

# Pax Natura REDD Project

Source(s): [Mitigation of greenhouse gas emissions through avoided deforestation of privately owned tropical rainforests in high conservation value areas in the Central Volcanic Range of Costa Rica](#)

## Project location



This programmatic project will recruit a total of **12,000 hectares** of privately owned forest (involving some 100 farm owners) that do not necessarily form a single forest block. The geographical distribution of these 12,000 hectares will be determined by the location of the farms of owners who voluntarily join the program. Recruitment will take place in a total area of **30,000 hectares** of privately owned forest lands, in an area of interest of **39,522 hectares** inside the Central Volcanic Range Conservation Area (ACCVC), specifically in the Central Volcanic Range Forest Reserve (RFCVC), in Cartago and Limón provinces. No national parks or biological reserves are included in these 39,522 hectares, although the area does border on several national parks (to the west with Braulio Carrillo National Park and to the south with Irazú and Turrialba National Parks). It is also important to note that the Guácimo and Pococí aquifers are inside the project area of interest. (p. 7)

## Forest area and types

p. 7, 8, 10 11

A FUNDECOR (Foundation for the Development of the Central Volcanic Range) analysis of a Landsat satellite image of the area (2005) determined that the project area comprises **30,018 hectares** of non-cloud forest, excluding forests inside national parks and biological reserves. A proportional distribution of clouds by land-use category determined that total forest cover in the project area may be

as much as **34,200 hectares**. The forest area without cloud cover is distributed among six Life Zones, according to Holdridge's classification (1971). The following table shows the number of hectares in each ecosystem, excluding national parks and biological reserves. (p. 11)

**Forest area (hectares) by life zone for the Pax Natura project, ACCVC, Costa Rica (p. 11)**

Tropical wet forest, Premontane transition (bmh-P)	9,037
Premontane rainforest (bp-P)	12,632
Lower montane rainforest (bp-MB)	6,494
Montane rainforest (bp-M)	735
Tropical wet forest (bmh-T)	964
Wet forest, basal belt transition (bmh-B)	156
Total	30,018

Precipitation is orographic, which makes it common for forest cover at the higher elevations to be cloud forest. There are no dry months in the project area, as it rains throughout the year. The precipitation regime in the mountainous sector consists of seven very rainy months (May-November) and five less rainy months (December-April). (p. 7)

The annual averages for maximum, medium, and minimum daily temperatures are 30.3° C, 25.3° C, and 20.3° C, respectively. The highest humidity values occur in July and August (88%); the lowest in April (79%). (p. 8)

The spatial environment of the project area and its morphological configuration has slopes with 30% to 60% inclines in the recharge area at the headwaters of the Jiménez, Roca, Perla and other rivers that descend from the mountains to form a radial drainage system in the intermediate and low sections. At the base of the fans and near the cities of Guápiles, Guácimo and Jiménez in the distribution area, the morphology is flat-to-rolling slopes with 5% to 15% inclines that lead to the low units where natural drainage systems meander along a concave-to-flat terrain with 1% to 5% slopes. The surface of the project area is made up of volcanic soils with high infiltration capacity in their natural state, meaning that they fulfill a very important function in regulating surface runoff and recharging the aquifers that originate there. (p. 10)

***Forest management and use context***

Land ownership in the project area is largely in the hands of small owners who will be recruited and brought into the project.

Because this is a programmatic project, the locations of the forest blocks that will comprise the 12,000 hectares to be recruited are still not known. Nonetheless, the distribution of at least 6,610 hectares of forest among 56 owners can be observed. These land owners, who have already signed agreements for forest technical assistance with FUNDECOR, and given their commitment to conservation through those agreements, will very likely join the Pax Natura project.

