND USE CATEGORY	SOIL	WATER	CLIMATE	CO_2	FLORA	FAUNA	LANDSCAPE
Crops	-3	-3	0	+1	0	+1	+1
Pastures	-2	-2	0	+0	0	+1	+1
Total w CDM project	-5	-5	0	+1	0	+2	+2

Note: Likely impacts were evaluated on a scale of –3 to +3, where –3 refers to major negative impacts, and +3 refers to major positive impacts.

Project scenario: environmental impacts

Table 8 shows the short-term and long-term environmental impacts of the CDM project activities (short term: < 3 years, long term: project period). All long-term project impacts are expected to be positive. The positive impacts of the project are particularly stronger under Forest Plantation and Natural Regeneration activities since they affect most of the ecosystem components such as soil, water, flora, and fauna.

Table 8: Short- and long-term environmental impacts of the CDM project.

ACTIVITY	SOILS		WATER		FLORA		FAUNA		LANDSCAPE	
	ST	LT	ST	LT	ST	LT	ST	LT	ST	LT
Soil preparation	+1	+3	0	0	0	0	0	0	0	0
Planting	+1	+2	0	+3	0	+3	0	+3	+2	+3
Maintenance	0	0	0	+1	0	+1	0	0	0	+2
Replanting	+1	+1	0	+1	0	+1	0	+2	0	+1
Harvesting	-1	-1	-1	-1	0	0	-1	-1	-1	-2
Wood hauling	0	-1	0	-1	0	0	-1	0	-1	-1
With Project	+2	+4	-1	+3	0	+5	-2	+3	0	+3

Note: Likely impacts are evaluated on a scale from –3 to +3, where –3 refers to major negative impacts, and +3 refers to major positive impacts. No road construction is planned. ST = short term (< 3 years), LT = long term (20 years).

E.2. If any negative impact is considered significant by the project participants or the host party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>> No significant negative impacts have been identified due to the environmentally-friendly techniques adopted in the proposed A/R CDM project activities, e.g., site preparation is reduced to the tree hole (which will be done manually); proper choice of tree species and their spatial arrangement.

E.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section E.2. above:

>> Although no significant negative impacts have been identified, an environmental monitoring plan and remedial measures for any risks will be implemented. Measures such as maintaining firebreaks around the project parcels, and keeping the areas free of fire hazards and far from the main roads, will be promoted to reduce the fire risk in the project areas. Additionally, parcels will be fenced when necessary if there is a danger of damage from cattle.

In order to address the positive impacts mentioned in section E.1, the monitoring plan includes the following measures.

Soil conservation:

- Monitoring soil loss/accumulation through the establishment of plot markers, which consist of iron bars inserted into the ground with the initial soil level permanently inscribed. Changes in the soil level relative to the initial mark will be measured, recorded and reported by the PIU at year zero and every six years.
- Monitoring soil conditions by performing water infiltration tests and laboratory analysis to determine soil texture and organic matter content at year zero and every six years.

Biodiversity:

- Use of aerial photos or satellite imagery to monitor forest cover, every six years.
- Increased flora species diversity and community dominance index will be determined through field inventory surveys of monitoring plots at year zero and every six years.
- Counts of birds and small mammals in the project areas, every six years.

SECTION F. Socioeconomic impacts of the proposed A/R CDM project activity:

>> The project proposes a well balanced combination of reforestation by natural regeneration in degraded hillsides, agroforestry, and forest plantations in the good sites. It is ideal to areas where maximization of social and environmental benefits is needed. Agroforestry allows farmers to improve their cash flow and manage their land to increase the provision of environmental services, such as water protection, control of soil erosion, and recovery of wildlife populations—especially small mammals and bird populations. This model does not compete with the present land uses of the farmers, because they can select a specific forestry activity according to the land use capacity of their farms. For example, reforestation by natural regeneration on the hillsides, agroforestry on the good croplands, and forestry plantations on the good sites with pastures. The project does not propose the establishment of large forest plantations, but rather a diverse landscape of areas in recovery by natural regeneration, blocks of plantation with native (50%) and non-native species, and trees mixed with crops. As a result, the project will improve land management in the CDM project area and promote sustainable rural livelihoods. Through this combination of activities, it will be possible to obtain a well balanced mix of social and environmental benefits, and at the same time the production of the carbon offsets required for the BioCarbon Fund.

Expected CDM project impacts:

- Increase soil conservation and consequently improve productivity of lands.
- Ensure wood supply in order to contribute to maintain stable timber prices.
- Create employment opportunities for local people in land preparation, planting, weeding, tending, protection, thinning, and harvesting. Planting, protection, thinning, and harvesting activities are the major sources of employment.

The following measures are expected to further enhance the project impacts and serve as mitigation measures to address implementation issues.

Payments for environmental services (PSA) and economic incentives.

. Households participating in the project activities (e.g., small and medium farmers whose traditional grazing grounds are deforested) are expected to receive payments for environmental services produced by them, such as: carbon sequestration, biodiversity conservation, hydrological services, and scenic beauty. These payments will be made by the project entity under an enhanced PSA Program. Certified carbon credits will regenerate approximately US$3.358 million or 81.0% of the total project budget. Farmers will receive in payments for environmental services US$3.602 million or 87% of the project costs.

Legal issues

- Provision of incentives and design of improved PSA contracts for benefit-sharing mechanisms.

Training and technical assistance.

- Harmonizing the afforestation activities with agricultural operations to generate continuous employment opportunities for rural communities.
- Developing integrated and participatory land-use planning in order to avoid land-use conflicts.
- Training local communities in forest management.

F.1. Documentation on the analysis of socioeconomic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

>> The net effect of project activities on local livelihoods is expected to be positive:

Net effect of project activities regarding employment.

- Increasing job opportunities in the project area through nursery and plantation jobs and collection of timber forest products. Reforestation and agroforestry activities will require labor that is normally supplied by the farmer and his or her family. The estimates of labor requirements for agroforestry

activities depend on the system type. For example, for windbreaks, it is 30.8, 7.8, and 8.7 (man-days/year) for the first, second, and third year respectively, for planting trees in fences it is 28.9, 6.7, and 7.2 (man-days/persons/year), and for trees mixed with crops it is 6.2, 1.5, and 0.5 (persons/year). Labor requirements for forest plantation are higher: 24.3, 15.3, 15.4, 11.0, 6.9, and 5.5 (man-days/year/ha) for the first, second, third, fourth, fifth, and sixth year, respectively. The estimation of labor force for reforestation by natural regeneration is 10 to 12 day persons per year/ha. Due to the size of the farmers' lands and the diversity of landowners who will participate in the project, the risk of immigration into the project area is low. Labor shortages may occur for reforestation through forest plantations. In order to mitigate labor shortages tree planting must be done from May to September, that is, when the *zafra* (sugarcane harvest) and the coffee harvest have finished in the region.

Net effect of project activities regarding income:

- Increasing property owners' annual income.
- Reducing the need to work outside the farm.

The socioeconomic impact of the project activities will be evaluated through the monitoring of the following socioeconomic indicators:

- Average household income in the project area to be compared with average household income of the baseline scenario over 5, 10, 15, and 20 years respectively.
- Number of seasonal and temporary jobs created per year as a result of project activity (seed collection, protection, and plantation).
- Number of permanent jobs created over the project period.
- Number of forestry contracts signed between the project entity and local property owners.
- Number of communal groups trained by the project entity in forest management.

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socioeconomic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

>> Negative social impacts have not been identified. The project activities are integrated with the production activities of the farmers, who will voluntarily dedicate part of their farms to reforestation or agroforestry. In this way, the CDM project is developing a balanced carbon sequestration project that creates a diverse landscape, and at same time allows local farmers to maintain food security and their present incomes. In addition, downstream communities will benefit from the environmental benefits produced by upstream farmers when they adopt forest production activities, such as water protection (quality and flow regulation), flood mitigation, protection of air quality, scenic beauty, etc.

The likely socioeconomic impacts of the project implementation have been assessed through a socioeconomic study and the findings support the project's positive impacts. Due to the small size of project parcels, farmers will not be required to abandon their current activities.

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2 above:

>>The impacts of the PSA program are measured by FONAFIFO, which contracts periodic technical and social evaluations. These studies are expected to continue, and the socioeconomic impacts of the proposed CDM project will be evaluated as part of these studies. The results of the evaluation are public, and if any communities are negatively affected they will be able to provide inputs for the design of alternative measures to correct the implementation of the project. However, given the wide participation of farmers in the project, and that it will be implemented through the Payments for Environmental Services (PSA) program, we do not anticipate negative socioeconomic impacts. These studies will be complemented by an annual survey given by COOPEAGRI staff to property owners during one of their visits to COOPEAGRI's Forestry Department.

COOPEAGRI is responsible for promoting the project among its affiliates. COOPEAGRI staff have prepared both printed and audiovisual materials. COOPEAGRI has presented the project to the farmers in their communities, and its staff will provide training to the farmers and the community members.

SECTION G. Stakeholders' comments:

G.1. Brief description of how comments by local stakeholders have been invited and compiled:

>> Stakeholder consultations were undertaken during project preparation in the form of meetings and a survey. The following consultations highlight the issues discussed in the consultation process.

- August 3, 2005. Preliminary project presentation to Mr. William Alpizar from the OCIC–MINAE (Costa Rican Office of Joint Implementation–Ministry of Environment and Energy) to inform them about FONAFIFO's initiative to submit a CDM project for carbon certification registration.
- August 16[t], 17, and 18, 2005. Project presentation to potential participants (COOPEAGRI affiliates) in the project area.
- August 29, 2005. CDM Project presentation to Mr. William Alpizar (OCIC–MINAE) to obtain feedback and government support for this initiative.

G.2. Summary of the comments received:

>> Three towns were visited by FONAFIFO and COOPEAGRI' staff during the month of August 2005.

- The first meeting was on August 16 in the town of Quizarra (Valley subregion) at 3:00 p.m. Twenty-five property owners attended. Their questions were mostly related to clarifications of the rules to participate in the proposed CDM project. Some of them asked about other species to include in the proposed CDM such as cypress, pine, and *poro*. They also asked about the ownership of the wood produced in the project activities.
- The second meeting was on August 17 in the town of Pueblo Nuevo (Northern Hillsides subregion) at 3:00 p.m. Forty property owners attended. Again most of the questions were related to the rules for participating in the CDM project; some of the property owners asked about payments for the establishment and maintenance of project activities and if they need to return any money at the end of the 20 years.
- The third meeting was on August 18 in San Rafael de Platanares (Southern Hillsides subregion) at 3:00 p.m. Twenty-five property owners attended. Once more, many of the questions were related to the requirements for participating in the CDM project. Someone asked how many project areas he/she could have on their farm and how these areas will be measured. There was a discussion about the opportunity cost of the project activities versus cattle farming or crops. Someone mentioned that they could have 1 or 2 cows per hectare, and that they could lease their pastures for $4.12/month (¢2000 at ¢485/$) to $6.18/month per cow (¢3000 at ¢485/$), however, the leases are not per year but rather only for six months. These data show that the enhanced PSA program may compete with cattle in marginal areas. A socioeconomic survey was distributed to all the property owners who attended the meetings to assist in the evaluation of the proposed CDM project and determine the initial socioeconomic conditions of the potential participants.

G.3. Report on how due account was taken of any comments received:

>>Must of the recommendations (such as land eligibility, utilization of the new A/R CDM additionality tool) given by Mr. William Alpizar of the OCIC–MINAE were incorporated into the documents.
The farmers' suggestions to use other tree species in the project activities was accepted under the condition that the species selected would be well known and not invasive.

ANNEX 2: DETAILED PROJECT DESCRIPTION

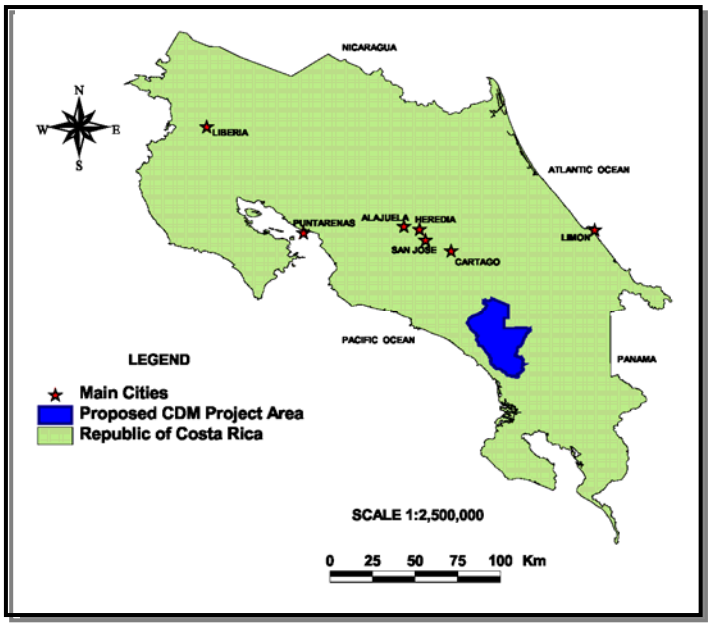
1. Objective

The project objective is to achieve 588,565 tons of CO_2e emission reductions by the year 2017 through the reforestation of 4,140 hectares on lands privately owned by small and medium farmers in Pérez Zeledón County, San José, Costa Rica. It will accomplished by promoting natural reforestation, forest plantations, and tree planting in agroforestry systems on small and medium farms of the project region. The project proposes to reach this goal by widening the scope of the existing PSA program to include a new modality: reforestation of degraded pasture lands by natural regeneration. In addition, the project will promote the use of forest plantations of native species and agroforestry systems to increase farmers' incomes, and the number of seed sources for the natural regeneration process. The project proposes to use the incomes from carbon credits produced by reforestation and tree planting in agroforestry systems to finance the reforestation activities.

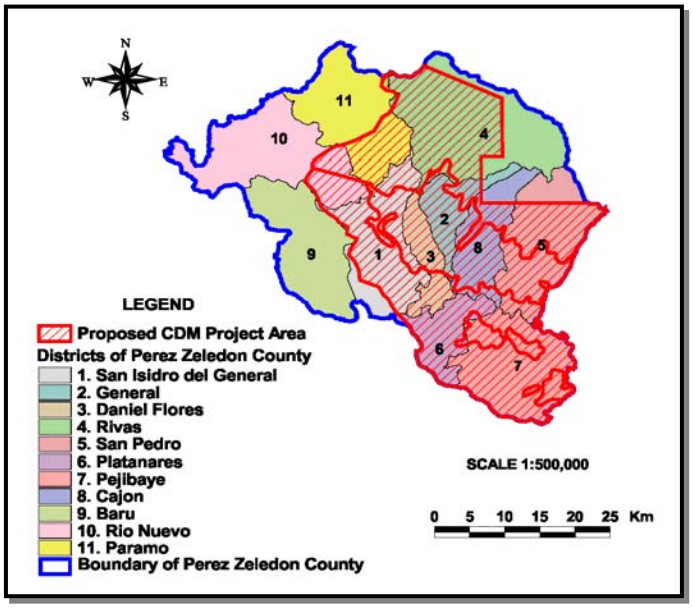
2. Location

The project is situated in southeastern Costa Rica. The nearest city is San Isidro de Pérez Zeledón. The project area is located in Pérez Zeledón County, San José, Costa Rica. It covers three different geographic locations of the county: the Northern Hillsides, the Southern Hillsides, and the Valley (see Maps 2.1 and 2.2). **The project's geographic location is Latitude North: 9.22° to 9.40°, Longitude West: 83.28° to 83.81° (Datum WGS84). It covers 4,140 ha, spread over 10 districts, 194 towns, and one municipality.**

Map 2.1 Location of the project area in Costa Rica



Map 2.2 Districts of Pérez Zeledón County and proposed project area



3. Selection of participating farmers

In an effort to inform the general population in the project area and invite all of them to be part of the project, between August and December 2005 COOPEAGRI made an open invitation to meet community leaders; visited communities to carry out a survey to detect their interest in the project; used their radio program to announce the new project; printed and distributed pamphlets on the proposed project in the cooperative supermarket, community information centers, general stores (*pulperias*), and general supply centers; and collected and registered with FONAFIFO information on the interested farmers.

Interested farmers who met basic criteria were registered after initial screening by COOPEAGRI and FONAFIFO's Payment for Environmental Services program. The basic criteria are that farmers: (i) possess lands that did not contain forest on December 31, 1989; (ii) are voluntarily willing to sign an environmental services contract with FONAFIFO (land title or a cadastral map must be available), i.e., giving access rights for sequestered carbon to FONAFIFO, receiving in exchange annual payments for environmental forest services; and, although not mandatory, (iii) be members of COOPEAGRI. The plots of the selected participating farmers were georeferenced to create a database for the project.

4. Project Components

Component 1: Contracting landholders to provide environmental services

Farmers will sign a PSA contract with FONAFIFO. This contract states that farmers will give access rights for sequestered carbon to FONAFIFO; in exchange, the farmers will receive from FONAFIFO annual payments for the environmental forest services provided by them, including carbon sequestration.

Farmers associated with COOPEAGRI will introduce forestry activities on their privately owned farms, through the PSA program. COOPEAGRI is a cooperative consisting of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle. The project will

have a total of 4,140 ha distributed among three different project activities, which will be established within a period of three years (see Table 1).

Table 2.1 Project area or number of trees allocated for each forestry activity

ACTIVITY	TOTAL AREA (ha)	AREA PER YEAR (ha/year)
Forest plantations	2,490	830
Natural regeneration	1,200	400
Agroforestry systems	450[30]	150[31]
Total	4,140	

Farmers will dedicate part of their farmland (under private ownership) to commercial reforestation (forest plantation), reforestation through natural regeneration, and agroforestry activities. Agroforestry will be promoted on lands presently used for agriculture or cattle located in the Valley or the foothills. Agroforestry systems included in the project are windbreaks, plantation in small blocks (less than 1 ha), plantation of trees in rows and fences, and trees mixed with crops. Reforestation by induced natural regeneration will be recommended on deforested hillside areas. The project relies on the supply of seeds from two sources: the existing forest patches and the seed–soil bank. Natural regeneration, frequently observed in the field, occurs when farmers stop burning or clear cutting the vegetation that grows naturally on pastures.

The proposed project aims to mimic this process by allowing the development of a new natural forest. This project activity includes the identification of areas, the establishment of wire fences around them to exclude cattle (if needed), the prevention of forest fires by establishing firebreaks, sign marking of the area, and hunting/poaching control. Finally, man-made forest plantations will be promoted on medium to high quality sites presently covered with pastures in the Valley area.

Farmers participating in project activities (e.g., small and medium farmers whose traditional pasture lands are deforested) will receive payments for environmental services provided by them, such as carbon sequestration, biodiversity conservation, hydrological services, and scenic beauty. These payments will be made by FONAFIFO through an enhanced PSA program. Certified carbon credits will generate approximately US$2.21 million or 65 percent of the total project budget (12-year project). Farmers will receive payments for environmental services totaling approximately US$2.81 million or 83 percent of project costs. PSA amounts and payment schedules are shown in Table 2.2.

Table 2.2 Payment amounts and schedules for project activities through the PSA Program with Certified Carbon

Project Activity	PSA Payment	Payment Schedule
Reforestation through natural regeneration	$41.00/ha	Per year for 5 years (renewable every 5 years up to a total of 20 years)
Reforestation through man-made plantations	$816.00/ha	In 10 years as follows: 1st year 46% ($372.60/ha) 2nd to 9th year 6% ($48.00/ha)
Agroforestry systems	$1.30/tree	In 3 years as follows: 1st year 65% ($0.85/tree) 2nd year 20% ($0.26/tree) 3rd year 15% ($0.19/tree)

[30] Equivalent to planting 180,000 trees in agroforestry systems.
[31] Equivalent to planting 60,000 trees per year in agroforestry systems.

Component 2. Monitoring and evaluation of (i) anthropogenic GHG removal, and (ii) social and economic impacts.

i) Anthropogenic GHG removal.

The monitoring methodology to be applied to this project has not yet been approved. The new methodology is proposed to estimate the project's GHG removals. The methodology outlines the procedures for monitoring carbon projects, in which many small and medium farmers participate. It allows the determination of GHG removals from one or more of the following three A/R activities: Forest Plantations, Natural Regeneration, and Agroforestry Systems. It is the basis for implementing the monitoring plan, and it facilitates the verification and preparation of project performance evaluation reports.

The objective of the proposed methodology is to provide FONAFIFO with information to accurately estimate the net anthropogenic GHG removals by sinks due to the selected project reforestation activities. It is calculated by subtracting from the actual net removals by sinks, the baseline removals and any leakage emissions during a given measurement period. The actual net removals by sinks are equal to the verifiable changes in carbon stocks in the selected carbon pools minus the GHG emissions by sources (transportation, fertilization, machinery use, etc.) due to the implementation of the proposed A/R CDM project activities.

This new methodology was developed to monitor GHG removals generated by projects with a high level of participation by small and medium farmers in tropical regions. These farmers not only own small land areas (fewer than 100 ha in the project area), but they also usually mix different land uses on their farms. Farmers normally have patches of pastures and crops, and they frequently maintain trees on their pasture and crop parcels. The methodology proposes techniques to survey and geographically locate these pasture and crop patches and test their land eligibility (deforested prior to December 31, 1989); it then establishes sampling, measurement, and calculation procedures to estimate the verifiable changes in carbon stocks in the selected carbon pools, i.e., above- and belowground tree biomass.

The sampling universe for the estimation of actual net GHG removals by sinks are the project implementation areas (parcels within farms). It is stratified, sampled, and measured to estimate total changes in carbon stocks in the selected carbon pools due to the three project activities. The location and the forest management techniques of the new trees in the parcels were used to define monitoring procedures for the GHG emissions by sources due to the implementation of the proposed A/R CDM project activities. These procedures include ways to monitor and estimate GHG emissions due to fertilization, seedling transportation, use of machinery in forest activities, etc. Finally, the methodology also includes the monitoring of leakage sources. It describes the procedures to monitor unexpected leakage sources such as diversion of pre-existing A/R activities, activity shifting, market effects, and super-acceptance.

In order to assess the impact of the proposed project on the region, the methodology recommends monitoring the project's socioeconomic and environmental benefits. The socioeconomic indicators to be monitored are the property owner's income, the time used to work on and outside the farm, the use of carbon incomes, and the creation of job opportunities related to the project. The environmental benefits to be monitored are biodiversity, landscaping, and soil conservation variables related to water quality.

ii) Social and economic impacts.

FONAFIFO is committed to monitor and evaluate social and economic impacts. It has already collected farmers' general socioeconomic data for this project and will monitor and report any

changes during project implementation. This information will help to replicate and/or expand the project in other areas of the country, which is in fact one of the objectives included in the proposed Bank/GEF–financed project: "Mainstreaming Market-Based Instruments for Environmental Management." This blended operation includes a component, "3C. Monitoring social and economic impacts," with a budget of approximate US$0.08 million to strengthen monitoring systems related to measuring socioeconomic impacts of the program, with a particular emphasis on the poor as well as small- and medium-sized landholders. The aim is to ensure that monitoring is more participatory and more effective in detecting the level of inclusiveness of the program as well as the impact of program-supported activities on various sets of actors, with a particular emphasis on the poor as well as small- and medium-sized landholders. This will allow FONAFIFO to respond to problems on a timely basis and improve the program's impact on the poor. It is intended to assure that participating farmers have a voice in defining specific priorities and objectives; evaluating social and economic impacts; identifying bottlenecks in project implementation; improving program operations, including beneficiary selection criteria; and access to information that project beneficiaries consider important. Based upon this information, FONAFIFO will reorient strategies and actions as necessary.

5. Expected outcomes

As indicated above, the primary performance indicators are:

(i) Timely delivery of 393,953 t of CO_2e emission reductions by 2012 and a cumulative total of 588,565 t of CO_2e by 2017.

(ii) At least 150 small and medium farmers participating in the project reforestation activities.

Beyond carbon sequestration, the project's environmental benefits include:

Soil conservation:

i. Conservation of topsoil and reduction of soil erosion.
ii. Improved soil conditions such as water infiltration.
iii. Increased soil organic matter accumulation.

Biodiversity:

iv. Increased forest cover (this contributes to the connectivity of forest patches).
v. Increased habitats for birds and small mammals.
vi. Increased flora diversity in the project areas through reforestation by natural regeneration and planting of native species.

Water resources:

vii. Increased water quality derived from higher water infiltration rates.
viii. Flow regulation derived from improved water infiltration.

ANNEX 3: IMPLEMENTATION ARRANGEMENTS

FONAFIFO and COOPEAGRI

FONAFIFO and COOPEAGRI representatives have been involved in project preparation. FONAFIFO acts both as sponsor and developer of the project. FONAFIFO is also responsible for implementing the project in coordination with COOPEAGRI, and for providing technical, social, and financial information on the project to COOPEAGRI, the Bank, the Government of Costa Rica, local authorities, and community members, in line with the Project Appraisal Document (PAD) and the Emission Reductions Purchase Agreement (ERPA) to be signed with the Bank.

Carbon finance is not part of the World Bank's lending program and there will be no regular loan or grant disbursement. The Bank, as a trustee for the BioCarbon Fund, will make direct payments under ERPA.

The Bank team will supervise safeguard issues for three years after ERPA negotiations. Supervision will be performed periodically until the end of payments (2017 at the latest) by an independent verifier of carbon sequestration who would be trained in Bank safeguard issues. Should any issue arise during supervision, the costs would be covered by the Bank's Carbon Finance Unit (ENVCF). For example, if safeguard policies are violated, carbon payments would cease and the necessary actions would be taken.

Payment and Flow of Funds

At the time of the signing of the ERPA, an anticipated schedule of payments will be prepared based on estimated disbursement of this document and the delivery of ERs. The project sponsors will make requests for payment to the BCF as agreed in the ERPA. For this project the BCF has not agreed to pay any advance for the generation of ERs. The ERPA, with the BCF, will expire after ERs for the total contract amount of CO_2e have been delivered.

In the event that the project sponsor fails to deliver the quantity of ERs for any given calendar year as set forth in the ERPA, the project sponsor will be required to recover the shortfall over the course of the following calendar year or another period agreed with the BCF, as indicated under Article XII of the ERPA. The Carbon Finance Unit's support to the project comes from corporate and government participants who are investors in the BCF and is to be deducted up to a maximum from the ER payments. Apart from this support, the project does not include any World Bank or International Finance Corporation financing.

The main institutions involved in the implementation of the proposed project include the National Forestry Financing Fund (*Fondo Nacional de Financiamiento Forestal*–FONAFIFO) and COOPEAGRI. FONAFIFO, as implementing agent for the Government of Costa Rica, would have full responsibility for overall project management and supervision, including monitoring and evaluation. This responsibility would be carried out in close collaboration with COOPEAGRI for which proper agreements would be signed.

Overall coordination will be performed by the office of the Executive Director within FONAFIFO. The fact that FONAFIFO has strong experience in managing projects financed by the World Bank, for which it makes use of suitable administrative structures and systems, places it in an advantageous position to take over, with relative ease, the financial management tasks of the proposed project. These will basically include: (i) budget formulation and monitoring; (ii) cash flow management (including the processing of payments and withdrawal applications); (iii) maintenance of accounting records, (iv) preparation of interim and year-end financial reports, (v)

administration of underlying information systems, and (vi) arrangements for executing external audits.

The direct implementation of the project will be the responsibility of FONAFIFO's existing Environmental Services Division (ESD). This office will be responsible for day-to-day activities of project implementation and coordination of the project monitoring plan, including verification and reporting. The ESD will ensure the implementation of the Monitoring Plan (EMP) and will annually monitor project progress and measure the impact of project activities against the baseline scenario. The ESD will carry out a systematic monitoring and analysis of project activities; the results will provide the necessary feedback to improve the implementation process. The ESD will be responsible for the following activities:

i. Coordinating project implementation;
ii. Processing annual ES payments to farmers after field verification of tree and forest growth in project parcels;
iii. Verifying the application of recommended techniques for development of the selected A/R activities;
iv. Establishing, maintaining, and monitoring permanent plots and subplots in farmers' parcels,
v. Maintaining and updating the project's GIS system;
vi. Maintaining project files for future verification, including data collection and storage in digital format;
vii. Preparing annual reports on project implementation;
viii. Estimating net anthropogenic GHG removals by sinks to report to the WB-BCF;
ix. Facilitating the verification of project progress; and
x. Assisting COOPEAGRI in implementing training programs for participating farmers.

FONAFIFO will also form a Project Steering Committee responsible for coordinating activities with COOPEAGRI. The designated Project Coordinator will serve as the Committee's secretary. The committee's tasks would include dissemination of information on project implementation and best practices, and coordination between COOPEAGRI and FONAFIFO on project financing and supervision.