The table below shows land use in the project area based on a satellite image from the Landsat 7 sensor (2005), classified by FUNDECOR's Geographic Information Systems Laboratory. It is important to note that more than 76.8% of the project area is under forest cover. Most is primary forest (74.8%); the remaining 2% is secondary growth or reforested. (pp. 16, 17)

**Land use in the Pax Natura project area (p. 17)**

Category	Area (ha)	%
Primary forest	29,553	74.8%

Manipulated forest	504	1.3%
Crops and pasture	2,934	7.4%
Wooded pasture	277	0.7%
Brush	7	0.0%
Bare soil	105	0.3%
Bodies of water	9	0.0%
Reforestation/recovery	308	0.8%
Clouds/No data	4,843	12.3%
Urban	982	2.5%
TOTAL	39,522	100%

### **Rates and drivers of deforestation and degradation**

*Note: The project document does not give a detailed account of the drivers of deforestation and degradation. But it can be inferred that the main driver of deforestation is the conversion of forests for pasture.*

The estimated annual deforestation rate (without the project) is 3.9%. (p. 36)

### **Project proponents**

- National Biodiversity Institute (INBio)
- National Forestry Financing Fund (FONAFIFO)
- Foundation for the Development of the Central Volcanic Range (FUNDECOR)

### **Implementation timeframe**

Under the project, the **12,000 hectares** of privately-owned forest lands will be protected for **10 years** under a payment for environmental services (PES) mechanism. Once the project is launched, around 5,000 hectares are expected to be recruited in year one, and an additional 3,500 hectares each year in years two and three, until **40%** of the forest area in the area of study to 2005 is covered under the PES mechanism, and maintained under that arrangement for the duration of the project. Although a 10-year timeframe is proposed, the commitment to reduce emissions is long term since Costa Rica has declared its intention to become carbon neutral by the year 2021 (two years after the conclusion of this project, assuming it begins in 2009). Also, when there is a long-term commitment to reducing emissions, the claims for carbon rights are restricted to deforestation avoided during the life of the project (10 years). (p. 28-29)

### **Project goals** p. 28

- Mitigate carbon dioxide emissions, and protect biodiversity and water resources in forest areas bordering national parks by reducing deforestation
- Contribute to efforts to prevent climate change
- Participate in maintaining the biological integrity of the landscape in the Central Volcanic Range Conservation Area

### Specific objectives

- Enroll 12,000 ha of private forests in the project area in the (PES) program for a 10-year period.
- Monitor deterioration or recovery according to a baseline of above-ground biomass, biodiversity, water quality, and contribution of economic resources through PES in the project area.

### Implementation activities

Project participants will be recruited using a protocol designed in accordance with Costa Rican environmental legislation, the FSC forest certification standard, and FONAFIFO's administrative procedures manual. (p. 34)

- **Legal and technical aspects:**

- Legal: Project participants must have a cadastral map and title deed duly recorded with Costa Rica's Property Records Office; if they lack the title deed, they must present legal documents proving that they have peaceful (undisputed) possession of the farm. FUNDECOR will ensure that no overlapping claims or land-tenure problems exist.
- Technical: FUNDECOR will conduct a field appraisal before an agreement is signed to ensure that the property actually exists, that the specified forest cover actually exists, that no illegal felling has taken place, and that property lines are duly defined.

#### Timeframe for project activities (p. 29)

Responsible party	Activity	Year										
		0	1	2	3	4	5	6	7	8	9	10
PAX NATURA	Manage/secure financing	X	X	X	X	X	X	X	X	X	X	X
FONAFIFO	Administer Payment for Environmental Services		X	X	X	X	X	X	X	X	X	X
INBio	Monitor biodiversity		X			X			X			X
CCBA standards auditor	Verification		X			X			X			X
FUNDECOR	Recruit forest owners		X	X	X							
	Regencia forestal: "Forest auditor" processes PES with relevant authorities		X	X	X	X	X	X	X	X	X	X
	Update, document, supervise, resolve conflicts, and maintain portfolio of project participants	X		X	X	X	X	X	X	X	X	X
	Monitor water quality of principal sources of potable water	X				X			X			X
	Monitor PES revenues to project participants	X				X			X			X
	Monitor changes in land use	X				X			X			X
	Monitor above-ground biomass and mortality	X				X			X			X
	Monitor tree-felling permits on agricultural lands in project area	X				X			X			X

- **FUNDECOR's generic approach (Annex 9), as stated in its group certification manual**

FUNDECOR strives to find economic alternatives that will add value to natural forests and forest plantations in order to increase the competitiveness of forestry activity as compared to other land-use alternatives. Thus, an important aspect of its work is to provide technical assistance and forestry advice to forest owners and owners of land suitable for reforestation in FUNDECOR's area of action:

the Central Volcanic Range Conservation Area (ACCV).