Institutional Analysis

National Forestry Financing Fund (FONAFIFO). FONAFIFO was created by Forestry Law No. 7575 (February 13, 1996) as a autonomous entity within the structure of the State Forestry Administration (a general superstructure within MINAE that includes SINAC as a component) to finance a variety of forestry activities and environmental services provided by forests and forest plantations through credit and other mechanisms directed to small- and medium-size producers. FONAFIFO has the legal power and independence to enter into legal contracts including the constitution of trust funds as required for administration of the resources entrusted to it. The institution is headed by an Executive Director under a Board of Directors, which has majority representation from the public sector. The executive entity currently has six divisions: Administration, Environmental Services, Credit, Fund-Raising, Legal Office, and Information Systems (totaling 42 staff in October 2005). FONAFIFO handles a regular annual budget of approximately US$20 million including patrimonial trust funds, PSA, and credits to forest entities. In addition to the proposed project, with the Bank's support FONAFIFO is developing the IBRD/GEF–Costa Rica: Mainstreaming Market-Based Instruments for Environmental Management Project (P093384), amounting to approximately US$40 million (US$30 million IBRD and US$10 million). FONAFIFO is expected to be the implementing agency of this blended operation. A brief description of FONAFIFO's main activities is presented below.

Administration: Responsible for strategic planning and budgeting, development of procedural manuals, personnel management, training, computer services, and other routine administrative and financial management for FONAFIFO. These activities are partially funded by five trust funds totaling approximately US$3 million.

Environmental Services: Since 2003, FONAFIFO assumed responsibility for the implementation of the PSA program and created eight regional offices that collect, review, and preapprove landholder PSA contracts. The PSA is primarily funded by a portion of the taxes on gas sales and by agreements with different types of private companies. FONAFIFO is currently responsible for coordination and management of individual projects delivering environmental services (with payments totaling approximately US$11.5 million in 2005), including evaluation of contracts solicited and the value of services offered, conclusion of agreements with companies or institutions to pay for hydrological services, and cooperation with SINAC/MINAE, among other institutions. PSA contracts with the energy sector account for an additional amount of approximately US$4 million.

Credit: Responsible for analysis and approval of applications for credit by forest sector entities (totaling about US$11.9 million, approved between 1987 and 2005), for disbursements of credit, and for technical and financial monitoring of activities financed by the credit. The credits approved in 2005 total approximately US$1 million.

Fund-raising: Responsible for preparation of proposals and negotiations with private environmental services users (both local and global) who need to protect specific areas of the country for the environmental services derived from them.

Legal Office: Responsible for legal review of PSA contracts, compliance with legal requirements, and entry of land titles in the national land register.

Information Systems: Responsible for the operation and maintenance of the Integrated Project Administration System (SIAP) and of the Geographic Information System (GIS) used to keep track of PSA contracts and their geographic location.

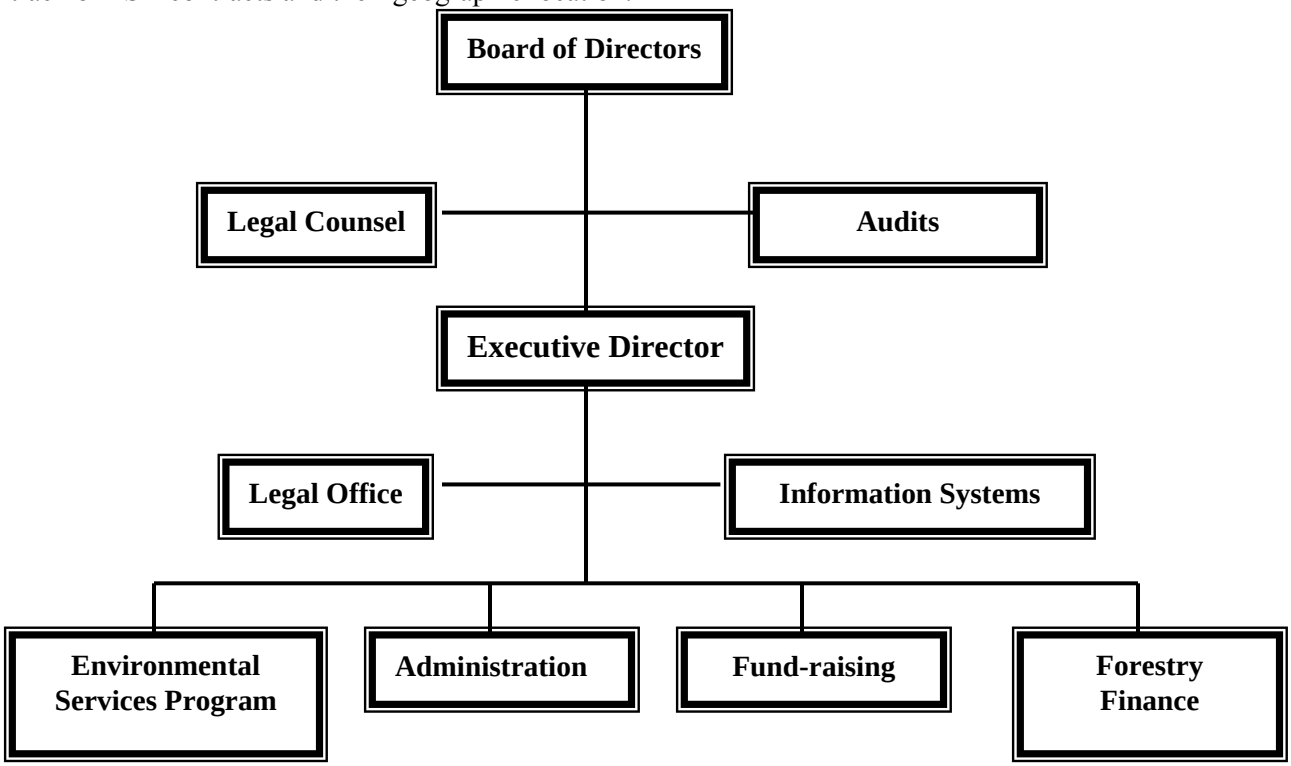


Figure 3.1: Administrative Structure of FONAFIFO

Agricultural and Industrial Cooperative (Cooperativa Agrícola Industrial y de Servicios Múltiples El General R. L.–COOPEAGRI). FONAFIFO lacks field presence for purposes of PSA promotion and provision of technical assistance to individual small- and medium-sized landholders. These functions will be assumed by COOPRAGRI which will provide technical assistance to individual small and medium landholders, such as promotion through sponsorship of farmer-to-farmer exchanges and assistance with the PSA application process; monitoring of PSA contract compliance; technical assistance in land titling; and implementation of forestry activities). These activities will be developed by the Forestry Department of COOPEAGRI. This Department is headed by a registered Forest Regent and three assistants. GFA Terra Systems, an independent body accredited by the Forest Stewardship Council (FSC), has recently certified that COOPEAGRI's forest operations (from August 16, 2005 to June 16, 2010) operate according to the FSC's ecological, social, and economic principles and criteria.

COOPEAGRI was founded in 1962 by a group of small producers who decided to produce and commercialize their products in an independent manner, i.e., bypassing all the intermediary buyers in order to earn better wages. The cooperative produces coffee, sugarcane, fruits, vegetables, and other foodstuffs. It brings together small producers and producers' cooperatives from different villages. There are over 10,000 affiliates, at least 30% of whom are women. Approximately 2,500 farmers are involved in the cooperative's activities, 900 cultivate sugarcane, while the remainder produce coffee. The average land size of each farmer is 2–3 hectares. The sugar produced by COOPEAGRI is used in internationally known products such as CTM Altromercato Compañera chocolate bars and in the Chocolate Hazelnut spread. COOPEAGRI is a well consolidated organization that includes rural committees to audit its operations. Its main activities include:

i. Product marketing and commercialization with the aim of maintaining fair prices and promoting greater profits for member producers; coffee and sugar are sold through Fair Trade, while other goods are sold at local markets.
ii. Provision of machinery, equipment, raw materials, and fertilizers. COOPEAGRI supplies its members with goods and services at more favorable prices (coffee and sugarcane, fertilizers, equipment; the cooperative runs a supermarket, an agricultural bank, and a warehouse).
iii. Promotion of sports and cultural activities. It organizes literacy courses, professional training, reforestation, and other community development programs.

As part of its activities, it provides its members with training on several topics including agricultural production activities and communal organization. The project will rely on COOPEAGRI's social structure to audit the operation of the CDM Project. Coordinators and delegates represent COOPEAGRI affiliates. They constitute the General Assembly and four committees: Administration, Surveillance, Education, and Family Development. In the 2002–2003 period this structure had 170 delegates, 120 coordinators, and 149 alternate delegates. During the same period, COOPEAGRI invested over US$43,000 in education and information. These programs included coordinator meetings, general assembly meetings, delegate meetings, field days, courses, posters, and publications.

ANNEX 4: FINANCIAL AND ECONOMIC ANALYSES

Financial analysis

Overview

Costa Rica is presently implementing through FONAFIFO the Payment for Environmental Services Program (PSA). The proposed project will allow FONAFIFO to expand the scope of the PSA program in southern Costa Rica. The additional incomes from the sales of Emission Reductions (ERs) to the World Bank BioCarbon Fund (BCF) will allow FONAFIFO to (i) create a new PSA modality: reforestation of deforested lands through human-induced promotion of natural seed sources (natural regeneration); and (ii) improve the cash flow pattern typical of forestry activities, making it appropriate for small and medium landowners' needs.

The project will promote the development of a diverse range of land uses within COOPEAGRI's area of influence. COOPEAGRI is a local cooperative consisting of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle ranching. The project will have a total of 4,140 ha distributed among three different reforestation activities: Natural Regeneration, Forest Plantations, and Agroforesty Systems.

Assumptions

The project area is located in Pérez Zeledón County, San José, Costa Rica. It covers three different geographic locations of the county: the Northern Hillsides, the Southern Hillsides, and the Valley. The project activities that will be promoted in the Northern and Southern Hillsides subregions are Natural Regeneration and Agroforestry Systems. Forest Plantations and Agroforestry Systems will be promoted in the Valley area. The project entity is FONAFIFO, and as the project will not generate financial revenues to FONAFIFO, an economic analysis is required. Farmers associated with COOPEAGRI will introduce forestry activities on their privately owned farms, supported by the PSA program. The payments that the farmers will receive are presented in Table 2. The financial analysis will assess the rate of investment from the small and medium farmers' perspective.

Table 2. Payment amounts and disbursement schedules for the project activities through the PSA Program

Project activity	Payment	Payment distribution
Natural regeneration	$41.00/ha	Per year for 5 years (renewable every 5 years up to a total of 20 years)
Forest plantations	$816.00/ha	In 10 years as follows: 1st year 46% ($375.36/ha) 2nd to 9th year 6% ($48.96/ha)
Agroforestry systems	$1.30/tree	In 3 years as follows: 1st year 65% ($0.85/tree) 2nd year 20% ($0.26/tree) 3rd year 15% ($0.19/tree)

Without Project Scenario

The land use alternatives for farmers in the project region (without project scenario) are limited to cattle ranching and agriculture. The main purpose of cattle production in the region is meat and the average number of animals/ha is 0.7 on the hillsides and 1.0 in the Valley.[32] The main agricultural crops in the area are coffee, sugarcane, pineapples, and blackberries. Coffee production varies, depending on whether coffee is grown in hill or valley areas. Sugarcane and pineapples are found only in the valley areas, while blackberries are limited to the hill areas. The average actual net incomes ($/ha/year) and NPV values for each land use activity under the baseline scenario are shown in Table 4.1.

Table 4.1 Financial analysis of land use alternatives in the project area (US$/ha/year)

Land Use	Average Total Cost	Average Total Income	Average Net Income	NPV (at 20 years and 10%)	IRR (%)
Cattle in the Valley subregion	181	272	92	781	NA
Cattle in the Hillside subregions	98	147	50	421	NA
Coffee in the Valley	1,086	1,174	88	(1,039)	NA
Coffee in the Hillside subregions	1,176	1,435	258	190	11.5%
Sugarcane in the Valley	1,866	2,160	294	2,506	NA
Pineapple in the Valley	30,327	31,007	680	7,201	NA
Blackberry in the Northern Hillsides	1,018	1,425	407	2,598	74.1%

Note: Numbers within parenthesis are negative values.
NA = Not applicable because the investment is recovered the same year or IRR is negative.

The financial analysis of the project forestry activities without carbon incomes is shown in Table 4.2. Comparing the financial analysis of the baseline land use alternatives (see Table 4.1) and the project reforestation activities without carbon financing (see Table 4.2), it is evident that pineapple and sugarcane are the most attractive land uses in the Valley subregion, blackberry is the most attractive land use in the Northern Hillsides, and cattle is the most attractive land use in the Southern Hillside subregion. The Natural Regeneration does not compete with any of the land use alternatives shown in Table 4.1. Natural Regeneration shows a negative net annual income throughout the entire period of analysis; therefore, this activity without carbon incomes is definitely not attractive to farmers. Agroforestry systems on the hillsides are financially possible, but they do not replace land uses such as cattle or coffee because the planted trees are integrated with these activities, making the latter even more economically attractive. However, Agroforestry Systems are not widely applied by small and medium farmers. Barrier analysis indicates that the main barriers for the forestry activities are lack of infrastructure, wood market access (such as strong presence of middlemen), and mainly financial barriers (such as lack of funding for the initial investment, the irregular cash flow, or the long return periods).

Forest Plantations without carbon financing are not a financially attractive alternative in the

[32] CORFOGA 2000. Informe del Censo Ganadero del 2000.

Valley subregion. They will not occur on lands currently planted with sugarcane or pineapples, but they might occur on marginal pastures and coffee plantations in the Valley's steepest lands, if the irregular cash flow observed in Forest Plantation activities is stabilized with the help of carbon financing. As shown in Table 4.2, the net annual income of the cash flow of forestry activities without carbon financing is negative throughout the 20-year period, i.e., this type of activity does not provide the farmers a regular annual income to support their needs; therefore, such activities are not attractive to them. Table 4.2 also shows that Forest Plantations (FP) and Agroforestry Systems (AF) are profitable activities according to their NPV (FP = US$862; AF = US$348) and IRR (FP = 14.4%; AF = 15.1%), but they are not as profitable as sugarcane (NPV = US$2,506) or pineapple (NPV = US$7,201) in the Valley, and blackberries on the Northern Hillsides (NPV = US$2,598). Therefore, farmers will tend to convert existing forest, forest plantations, coffee plantations or pastures to the latter two land use activities. In the case of Natural Regeneration, Table 4.2 shows that at least for the first 20 years, farmers will not receive incomes from this type of forestry activity; therefore, farmers will not adopt this activity in the absence of carbon financing.

Table 4.2 Financial analysis of each forestry activity in the baseline scenario (without carbon financing) over a 20-year period (US$/ha/year)

YEAR	NATURAL REGENERATION			FOREST PLANTATION (Native species and Teak)			AGROFORESTRY		
	COSTS	INCOMES	NET ANNUAL INCOME	COSTS	INCOMES	NET ANNUAL INCOME	COSTS	INCOMES	NET ANNUAL INCOME
1	12	-	(12)	712	-	(712)	224	-	(224)
2	12	-	(12)	190	-	(190)	34	-	(34)
3	12	-	(12)	39	-	(39)	40	-	(40)
4	12	-	(12)	39	-	(39)	-	-	-
5	12	-	(12)	63	141	112	-	-	-
6	12	-	(12)	29		(29)	-	-	-
7	12	-	(12)	29	-	(29)	-	-	-
8	12	-	(12)	29	-	(29)	-	-	-
9	12	-	(12)	29	-	(29)	-	-	-
10	12	-	(12)	62	194	132	-	-	-
11	12	-	(12)	29	-	(29)	-	-	-
12	12	-	(12)	29	-	(29)	-	-	-
13	12	-	(12)	29	-	(29)	-	-	-
14	12	-	(12)	29	-	(29)	-	-	-
15	12	-	(12)	54	1,268	1,214	-	-	-
16	12	-	(12)	29	-	(29)	-	-	-
17	12	-	(12)	29	-	(29)	-	-	-
18	12	-	(12)	29	-	(29)	-	-	-
19	12	-	(12)	29	-	(29)	-	-	-
20	12	-	(12)	51	9,854	9,803	18	4,125	4,106
TOTAL	**240**	**-**	**(240)**	**1,553**	**11,457**	**9,904**	**316**	**4,125**	**3,809**
NPV	(99)			862			348		
IRR	NA			14.4%			15.1%		

Note: Numbers within parentheses are negative values.
NPV at 20 years and 10% rate.
NA = Not applicable because the IRR is negative.

Project scenario

Considering the difficulties in obtaining funds for afforestation/reforestation projects, it is important to examine the financial performance of the project scenario. The financial analysis is conducted on the expected cash flows of the project scenario over the project period. The cash flow analysis considers reforestation issues, such as site preparation, seedling production, planting, fertilization, tending, protection, thinning, and harvesting. The revenues include sales of timber from thinning and harvesting. The financial analysis evaluates the project scenario (with and without carbon financing) at 20-year, 40-year, and 60-year periods to coincide with the crediting periods. Financial analysis is conducted in two steps. In the first step, the performance of forestry activities on one hectare of land is assessed. In the second step, the performance of the overall project area is assessed.

Performance at 20 years (1st crediting period)

The net annual income of the cash flow of project activities under the project scenario is shown in Table 4.3. This cash flow assumes that farmers will receive incomes from carbon sales through the FONAFIFO PSA program.[33] In the case of Natural Regeneration, the cash flow is significantly improved with carbon financing. For example, it shows a positive accumulated net income. The NPV (US$173) is positive and the IRR is 52.0%; however, the estimated annual rent is lower than the estimated annual rent from cattle ranching. It is expected that with the incorporation of carbon financing, Natural Regeneration activities will compete with extensive cattle ranching in the less productive and marginal areas of the project's Northern and Southern Hillsides subregions.

Forest Plantations do not compete with sugarcane and pineapples in the Valley, and with blackberry in the Northern Hillsides subregion. However, they compete with coffee and cattle in all three subregions (see Table 4.1). Because coffee and cattle prices change cyclically it is not expected that farmers will change their coffee plantations or good pastures for Forest Plantations. They will wait for better cattle and coffee prices in the near future, as has traditionally occurred in the past. The accumulated net annual income of Forest Plantations under the baseline scenario is negative during most of the project period. This project activity without carbon incomes has a very irregular distribution of annual incomes for the farmers, which makes it unaffordable for them. On the other hand, the net annual income of the cash flow for Forest Plantations under the project scenario (with carbon financing) is positive for most of the project period, providing the farmers a regular net annual income to support their needs (see Table 4.3).

[33] Level of payments for each forestry activity is presented in Table 2.2, Annex 2.

Table 4.3 Financial analysis of each forestry activity under the project scenario (with carbon incomes), over a 20-year period ($/ha/year)

YEARS	NATURAL REGENERATION			FOREST PLANTATION (Native species and Teak)			AGROFORESTRY		
	COSTS	INCOMES	NET ANNUAL INCOME	COSTS	INCOMES	NET ANNUAL INCOME	COSTS	INCOMES	NET ANNUAL INCOME
1	97	41	56	718	375	(343)	229	335	106
2	12	41	29	190	49	(141)	34	104	70
3	12	41	29	39	49	10	41	78	37
4	12	41	29	39	49	10	-	-	-
5	12	41	29	63	190	127	-	-	-
6	12	41	29	29	49	20	-	-	-
7	12	41	29	29	49	20	-	-	-
8	12	41	29	29	49	20	-	-	-
9	12	41	29	29	49	20	-	-	-
10	12	41	29	62	242	180	-	-	-
11	12	41	29	29	49	20	-	-	-
12	12	41	29	29	49	20	-	-	-
13	12	41	29	29	49	20	-	-	-
14	12	41	29	29	49	20	-	-	-
15	12	41	29	54	1,316	1,262	-	-	-
16	12	41	29	29	49	20	-	-	-
17	12	41	29	29	49	20	-	-	-
18	12	41	29	29	49	20	-	-	-
19	12	41	29	29	49	20	-	-	-
20	12	41	29	51	9,854	9,803	18	4,125	4,107
TOTAL	325	820	495	1,563	12,695	11,132	322	4,785	4,463
NPV	173			1,550			882		
IRR	52.0%			21.0%			NA		

NA = Not applicable because with the first year's income the investment is recovered.

Performance at 40 years (2nd crediting period) and at 60 years (3rd crediting period)

The financial performance of the forestry activities and the overall project scenario with and without carbon financing is shown in Table 4.4. Without sales of ERs, Natural Regeneration will never occur because this activity will not provide regular incomes to farmers. Therefore, farmers will not be interested in this activity. With and without the sales of ERs Forest Plantations are economically and financially attractive activities. However, the table does not show that without carbon financing the farmers must face a negative net annual income for most of the forest plantation rotation (see Table 4.2). In the case of Agroforestry Systems, both NPV (without and with carbon incomes) are positive for all three crediting periods. This result suggests that Agroforestry Systems with carbon financing is one of the most economically attractive courses of action for farmers, and it will have a strong influence on their land use decisions. The conclusion of the above analyses is that project activities without the financial benefits from carbon are not financially attractive for small and medium farmers, and the carbon sales can play a significant role in influencing farmers' investment decisions.

Table 4.4 Financial analysis of the project reforestation activities for different time horizons and two project scenarios (NPV in US$)

Reforestation Activity	Without Sales of ERs		With Sales of ERs	
	NPV (10%)	IRR	NPV (10%)	IRR (%)
	20 YEARS			
Natural Regeneration	(99)	NA	173	52.0
Forest Plantations	862	14.4	1,550	21.0
Agroforestry	348	15.1	882	NA
	40 YEARS			
Natural Regeneration	(113)	NA	185	52.0
Forest Plantations	1,080	14.6	1,870	21.2
Agroforestry	400	15.1	1,013	NA
	60 YEARS			
Natural Regeneration	(116)	NA	186	51.8
Forest Plantations	1,112	14.6	1,917	21.2
Agroforestry	408	15.1	1,033	NA
	PROJECT AVERAGE*			
At 20 years	528	14.7%	1,050	26.4
At 40 years	660	14.8%	1,260	26.5
At 60 years	680	14.8%	1,291	26.5

* Weighted average based on the number of hectares established for each project activity.
NA = Not applicable because the investment is recovered during the first year of establishment.

Sensitivity analysis

A sensitivity analysis was conducted to examine the influence of changes in timber prices and labor costs on each reforestation activity, without including sales of ERs (see tables 4.5, 4.6, 4.7). This analysis shows that the financial attractiveness of the project activities is robust with reasonable variations in the critical assumptions. Forest Plantations and Agroforestry Systems in the Valley do not compete with sugarcane and pineapple, even in the best-case scenario. Likewise, Natural Regeneration without carbon financing in the Hillsides subregions is still the less attractive option for small and medium farmers. Forest Plantations in the Valley are financially more attractive than cattle ranching; however, without the carbon financing it is not attractive to farmers due to the negative cash follows they face during the rotation period of the plantations. In summary, without the financial benefits from the sales of ERs the project is not feasible, because it is unlikely that farmers will adopt the proposed reforestation activities. The proposed project will alleviate the financial hurdles of the proposed reforestation activities, as well as the other identified barriers. The financial benefits from selling the ERs will generate incomes that, when transferred to small and medium farmers, will make forestry activities one of the most attractive land use options, in this sense, the ERs will be a new "cash crop," which has a guaranteed price and generates annual incomes to the farmers.

Table 4.5 Sensitivity analysis for Forest Plantations

VARIABLE	VARIATION	NPV (in US$ at 20 years and 10%)	IRR (%)
Wood price	+ 15%	1,151	15.4
	0%	862	14.4
	- 15%	574	13.2
Labor Costs	+ 15%	798	14.0
	0%	862	14.4
	- 15%	1,058	16.0

Table 4.6 Sensitivity analysis for Agroforestry Systems

VARIABLE	VARIATION	NPV (in US$ at 20 years and 10%)	IRR (%)
Wood price	+ 15%	440	16.0
	0%	348	15.1
	- 15%	256	14.1
Labor Costs	+ 15%	313	14.3
	0%	348	15.1
	- 15%	388	16.1

Table 4.7 Sensitivity analysis for Natural Regeneration

VARIABLE	VARIATION	NPV (in US$ at 20 years and 10%)	IRR (%)
Wood price	+ 15%	(99)	NA
	0%	(99)	NA
	- 15%	(99)	NA
Labor Costs	+ 15%	(113)	NA
	0%	(99)	NA
	- 15%	(84)	NA

Economic analysis

The economic analysis assesses the rate of investment from the FONAFIFO perspective, considering that it is part of MINAE. The economic analysis shown in Table 4.8 includes the adjustment of prices and the positive externalities generated by the increased forest cover in the project area. The proposed project with or without carbon incomes represents a good investment for the country. However, the financial analysis shows that the proposed project activities without carbon incomes are the less attractive option for small and medium farmers. Natural Regeneration without carbon incomes is the less attractive option for the country, but when carbon incomes are taken into account it becomes one of the most attractive land use options. This attractiveness comes from the many positive externalities derived from the establishment of a natural forest, especially on the hillsides of the project area. Forest Plantations have some positive externalities (soil conservation, wildlife habitat, watershed protection, etc.), and when they are considered in the economic analysis the NPV and IRR increase slightly. These indicators are significantly increased when carbon incomes are taken into account.

Table 4.8 Economic analysis of the project reforestation activities for different time horizons and two project scenarios (NPV in US$)

Reforestation Activity	Without Sales of ERs		With Sales of ERs	
	NPV (10%)	IRR	NPV (10%)	IRR
	20 YEARS			
Natural Regeneration	(230)	NA	6,279	NA
Forest Plantations	886	15.5	7,715	NA
Agroforestry	338	16.1	5,362	NA
	40 YEARS			
Natural Regeneration	(264)	NA	7,434	NA
Forest Plantations	1,096	15.7	9,940	NA
Agroforestry	389	16.1	6,150	NA
	60 YEARS			
Natural Regeneration	(269)	NA	7,606	NA
Forest Plantations	1,127	15.7	9,122	NA
Agroforestry	396.36	16.0	6,267	NA
	PROJECT AVERAGE*			
At 20 years	503	15.8	7,043	NA
At 40 years	625	15.9	8,200	NA
At 60 years	643	15.9	8,372	NA

* Weighted average based on the number of hectares established for each project activity.
NA = Not applicable because the investment is recovered during the first year of establishment.

Conclusions

The proposed project will alleviate the economic and financial hurdles shown in the financial analysis of the proposed reforestation activities, thereby enabling farmers to adopt them. The proposed project will generate the following benefits:

i. The reforestation activities with carbon financing will generate incomes that, when transferred to the farmers, will convert them into suitable land use options in the project region.
ii. Carbon financing will reduce the perceived investment risks of the forestry activities by providing a more steady (timing), and guaranteed (fixed purchase price of CO_2) income stream. The ERs derived from reforestation will be a new "cash crop," which has a guaranteed price and generates annual incomes for the small and medium farmers participating in the project.
iii. In the absence of the proposed project, carbon stocks in the project area are expected to decrease or remain steady.
iv. The proposed project is replicable in other areas inside and outside Costa Rica. It will attract other organizations that will see it as a testing ground for future carbon financing activities, including participation in "learning by doing" exercises regarding carbon monitoring, verification, and certification.

ANNEX 5: SAFEGUARD POLICY ISSUES

The Costa Rica Carbon Sequestration in Small Farms in the Brunca Region Project (COOPEAGRI Project) is intended to be entirely positive from an environmental standpoint (carbon sequestration as well as benefits with regard to ecological, wildlife, and landscape diversity). In line with Bank Operational Policy (OP) 4.01, an EA is presented to address the environmental issues identified during project preparation. In this regard the purpose of the EA is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted and informed. In particular, this EA addresses two environmental issues: forest and pest management.

Since the project will be implemented on a voluntary basis on land owned by COOPEAGRI members and used only by them, the social safeguard policies are not triggered. The project will enable sustainable income generation options for poor and vulnerable communities, generate jobs, increase income, offer training opportunities, and increase national knowledge of BioCarbon projects. In addition, downstream communities will benefit from the environmental benefits produced by upstream farmers when they adopt forest production activities, such as water protection (quality and flow regulation), flood mitigation, air quality protection, scenic beauty, etc. The likely socioeconomic impacts of project implementation have been assessed through a study that confirms there will be positive results. Due to the small size of project parcels, farmers will not be required to abandon their current activities.

Environmental Assessment

Project Description

Through the COOPEAGRI BioCarbon Project, FONAFIFO plans to expand the scope of its Payment for Environmental Services (PSA) program in a specific area of the country (Pérez Zeledón County). Under the proposed Mainstreaming Market-Based Instruments for Environmental Management Project with the World Bank, FONAFIFO will expand and make more efficient the program of payments to farmers for environmental services. The additional incomes from carbon sales to the World Bank BioCarbon Fund (BCF) will allow FONAFIFO to:

(i) Create a new PSA modality: reforestation of deforested lands through human-induced promotion of natural seed sources (natural regeneration), and

(ii) Improve the cash flow pattern typical of forestry activities, making it appropriate for small and medium landowners' needs.

At least 150 farmers associated with COOPEAGRI will introduce forestry activities on their privately owned farms.

COOPEAGRI is a cooperative of 10,162 farmers presently dedicated to agricultural activities such as coffee, sugarcane, and cattle.

As indicated in the project documents, the project's main objective is to support the generation of carbon dioxide (CO_2) emission reductions through reforestation activities.

The project will have a total of 4,140 ha distributed in three different project activities, which will be established within a period of three years: forest plantations (2,490 ha), natural regeneration (1,200 ha), and agroforestry systems (450 ha, equivalent to 180,000 trees).