For all purposes, these forest owners have been given the title “FUNDECOR client-families,” in the understanding that the relationship is with all the family members of the legal owner of the property. Most are small and medium-scale owners, holding an average 75 hectares each per Forest Management Unit (forest). Some live on the property and earn their livelihoods through their own agricultural and forest activities; others live on their farms but do not earn their livings from production activities because they earn salaries from stable jobs in the goods and services industries of the region. Other client-families do not live on their farms but contract an overseer to care for and provide maintenance for the farm. (p. 97)

With regard to forest resources, FUNDECOR supports three types of projects: sustainable natural forest management, where timber is harvested periodically; absolute forest protection, when management is not feasible; and commercial reforestation of sites stripped of forest coverage. All are implemented in accordance with the strict planning set out in management plans designed for each farm. (p. 98)

**Actors’ roles and responsibilities** (p. 32)

The project will be conducted by a consortium composed of the following organizations:

Organization	Role
Pax Natura Foundation	Secure resources needed to cover the payments for environmental services and all project design and implementation costs.
FONAFIFO	Execute the payments for environmental services to each project participant, pursuant to Costa Rican public administration regulations.
FUNDECOR	Implement the project pursuant to the guidelines established by the Climate, Community and Biodiversity Alliance (CCBA). FUNDECOR’s duties will include: <ul style="list-style-type: none"> <li>• promoting the project</li> <li>• recruiting forest owners</li> <li>• responding to queries, concerns, and complaints of stakeholders</li> <li>• providing training to project participants</li> <li>• monitoring the carbon pool in the project area</li> <li>• monitoring project impact on the communities</li> </ul>
INBio	Monitor project impact on biodiversity in the project area

**Community participation**

The project area includes farms and properties isolated from community centers, with the exception of some very small hamlets. In general, the area is made up of small to medium-sized properties on which owners have constructed their homes and whose closest neighbors are at a distance of hundreds of meters or kilometers.

The two closest large centers of population outside the project area are Guácimo and Pococí, which belong to the cantons of the same name in Limón Province. Since the aquifers that supply these two communities are inside the project area, analysis of the social impact of the project will be focus on water quality, as it is directly related to forest mass and would be seriously affected by degradation or disappearance of same. (p. 15)

Very little of the land in the project area is suitable for agricultural or livestock activity. By and large, forestry is the main land use of farms in the project area, most of which belong to small and medium-scale owners. Given the limited alternative sources of revenue for inhabitants, an injection of resources tied to forest conservation can be expected to induce forest owners to relinquish the idea of converting forest land to cropland or pasture. (p. 41)

### **Participation of local individuals and groups in project planning**

The areas participating in the project will be under FSC forest certification, which requires that up-to-date information be available and readily accessible for consultation by stakeholders and the general public. This information is published on the FSC website: <http://www.fsc-info.org>. As the project's executing agency, FUNDECOR will also make this information available to the public on its web site: <http://www.fundecortechology.org/fundecor/Inicio.html>. (p. 31)

As all properties enrolled in the project will be under FSC forest certification, accredited auditors will conduct annual evaluations of project impact (both positive and negative) through interviews with stakeholders. Stakeholders are selected primarily on the basis of their representativity, as well as the legitimacy and urgent nature of their project-related concerns. (p. 41)

### ***Project financing***

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**Total cost:** US\$10,000,000.00 (p. 6)

**Carbon benefits withheld from regulatory markets:** The project is a REDD-type avoided deforestation project and will therefore be sold on voluntary markets. However, it will not be offering all the potential carbon benefits on those markets. In the first place, the biomass of regenerated forests in the project area is not being included. Secondly, the carbon benefits generated by the avoided deforestation outside the 12,000 hectares recruited in the project area (attributed to landowners waiting to join the PES program), will also not be offered. (p. 40)

### ***Benefit sharing***

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The National Forestry Financing Fund (FONAFIFO) is the institution that has experience managing and executing the funds of payment for environmental services (PES) programs. It was created by law 1996 as an autonomous organization of the State Forestry Administration, and is overseen by the Ministry of Environment, Energy, and Telecommunications (MINAET). (p. 33)