Potential Project Impacts

The likely environmental impacts due to project implementation are shown in Table 5.1.

Table 5.1 Potential Project Impacts

Terminal Effect[34]	P	E	I	R	V
Protection of water sources and courses	4	2	4	4	**14**
Prevention and decrease of erosion	3	2	3	4	**12**
Increased biodiversity	4	3	3	3	**12**
Improved landscape	4	3	3	3	**12**
Improved forest connectivity	2	2	3	4	**11**

Note: Score scale 1=low impact, 4=high impact.

Positive Environmental Impacts
The project is expected to be overwhelmingly positive by using PSA to induce rural landowners to maintain the forests or other natural vegetation on their lands. An analysis of the environmental impacts of the proposed project activities highlights the following positive impacts:

Soil conservation. Conservation of topsoil and reduction of soil erosion, improved soil conditions such as water infiltration, and increased organic matter accumulation in soils.

Biodiversity. Increased forest cover (this contributes to the connectivity of forest patches and the consolidation of the Mesoamerican Biological Corridor), increased habitats for birds and small mammals, and increased flora diversity in the project areas through reforestation by natural regeneration and planting of native species.

Water resources. Increased water quality derived from higher water infiltration rates, and flow regulation derived from improved water infiltration.

Adverse Environmental Impacts
No significant negative impacts have been identified due to the environmentally friendly techniques adopted in the proposed COOPEAGRI project activities, e.g., site preparation is reduced to the tree hole (which will be done manually), and proper choice of tree species and their spatial arrangement. The National Forestry Financing Fund (FONAFIFO) will implement an environmental monitoring plan and remedial measures for any risks. Measures such as maintaining firebreaks around project parcels, and keeping the areas free of fire hazards and far from the main roads, will be promoted to reduce the fire risk in project areas. In addition, parcels will be fenced when necessary if there is a danger of damage from cattle.

Any environmentally adverse consequences from this project would be both strictly unintended and highly unlikely. Nonetheless, it is important to assess what these adverse impacts could be. Adverse impacts were considered during the implementation of the Bank–funded Ecomarkets Project and the preparation of the abovementioned Mainstreaming Market-Based Instruments for Environmental Management Project and were found not to be significant.

Forests (OP 4.36)
The Bank's Forest Policy applies to Bank–financed investment projects that: (a) have or may have impacts on the health and quality of forests; (b) affect the rights and welfare of people and their level of dependence upon or interaction with forests; and (c) aim to bring about changes in

[34] Probability=P/Extension= E/Intensity=I/Reversibility=R/Value=V

the management, protection, or utilization of publicly, privately, or communally owned natural forests or plantations.

This project is fully compatible with the Bank's Forest Policy (OP/BP 4.36). It would not support any clearing or degradation of forests or other natural habitats. Instead, it is intended to promote the conservation and restoration of forests and other natural vegetation through FONAFIFO's reforestation and agroforestry modalities. Compliance with the Bank's Forest Policy will be ensured through FONAFIFO's operating rules, as described in the PSA program's Operational Manual.

Moreover, COOPEAGRI is now Forest Stewardship Council (FSC) certified. COOPEAGRI was inspected and it was found that the FSC's ecological, social and economical principles and criteria are fully implemented for round wood. The certification was issued on June 16, 2005 by GFA Terra Systems.

Pest Management (4.09)
The Bank's Pest Management Policy applies to all projects that will procure pesticides or pest control equipment, or to projects that would result in significant increases in pesticide use.

While the project does not finance the purchase of pesticides or pest control equipment, pesticides, specifically, Glyphosate-based pesticides, will be used by the project's participating farmers. Prior to tree planting, in the case of Forest Plantations and Agroforestry Systems, site preparation will be manual and with minimum soil disturbance. This will be limited to making a hole with a tree planting shovel and keeping a circle around the seedlings (35 cm radius) free of weeds. The use of pesticides may be required at one stage during the life cycle of the plantations to control weed competition in the first two to three months after planting. In such cases, trained COOPEAGRI farmers may apply a small amount of the pesticide in a small circle around each tree seedling.

Glyphosate is listed on the "WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2004" as unlikely to present acute hazard in normal use. Therefore it is not classified as Type IA, IB, or II (pesticides with hazardous active ingredients) nor is it subject to Prior Informed Consent (PIC) procedures. Since Glyphosate is not persistent it is also allowed under the FSC. After plantation establishment, weed control is carried out only manually with machetes and no further pest control is required. The project does not lead to substantially increased pesticide use and subsequent environmental problems, and the COOPEAGRI farmers will use only Glyphosate or a Type III or IV in the WHO's classification. This commitment will be reflected in the Emission Reduction Purchase Agreement (ERPA). Farmers will not be allowed to mix herbicides by hand or to reuse old pesticide containers, and they will be required to use protective equipment when applying herbicides.

In compliance with Costa Rica's regulatory framework for safe, effective, and environmentally sound pest management, the project will apply commonly accepted procedures for procurement, handling, application, and disposal of pesticides. This is reflected in the COOPEAGRI pesticides manual, which is available to all persons involved with pesticide application in their projects. COOPEAGRI has the capacity to manage the procurement, handling, application, and disposal of pest control products; to monitor the precision of pest control and the impact of pesticide use; and to develop and implement ecologically based pest management programs. COOPEAGRI offers training to those who are responsible for pesticide application.

Thus, in line with Bank policies: (i) the expected quantities of pest control products are not significant from a health or environmental standpoint; (ii) no significant environmental or health concerns related to pest control need to be addressed; and (iii) the project implementing agency, COOPEAGRI, will not introduce the use of new pesticides or other non-indigenous biological controls, or significantly increase the level of current pesticide use. In addition to Bank supervision, an independent verification entity monitors pest management practices as part of the FSC certification. This monitoring includes announced and unannounced yearly visits, inspection of pesticide storage locations and equipment, and interviews with workers involved in pesticide application.

Consultation and Disclosure

The benefits and risks mentioned above were presented in the communities of Rivas, Quizarrá and Platanares in Pérez Zeledón County from August 16 to 18, 2005 with the participation of community leaders and farmers; and in San Isidro de Pérez Zeledón on February 16, 2006 with COOPEAGRI's Administrative Council and Forest Department staff. Information on public consultations, a summary of issues raised, and list of attendees are attached to this document as Appendix A.

In accordance with the Bank's policy on consultation and disclosure, this project EA will be disclosed before project appraisal at the Bank and in Spanish in Costa Rica.

COOPEAGRI is responsible for promoting the project among its affiliates. COOPEAGRI's staff has prepared printed and audiovisual materials on the project to make presentations to the farmers in their communities, and will provide training to the farmers and the community members as required.

1. Physical characteristics

Pérez Zeledón County is located in the western section of San Isidro's General Valley in southeastern Costa Rica. It covers an area of 190,183 ha and is divided into 11 districts and 230 towns, 194 of which are located in the project area. All these towns are under one municipality. The county has a population density[35] of 63 persons/km^2. The project area is located within Pérez Zeledón County and has been divided in three subregions (Northern Hillsides, Valley, and Southern Hillsides—see Map 5.1) in order to facilitate fieldwork, increase the accuracy and precision of measuring and estimating carbon stocks, and reduce monitoring costs.

Geology:

The geology of the project area varies from intrusive volcanic rocks of the Tertiary period to sedimentary rocks from the Eocene to Quaternary periods, as well as from the Cretaceous to the Pliocene periods.

Topography:

The topography of the project area is shown in Map 5.1. The Northern Hillsides subregion is mainly covered with pastures and small second-growth or disturbed forest patches (see Figure 5.1). This area borders Chirripó National Park and has slopes ranging from 60 to 80 percent or even more in some areas. From these hillsides three main rivers flow to the Valley: Pacuar,

[35] Schram, Albert. 1997. Estudio socio-económico: una caracterización del Cantón de Pérez Zeledón. Centro Centroamericano de Población (CCP). Universidad de Costa Rica.

General, and Peñas Blancas. These three rivers later form the Río Grande de Terraba. The elevation of these hillsides varies from 800 to 2,200 m. Reforestation by natural regeneration and agroforestry will be the main land uses that will be promoted by the project in these hillside areas.

The Valley is presently covered by pastures, coffee, sugarcane, and small forest patches (see Figure 5.2). The major cities are located in this area. The terrain consists of rolling hills with slopes ranging from 0 to 30 percent and elevations between 400 and 800 m. The forestry activities to be promoted by the project in this subregion are man-made forest plantations, and agroforestry activities such as small forest blocks, trees mixed with crops, windbreaks, and tree planting in rows and fences.

The Southern Hillsides subregion borders the "Paso de la Danta" Biological Corridor, which is at the same time part of the Mesoamerican Biological Corridor. The lands in this subregion are similar to the Northern Hillsides; they are mainly covered with pastures and small secondary growth or disturbed forest patches (Figure 5.3). This subregion also has very steep areas (slopes greater than 60 percent), but with elevations only from 700 to 1,200 m. The proposed land uses to be promoted in this area are agroforestry and reforestation by natural regeneration.

Map 5.1 Topography of the project area by subregion

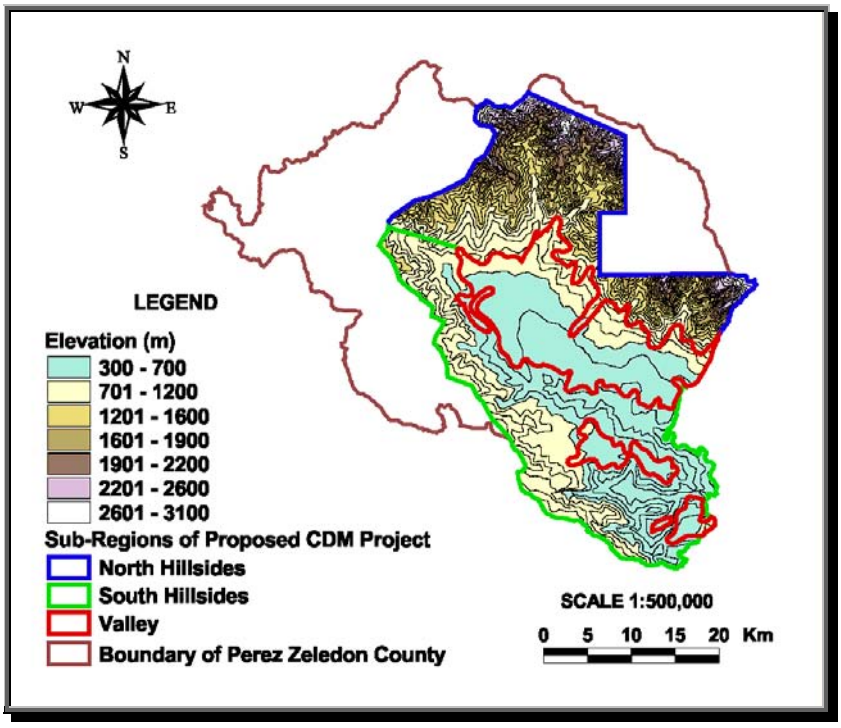


Figure 5.1 General view of the Northern Hillsides subregion.

Figure 5.2 General view of the Valley subregion.

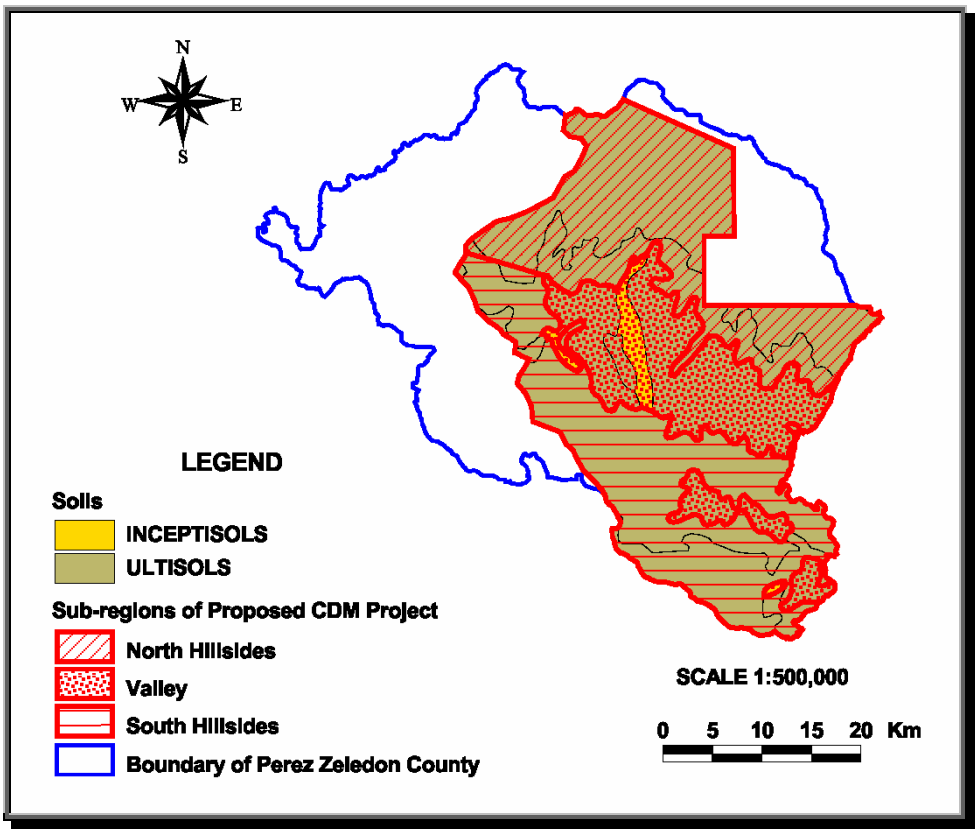
Figure 5.3 General view of the Southern Hillsides subregion.

Soils:

The soils of the project area are shown in Map 5.2. Most of the soils in the Northern and Southern Hillsides subregions are Humult Ultisols on steep terrains (slopes>than 60 percent) or strongly wavy terrains (slopes ranging from 30 to 60 percent). They contain an argillic[36] horizon with less than 35 percent base saturation. The Humult sub-order indicates that these soils have a high content of organic matter. Ultisols are generally deep, well drained soils, red or yellow in color, which indicates relatively low fertility.

The soils in the Valley subregion are also mostly Humult Ultisols, although this subregion also has some Tropept Inceptisols. Even though Ultisols are the predominant soils in this subregion, they differ from the Ultisols in the other two subregions because most of the Valley's terrain is moderately (slopes ranging from 15 to 30 percent) or softly (slopes ranging from 2 to 15 percent) wavy. Inceptisols are young soils with a cambic[37] B-horizon under an ustic regimen with softly wavy or flat terrains (0 to 2 percent).

Map 5.2 Soil types for the project area by subregion



[36] Argillic horizon: a zone of silicate clay accumulation. The horizon contains at least 20 percent more clay than the horizon above it.
[37] Cambic horizon: a horizon too weakly developed to meet the criterion of any other diagnostic horizon.

2. Climate

Precipitation:
The average precipitation in the Northern Hillsides subregion ranges from 3,000 to 4,500 mm per year with a dry regimen of 1 to 2 months. The average precipitation in the Valley ranges from 2,000 to 3,000 mm per year with a dry regimen of 3 to 4 months. The average precipitation in the Southern Hillsides ranges from 2,000 to 2,500 mm per year with a dry regimen of 3 to 4 months.

Temperature:
The annual temperature in the Northern Hillsides subregion ranges from 15 to 20°C (low montane and montane elevation zones). The annual temperature in the Valley subregion ranges from 24 to 28°C (tropical elevation zone). The annual temperature in the Southern Hillsides subregion ranges from 20 to 24°C (premontane elevation zone).

3. Land use of the project area

Table 5.2 presents the land use distribution[38] for the total project area. Pasture is the main land cover in the area, followed by agriculture (see Map 5.3.)

Table 5.2 Land cover in the total project area

REGION/LAND COVER	HECTARES	PERCENTAGE (%)
Forest	20,773	17.8
Agriculture and pasture	90,228	76.9
No Data	6,320	5.4

[38] 1992 Land use data (ITCR 2004, Atlas Digital de Costa Rica 2004.)

Map 5.3 Land Use of the project area by subregion

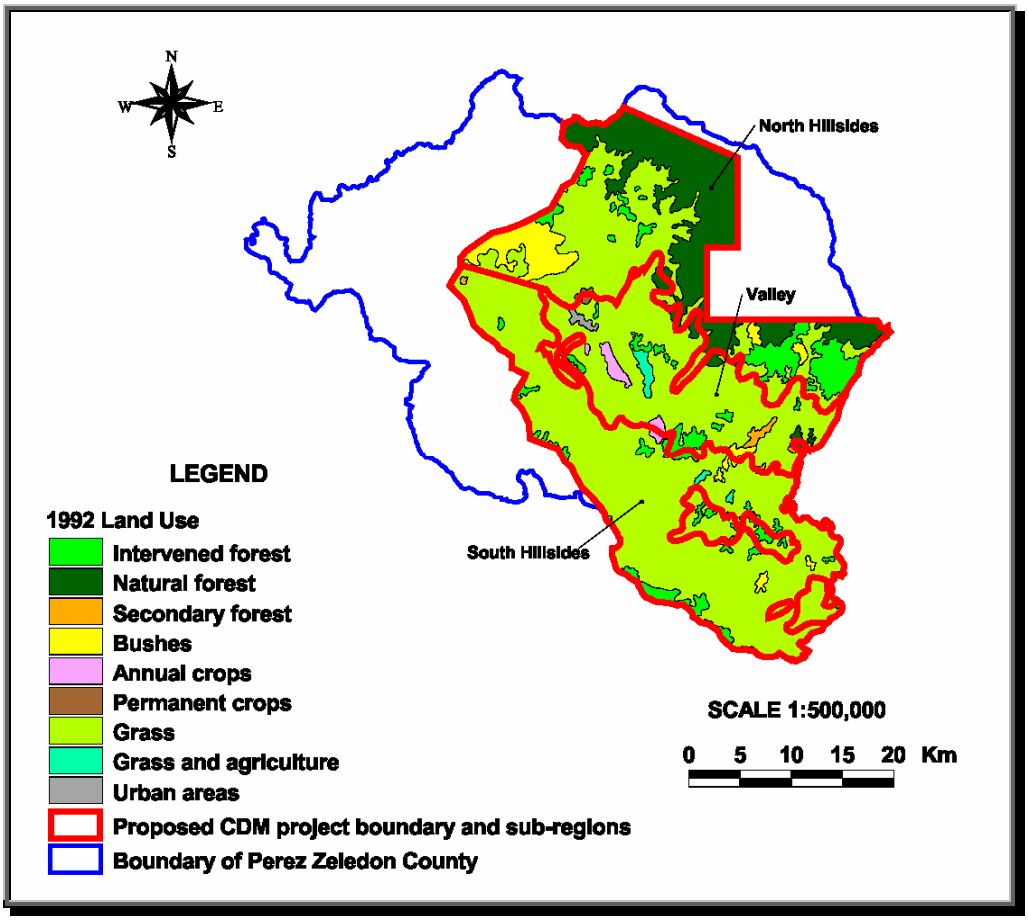


Table 5.3 presents the land use distribution for each subregion. The Northern Hillsides is the subregion with a greater percentage of forest cover compared to the Southern Hillsides and Valley subregions. However, its forest cover is still less than the area for agriculture and pastures. The Southern Hillsides and Valley subregions have the most area dedicated to agriculture and pastures.

Table 5.3 Land cover of the project by subregion

Subregion	Land Cover	Hectares	Percentage (%)
Northern Hillsides	Forest	16,614	39.4
	Agriculture and pasture	19,588	46.6
	No Data	5,818	13.9
	Subtotal	**42,020**	**100.0**
Southern Hillsides	Forest	1,763	4.0
	Agriculture and pasture	41,758	94.9
	No Data	487	1.1
	Subtotal	**44,008**	**100.0**
Valley	Forest	2,396	7.6
	Agriculture and pasture	28,941	92.3
	No Data	16	0.1
	Subtotal	**31,353**	**100.0**

4. Biodiversity Communities

The project area covers many ecological life zones (see Map 5.4), which could have presented higher biodiversity than what exists today. However, these subregions have suffered high levels of disturbance, significantly reducing this biodiversity.

The three subregions—Northern Hillsides, Valley, and Southern Hillsides—are distinctly different in their current biodiversity. The Northern Hillsides contain most of the forest cover that connects with Chirripó National Park. This has contributed to the protection of wildlife habitat in the subregion. The Valley area is covered by crops, various types of plantations, and the region's principal infrastructure, which significantly reduce the wildlife habitats in this subregion. The Southern Hillsides contain less forest cover than the Northern Hillsides and more areas of secondary growth, pastures, and various types of forest plantations, favoring slightly more the survival of birds and small mammals. Consequently, the reforestation of these areas is critical to the restoration and protection of the region's biodiversity.

Data obtained from the Web site of the National Biodiversity Institute (INBIO)[39] indicate that the region's flora has been intensely studied. However, there are few data regarding mammal, bird, insect, and reptile species. The Tropical Scientific Center's (CCT's) bird count[40] at Los Cusingos Neotropical Bird Sanctuary, performed on April 8, 2004, reported a total of 229 bird species and 2,723 individuals, which were identified in only one day. The most abundant bird species that day were the Barn Swallow *(Hirundo rustica),* Swainson's Thrush *(Catharus ustulatus),* and Cherries' Tanager *(Ramphocelus costaricensis)* (see Figure 5.4) with more than 100 individuals counted. Among the less abundant species (with only one individual) were the Blue-black Grosbeak *(Cyanocompsa cyanoides),* Canada Warbler *(Wilsonia Canadensis),* Louisiana Waterthrush *(Seiurus motacilla),* Great-crested Flycatcher *(Myiarchus crinitus),* Ruddy Woodcreeper *(Dendrocincla homochroa)*, Common Potoo *(Nyctibius griseus)*, Ruddy Quail-Dove *(Geotrygon montana*), and Swainson's Hawk (*Buteo swainsoni).*

[39] http://atta.inbio.ac.cr/scripts/pbcgi60.exe/TUTORIAL/uo_pbdemo/f_getlogon01?as_userid=&as_userpass=

[40] López-Vargas, W.2004. Conteo de Aves: Corredor Alexander Skutch. Santuario Neotropical de Aves Los Cusingos. CCT. 12 pp.

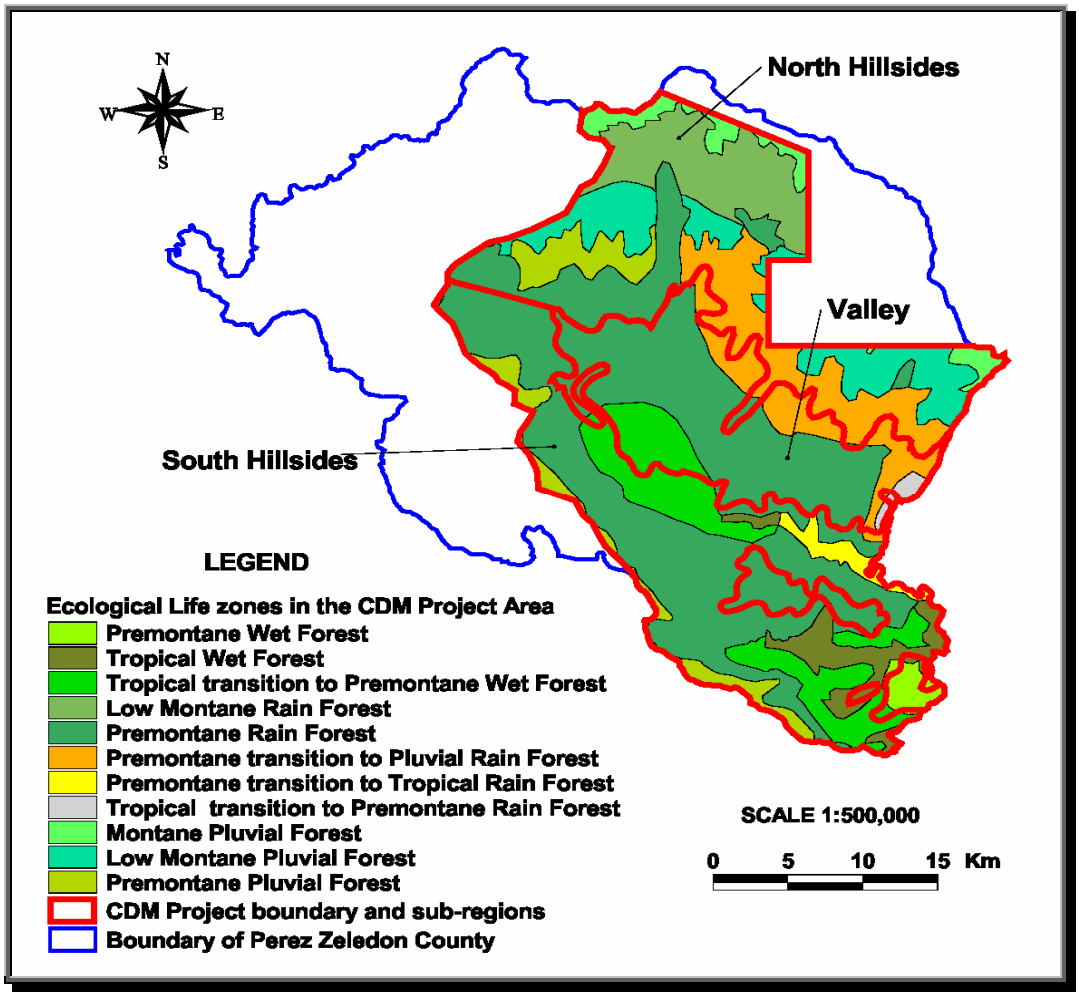
The results of this bird count provide evidence of the rich biodiversity in these subregions because many of these bird species often require specific food sources (vegetables or animals) that must be present in the area for their support.

Figure 5.4 *Ramphocelus costaricensis*

© Lou Hegedus[41]

[41] http://www.mangoverde.com/birdsound/picpages/pic201-112-1.html

Map 5.4 Ecological Life Zones in the project area



Flora

The Northern and Southern Hillsides forest types were Low Montane and Montane Rain Forests, including forest types such as cloud forest, tropical oak forests, or mixed forests including species such as tropical oaks, alder, *podocarpus*, *lauracea, ulmus*, etc. The Valley was covered mainly with tropical rain forest species such *Vochysia, Dendropanax, Terminalia, Tabebuia, Dimopanax,* and *Hyeronima.*

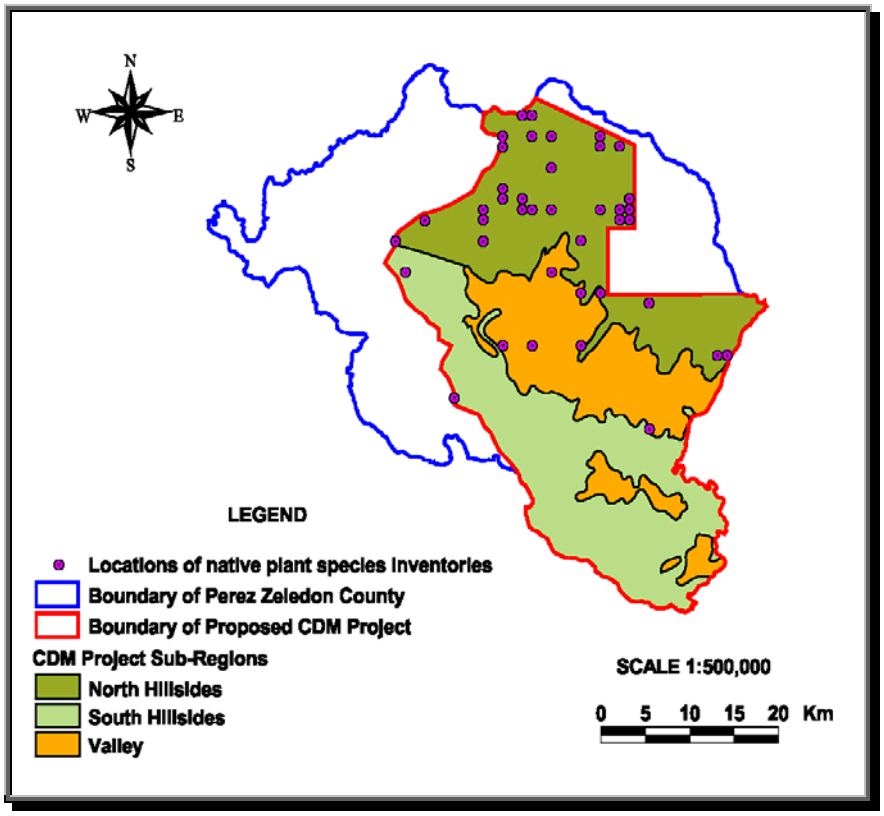
The destruction of forest cover has resulted in the degradation of ecosystems. Due to severe overgrazing, pastures are degraded, and vegetative cover is transformed into resistant and weedy species. These negative changes have resulted in undesirable consequences for wildlife habitat.

INBIO's Web site reports plant species data and sample locations (latitude and longitude coordinates) that were introduced into the project GIS. In this way, it was feasible to identify 65 native plant species, 4 endangered plant species, and 26 new plant species for science within the project area.

Native plant species:

The sites where these 65 native species were found are shown in Map 5.5. Among the native species located in the Northern Hillsides subregion are *Monstera epipremnoides*, *Chamaedorea crucensis*, *Clusia osaensis*, *Clusia talamancana*, *Sechium talamancensis*, and *Dendrophthora turrialbae*. Among the native species detected in the Valley subregion are *Weberocereus imitans*, *Croton skutchii*, *Conostegia bigibbosa*, and *Alloplectus tetragonus*. Among the native species identified in the Southern Hillsides subregion are *Lacmellea zamorae*, *Justicia skutchii*, *Schefflera brenesii*, *Byrsonima herrerae*, and *Marcgravia pittieri*.

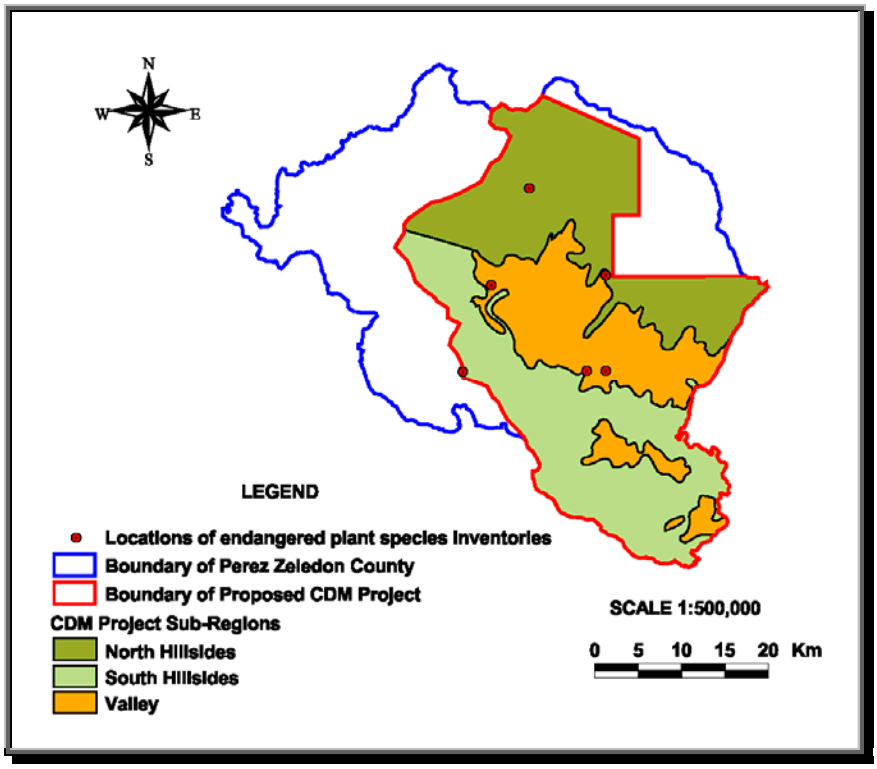
Map 5.5 Locations of native plant species within the project area



Endangered plant species:

The sites where these four endangered species were found are shown in Map 5.6. *Guarea grandifolia* is an endangered plant species in all three project subregions; while *Hymenaea courbaril*, *Humiriastrum diguense*, and *Enterolobium schomburgk* are endangered plant species in the Valley area.

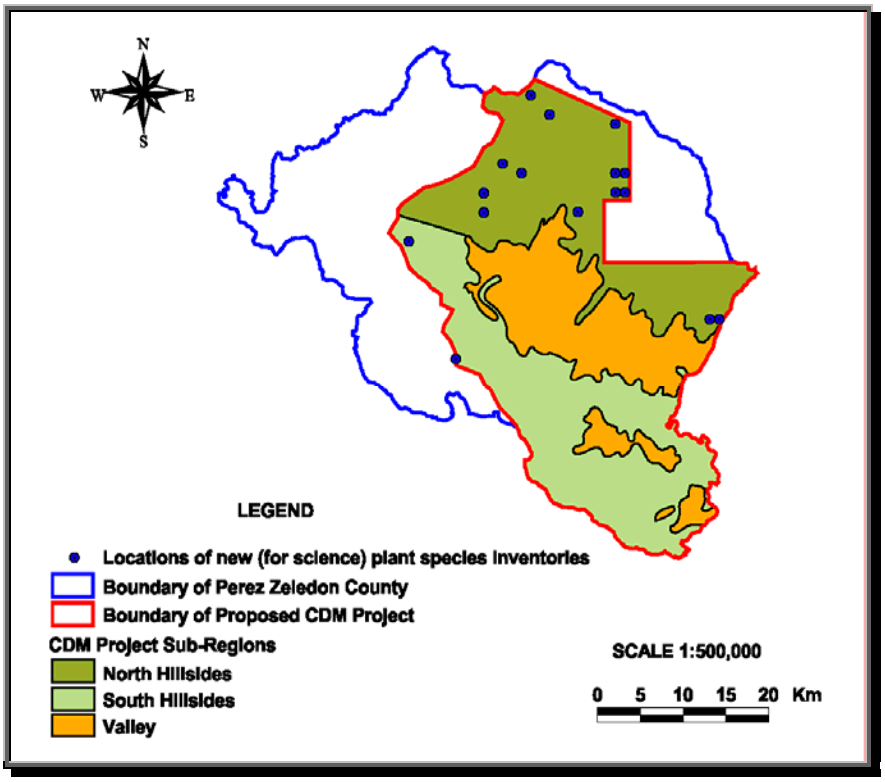
Map 5.6 Locations of endangered plant species within the project area



New plant species for science:

The sites where these new plant species were found are shown in Map 5.7. Of the 87 new plant species located on Pérez Zeledón County, 26 were discovered within the project area, specifically in the Northern Hillsides (20 new species). Among these new species discovered in the Northern Hillsides subregion are *Guatteria talamancana*, *Ilex skutchii*, *Calathea retroflexa*, *Passiflora gilbertiana*, *Ocotea praetermissa*, *Polystichum concinnum*, and *Philodendron thalassicum*. The new species discovered in the Southern Hillsides subregion are *Lacmellea zamorae*, *Philodendron dodsonii*, *Chamaedorea rossteniorum*, *Costus ricus*, *Byrsonima herrerae*, and *Sarcopera rosulata*.

Map 5.7 Locations of new plant species within the project area



Species and varieties selected in the project area:

The selection of species for Forest Plantations or Agroforestry Systems was based on the country's accumulated experience. The selected species grow well in plantations, have good seed supply, and will provide additional incomes to the farmers. In addition, these species have a good market; they are fast growing and well known by the farmers (see Table 5.4).

Forest species from Natural Regeneration will all be native species. The natural regeneration process allows the recovery of the original forest type. Therefore, it will be promoted in the project's hillsides areas (Northern and Southern), where the remaining forest patches will function as seed sources.

In the case of Agroforestry Systems the project proposes to plant 180,000 trees of native species in association with crops and pastures**.**

In the case of man-made *Forest Plantations* the project will promote the use of four native species (50 percent of trees), and two non-native species (50 percent of trees). Because man-made plantations will be established in the Valley subregion, and this subregion's estimated area is 31,352 ha, the expected percentage of non-native plantations at the end of the project for this subregion will be around 4.0 percent.

Table 5.4 Total area and percentage to be planted with native and non-native species in Forest Plantations

Tree Species	TYPE	AREA (ha)	PERCENTAGE (%)
Amarillon (*Terminalia amazonica*)	Native	312	12.5
Botarrama (*Vochysia ferruginea*)	Native	311	12.5
Cebo (*Vochysia guatemalensis*)	Native	311	12.5
Pilon (*Hieronyma alchorneoides)*	Native	311	12.5
Melina (*Gmelina arborea)*	Non-native	624	25.1
Teak (*Tectona grandis*).	Non-native	621	24.9
Total		**2,490**	**100.0**

Native species:

The native species shown in Table 5.4 have been used in reforestation projects in Costa Rica since 1990. These species are very popular among farmers. With the help of FONAFIFO, COOPEAGRI, and other organizations, "seed stands" have been established in the Pérez Zeledón region to provide good seed quality for reforestation and agroforestry projects.

Terminalia amazonica:[42]*:* trees of this species can often reach 30 m height and 90 cm diameter in its natural environment. This species grows well on steep (see Figure 5.5) or flat terrains with moderately deep to deep soils and good drainage. However, this species' optimal growth occurs on loamy to frank soils with pH ranging from acid to neutral. It does not tolerate heavy loamy soils and is susceptible to competition with a grass called Brachiaria. Amarillon is also sensitive to dry regimens lasting more than four months. It requires annual temperatures from 21 to 24ºC and annual precipitations from 2,000 to 4,500 mm. Its wood has a variety of uses such as ships, plywood, furniture, construction, tool handles, pulp, bridges, and floors. Amarillon's tannin-rich bark can be used to tan leather. The species rotation ranges from 25 to 40 years.

[42] Solís, M. and Moya, R. 2000. *Terminalia amazonia* en Costa Rica. FONAFIFO. pp. 97.

Figure 5.5 Amarillon forest plantation on a hillside (6 years old)

Vochysia ferruginea and *Vochysia guatemalensis:*[43] trees of these species can often reach 45 m height and 1.8 m in their natural environment. They are fast growing species that can adapt to a variety of sites such as rolling hills (see Figure 5.6), alluvial but well drained flat areas, or dry sites with degraded Ultisol soils. These species require moderately deep to deep soils of loamy-sandy texture, pH ranging from 5.5 to 6, and a high content of iron and bauxite. Because of their fast growth, their wood is not heavy and cannot be used for packing. These species' rotation ranges from 15 to 25 years.

Figure 5.6 *Vochysia guatemalensis* - Cebo forest plantation on rolling hills after three prunings (10 years old)

Hieronyma alchorneoides:[44] trees of this species can often reach up to 45 m height and 1.2 m in diameter in their natural environment. Pilon grows well on rolling hills and tolerates acid and stony soils with low fertility. It can be found in areas with altitudes from 0 to 800 m above sea level and precipitation ranging from 3,000 to 4,000 mm. Pilon's wood has a variety of uses such as exterior and interior construction, floors, bridges, boats, poles, and marine construction. The species' rotation ranges from 25 to 40 years (see Figure 5.7).

[43] Solís, M. and Moya, R. 2000. *Vochysia guatemalensis* en Costa Rica. FONAFIFO. pp. 97.
[44] Solís, M. and Moya, R. 2000. *Hieronyma alchorneoides* en Costa Rica. FONAFIFO. pp. 97.

Figure 5.7 Pilon forest plantation after first thinning (4 years old)

Non-native species:
The non-native species shown in Table 5.4 have already been planted in many other regions of Costa Rica. The first Melina and Teak plantations were established in 1960 and 1930, respectively. The country has also developed high levels of knowledge and expertise in the use of these species, and there are no reports of negative impacts when the plantations are established on terrains with low slopes and proper management (especially in the case of Teak). Moreover, there are no reports of invasiveness, hybridization, etc., for these two species in the country.

Gmelina arborea.[45] This species is widely adapted to different sites and climates in Costa Rica, ranging from wet to dry regimes. It is a fast growing species but requires low terrains (see Figure 5.8) with fertile soils and plenty of water. It likes soils with a high content of calcium and magnesium. Melina wood has a variety of uses such as lumber, construction, furniture, and pulp. The species' rotation ranges from 10 to 14 years.

Figure 5.8 Melina forest plantation with pruning.

Tectona grandis.[46] Trees of this species can often reach over 35 m in height (in the best sites) and more than 30 cm in diameter at ages greater than 15 years. This species adapts well to a variety of soils, but it prefers alluvial flat areas with fertile, well drained deep soils, neutral to acid pH and frank-sandy to loamy soil texture. In addition, this species requires soils with high contents of calcium (Ca), phosphorous (P), magnesium (Mg), as well as plenty of light and space. It is very

[45] Rojas, F. et al, 2004. Manual para productores de *Gmelina arborea* en Costa Rica. FONAFIFO. pp. 151.
[46] Fonseca, W. 2004. Manual para productores de *Tectona grandis* en Costa Rica. FONAFIFO. pp. 109.

sensitive to weeds and fire. Teak is not recommended on sites with slopes greater than 30 percent to avoid erosion problems, or on sites located in the middle or the foothills because of poor growth increments, or on sites affected by strong winds. Other limiting factors for this species are shallow flat soils with a stony layer near the ground surface, poor drainage or flooded areas, hard loamy or compacted soils, shallow and sandy soils, and a high content of interchangeable iron (Fe) and aluminium (Al). Teakwood has also a variety of uses such as bridges, furniture, carpentry, floors, doors, poles, musical instruments, and toys. The rotation for this species ranges from 25 to 40 years (see Figure 5.9).

Figure 5.9. Teak forest plantation with thinning, but no pruning

There are forestry manuals for all the proposed species in this project. These manuals were developed by FONAFIFO and other institutions.

FONAFIFO has already considered the need for seed sources to develop the plantations with both native and non-native species. Consequently, it has started a tree improvement program aimed at the production of good quality seed for agroforestry and tree plantations. The best plantation stands in the area have been selected. By thinning them, improved "seed stands" have been developed. These stands belong to COOPEAGRI, its associates, or other farmers in the region. COOPEAGRI collects the seeds using tree climbing ropes, hand cutters, bags, etc.

Appendix A: Public Consultations

As part of the project preparation activities and in compliance with Bank policies, public consultations were held in the communities of Rivas, Quizarrá and Platanares in Pérez Zeledón County from August 16 to 18, 2005 with the participation of community leaders and farmers; and in San Isidro de Pérez Zeledón on February 16, 2006 with COOPEAGRI's Administrative Council and Forest Department staff.

Summary of issues raised

In summary, the main issues raised during these consultations are related to payments, requirements/conditions to participate in the project, sale price, and the positive environmental impacts from project implementation. These issues are described below:

- Payment amounts for each forestry activity under the project (and as part of FONAFIFO's Payment for Environmental Services program).
- If existing forests and trees are subject to the payments.
- When payments would be received.
- If establishment costs should be covered by farmers.
- If farmers should be given back payments and wood at the end of the project.
- Requirements to participate in the project.
- Type of trees that can be planted.
- Possibility to carry out various forestry activities at the same time on their farms.
- Impact of species produced under natural regeneration activity in the project.
- Sale price of carbon reductions and the interest to maximize it (through other buyers).
- Positive environmental impacts expected by the population of the area.

All the issues were addressed during the consultations and the relevant information included in the PAD. Specific suggestions to change aspects of the project design or to further elaborate on safeguard documents (Environmental Assessment in this case) were not received.

List of attendees

A total of 103 persons representing civil society, indigenous peoples, and other stakeholders participated in the consultations (79 community members, 19 COOPEAGRI members, 4 FONAFIFO representatives, and 2 from York University).

#	*Name*	*Community or institution*	*Date*
1	Fernando Ureña Quirós	Quizarrá	8/16/2005
2	Adilia Gamboa Vargas	Quizarrá	8/16/2005
3	Guillermo Cisneros Campos	Quizarrá	8/16/2005
4	Carmen Julia Vargas H.	Quizarrá	8/16/2005
5	Carmen Matamoros	Quizarrá	8/16/2005
6	Virginia Cisneros Gamboa	Quizarrá	8/16/2005
7	Enrique Díaz Granadilla	Quizarrá	8/16/2005
8	Donald Díaz Venegas	Cidral	8/16/2005
9	José Antonio Díaz Serrano	Cidral	8/16/2005
10	Roberto Díaz Elizondo	Cidral	8/16/2005
11	Marvin Valverde	Quizarrá	8/16/2005
12	Robert Cascante	San Francisco	8/16/2005
13	Roy Díaz Venegas	Cidral	8/16/2005
14	Rigoberto Gamboa Vargas	Cidral	8/16/2005
15	María Mora Vásquez	Montecarlo	8/16/2005
16	Rafael Angel Viquez	Quizarrá	8/16/2005
17	Gonzalo Godínez Fonseca	Santa Elena	8/16/2005
18	Jordan Vásquez A.	Santa Elena	8/16/2005
19	Carlos Vargas A	Santa Elena	8/16/2005
20	Carmen Lidia Arias Barboza	Quizarrá	8/16/2005
21	Luis Angel Rojas González	Quizarrá	8/16/2005
22	Luis Abarca	Quizarrá	8/16/2005
23	Hazel Vásquez Padilla	Quizarrá	8/16/2005
24	Adolfo Ureña Q	Quizarrá	8/16/2005
25	Fabio Fonseca Valverde	Pueblo Nuevo de Rivas	8/17/2005

#	Name	Community or institution	Date
26	Adrián Borbón	Buena Vista	8/17/2005
27	Santiago Angulo Serrano	Buena Vista	8/17/2005
28	Oldemar Blanco Badilla	Herradura	8/17/2005
29	Dennis Elizondo Elizondo	Herradura	8/17/2005
30	Gerardo Fonseca Hernández	Buena Vista	8/17/2005
31	Arcelio Villarena Rosales	Herradura	8/17/2005
32	Carlos Cascante Ureña	San José-Rivas	8/17/2005
33	José Joaquín Villarena	Herradura	8/17/2005
34	Osvaldo Torres Aguilar	Buena Vista	8/17/2005
35	Virgita Portuguéz	Buena Vista	8/17/2005
36	Oscar Santamaría Villarena	Buena Vista	8/17/2005
37	Fernando Villarena Elizondo	Herradura	8/17/2005
38	Elián Robles Santamaría	Herradura	8/17/2005
39	María C. Garro	Buena Vista	8/17/2005
40	Angel Portuguéz	Buena Vista	8/17/2005
41	Claudia Gómez	Buena Vista	8/17/2005
42	Diego Portuguéz	Buena Vista	8/17/2005
43	Elizabeth Gamboa Robles	Tirecí	8/17/2005
44	Erika Barrantes	Tirecí	8/17/2005
45	Róger Barrantes Cordero	Tirecí	8/17/2005
46	Ramón Cruz Hidalgo	Pueblo Nuevo	8/17/2005
47	Oscar Hidalgo Cruz	San José-Rivas	8/17/2005
48	Omar Jiménez Villalobos	Herradura	8/17/2005
49	Francisco Barquero	Pueblo Nuevo	8/17/2005
50	Karen Villarevia	Herradura	8/17/2005
51	Mauren Villarevia	Herradura	8/17/2005
52	Vivian Villarevia	Herradura	8/17/2005
53	Misael Garro Elizondo	Pueblo Nuevo	8/17/2005
54	Alcides Abarca Barrantes	Palmital	8/18/2005
55	Juan Rafael Murillo Peraza	Paraíso	8/18/2005
56	Antonio Peraza Escalante	San Rafael Platanares	8/18/2005
57	Leonel Guillén Matamoros	Naranjo	8/18/2005
58	Juan Diego Bolaños Salas	Villa Argentina	8/18/2005
59	Gerald Villalobos Conejo	Vista del Mar	8/18/2005
60	Mario García Mora	San Gerardo	8/18/2005
61	Luis Anchía Carranza	San Gerardo	8/18/2005
62	Mauren Carranza Villalobos	Bolivia	8/18/2005
63	Willian Quesada N.	San Gerardo	8/18/2005
64	Johnny García M	San Gerardo	8/18/2005
65	Mauren Alvarado Ch.	San Gerardo	8/18/2005
66	Dimas Elizondo A.	San Gerardo	8/18/2005
67	German Picado Vega	San Gerardo	8/18/2005
68	Juan V. Alvarado Ch.	San Gerardo	8/18/2005
69	Javier Villalobos Retana	Vista del Mar	8/18/2005
70	Arnulfo García Cruz	San Gerardo	8/18/2005
71	Froilan Díaz Jiménez	Mollejones	8/18/2005
72	Santana Montero Soto	Mollejones	8/18/2005

#	Name	Community or institution	Date
73	Eladio Fallas Vargas	Bolivia	8/18/2005
74	José Navarro Guillén	Vista del Mar	8/18/2005
75	Juan Ávila Fernández	San Miguel-Pejibaye	8/18/2005
76	Elizabeth Anchía Vega	San Gerardo	8/18/2005
77	Darling Anchía Moya	San Gerardo	8/18/2005
78	Aberlardo Jiménez P.	San Rafael	8/18/2005
79	Edwin Leiva Fonseca	Buenos Aires	8/18/2005
80	Ana Elizabeth Gómez	FONAFIFO	8/18/2005
81	Eduardo Hidalgo Solano	Forestales Coopeagri R.L.	2/16/2006
82	Donald Córdoba Aguilar	Asesor Independiete	2/16/2006
83	Mauricio Calderón M	Consejo Administrativo	2/16/2006
84	Carlos A. Murillo M	Consejo Administrativo	2/16/2006
85	Rafael Calderón Ortiz	Consejo Administrativo	2/16/2006
86	Abilio Mora Mora	Consejo Administrativo	2/16/2006
87	Herberth Gamboa Mora	Consejo Administrativo	2/16/2006
88	Denia Quesada García	Asistente Administrativa	2/16/2006
89	Alfredo Monge Esquivel	Consejo Administrativo	2/16/2006
90	Amado Castro Fernández	Consejo Administrativo	2/16/2006
91	Víctor Hugo Carranza Salazar	Gerente COOPEAGRI	2/16/2006
92	Hubert García Delgado	Consejo Administrativo	2/16/2006
93	Alba Nidia Rojas Borbón	Consejo Administrativo	2/16/2006
94	Ana Leticia Elizondo M	Auditoría COOPEAGRI	2/16/2006
95	Henry Acuña Quirós	Consejo Administrativo	2/16/2006
96	Rob Macdonald	York University	2/16/2006
97	Howard Dangherty	York University	2/16/2006
98	Róger Zúñiga Castro	Consejo Administrativo	2/16/2006
99	Freizelh Vargas Fallas	Forestales Coopeagri R.L.	2/16/2006
100	Luis Salazar Salazar	Forestales Coopeagri R.L.	2/16/2006
101	Adolfo Pérez Corrales	Forestales Coopeagri R.L.	2/16/2006
102	Edgar Ortiz Malavasi	FONAFIFO	2/16/2006
103	Oscar Sánchez Ch.	FONAFIFO	2/16/2006
104	María Elena Herrera Ugalde	FONAFIFO	2/16/2006

ANNEX 6: PROJECT PREPARATION AND SUPERVISION

	Planned	Actual
PCN review	8/31/05	8/31/05
Initial PID to PIC	1/10/06	1/10/06
Initial ISDS to PIC	10/27/05	10/27/05
Appraisal	5/8/2006	
Negotiations	5/8/2006	
Sign ERPA	5/24/2006	

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Armando E. Guzmán	Task Manager/Environmental Spec.	LCSEN
Alexandre Kossoy	Deal Manager	ENVCF
Edgar Ortíz Malavasi (STC)	Environmental Services Specialist	LCSEN
Ronald Mejías (STC)	Financial and Economic Specialist	LCSEN
Douglas J. Graham	Sr. Biodiversity Specialist	LCSEN
Flavia Rosembuj	Legal Counsel	ENVCF
Maria Nikolov	Program Assistant	LCSES

ANNEX 7: EMISSION REDUCTION PURCHASE AGREEMENT
A generic ERPA table of contents is shown below. The actual document is expected to be signed by May 24, 2006.

ARTICLE I: APPLICATION OF GENERAL CONDITIONS
Section 1.01 Application of General Conditions
Section 1.02 Inconsistency with General Conditions

ARTICLE II: PROJECT DETAILS
Section 2.01 Description of the Project

ARTICLE III: CONDITIONS FOR SALE AND PURCHASE
Section 3.01 Preconditions to be fulfilled
Section 3.02 Conditions for benefit of Trustee
Section 3.03 Termination of the Agreement

ARTICLE IV: PURCHASE AND SALE OF EMISSION REDUCTIONS
Section 4.01 Contract ER Volume and Unit Price
Section 4.02 Transfer of Contract ERs
Section 4.03 Advance Payment
Section 4.04 Annual Payment

ARTICLE V: CALL OPTION
Section 5.01 Call Option provisions do not apply
Section 5.01 Call Option Volume and Exercise Price

ARTICLE VI: PROJECT DEVELOPMENT AND MONITORING
Section 6.01 Project Development
Section 6.02 Monitoring Plan

ARTICLE VII: REPRESENTATIONS AND WARRANTIES
Section 7.01 Additional Project Entity Warranties
Section 7.02 Notices

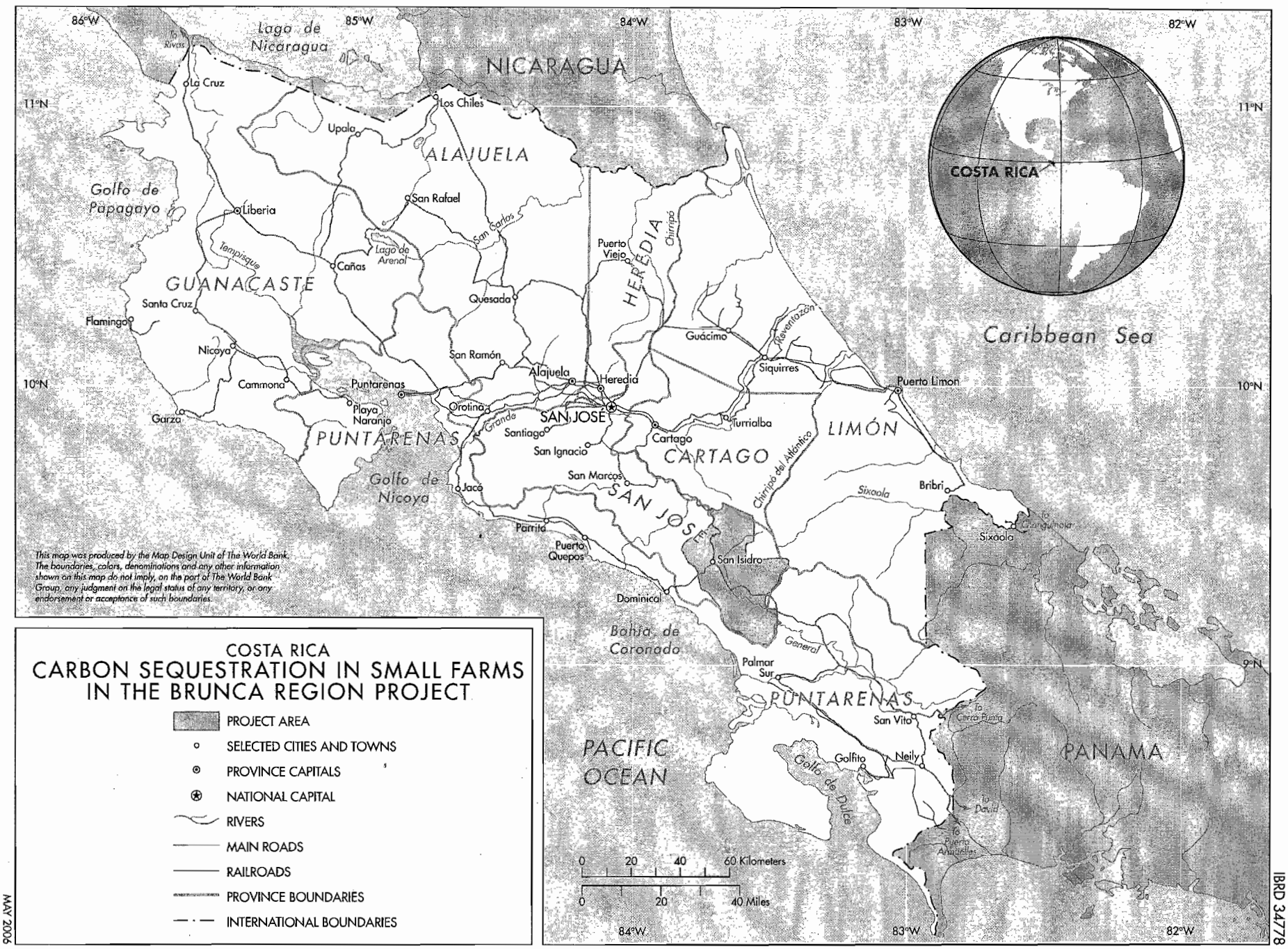
ARTICLE VII: TERM
Section 8.01 Term

ARTICLE IX: NOTICES
Section 9.01 Notices

SCHEDULE 1: CONDITIONS FOR SALE AND PURCHASE
SCHEDULE 2: ANNUAL AMOUNTS
SCHEDULE 3: MONITORING PLAN

ANNEX 8: CARBON FINANCE RISK ASSESSMENT

Risk	***Rating***	***Risk Mitigation***
Delivery	Low: Knowledgeable sponsor and LoE available	None
Baseline	Low: Conservative calculation	Larger Kyoto compliant area available for project implementation (over 60k ha)
Additionality	Low: High investment barriers and alternative land uses well evaluated	None
Financial	Low: Low initial investments and solid equity source	Payment on delivery
Non-permanence	To be determined: Concerns about lCERs; project originally designed for 20 years.	Sponsors are working on longevity plan for the project



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COSTA RICA

CARBON SEQUESTRATION IN SMALL FARMS IN THE BRUNCA REGION PROJECT

- PROJECT AREA
- SELECTED CITIES AND TOWNS
- PROVINCE CAPITALS
- NATIONAL CAPITAL
- RIVERS
- MAIN ROADS
- RAILROADS
- PROVINCE BOUNDARIES
- INTERNATIONAL BOUNDARIES

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