Each property enrolled in the project will have a management plan or technical study, which is required for registering in FONAFIFO's Payment for Environmental Services program. (p. 35)

When the legal and technical aspects are in order, FUNDECOR will sign the agreement with the property owner and prepare the documents to be submitted to FONAFIFO for obtaining PES. Subsequently, the landowner or landholder will sign a PES contract with FONAFIFO whereby the owner transfers to FONAFIFO the rights to carbon emissions avoided, in exchange for annual payments for environmental services produced, including the environmental service of avoided deforestation. (p. 34)

Once FONAFIFO has signed a contract with a landowner, it will attach a legal notation to the title of the farm to identify it as being under contract with the State through the Public Records Office for Property. Every year, before any funds are disbursed, the farms will be visited by FUNDECOR to confirm that the activities are being carried out as planned and that the forest cover is still there. (p. 35)

### ***Emissions and removals with and without project***

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- 1. Carbon stock estimation** (pp. 11-15)

To estimate the carbon pool in the project area, only above-ground biomass made up of all the above-ground live woody vegetation, including stems, branches, cortex, fruits and foliage, and excluding herbaceous biomass, was considered. Dead wood, litter, and soil-stored carbon were not considered in calculating the biomass of the soil.

**Dead organic matter:** Because the project area is not affected by management practices or disturbances that significantly change the forest's mortality and recruitment patterns, it has been assumed that the pool comprising dead wood and litter are in equilibrium, and that the change in the pool of dead organic matter is zero.

**Soil carbon:** Considering the linear model of Powers et al (2004) for elevations higher than 120 m, it is estimated that the average carbon pool, to a depth of 30 cm, for the project area under forest cover is 104.8 Mg\*ha<sup>-1</sup>. This model was developed for a 140,000 hectare area in the Sarapiquí region, which is less than 20 kilometers from the project area. Also, using a linear model developed by the same authors, it is estimated that the percentage change in the carbon pool resulting from forest conversion to pasture is 26.11%.

**Above-ground biomass:** According to Holdridge (1971), the forests in the project area occupy five different life zones; the above-ground biomass for each life zone was estimated by Helmer and Brown (2000). All forests appearing on the land-use maps of 1986 (CATIE, 1986) that are still present in the land-use maps of 2005 (FUNDECOR, 2007) are regarded as original forest and consequently are attributed 100% of the biomass reported by Helmer and Brown.

The rationale is that these forests have had 30 years or more to recover from any type of human intervention, which ensures total occupation of the sites in all life zones. The remaining forests did not appear in the 1986 land-use maps and are therefore considered degraded. Although secondary forests in the northern lowlands of Costa Rica that are five years of age and older report biomass values greater than 40 Mg\*ha<sup>-1</sup> (Sesnie, 2006), for the purposes of the present project their biomass was taken to be zero (0 Mg\*ha<sup>-1</sup>).

The information in the table below was used to estimate the average amount of carbon per hectare for the forests in the project area. This is a weighted average of the forest area without cloud cover, observed in 2005, by life zone. A weighted average is used for each life zone instead of the average because the project is programmatic and therefore the specific location of the forest blocks that will make up the 12,000 hectares of forest to be recruited is still unknown. Therefore, all estimates for the present project were made with the weighted average of carbon, estimated at 115 Mg\*ha<sup>-1</sup>.

**Average biomass corrected for forests in the Pax Natura project area (p. 15)**

Life zone	Non-cloud forest 2005 (ha)	Proportion original forest (forest 86)	Carbon Mg* ha <sup>-1</sup>		Weighted average of carbon Mg* ha <sup>-1</sup>
			In original forest	In forest with corrected biomass	
Bmh-T (Prem)	9,037	76%	161	122	37
Bp-P	12,632	83%	140	116	49
Bp-MB	6,494	76%	143	109	24
Bp-M	735	87%	136	118	3
Bmh-T	964	60%	161	97	3
Bmh-P (Basal)	156	40%	135	53	0
Total	30,018				115

*Note: The methodology including formula for estimating carbon based on above ground biomass is given in Annex 5 of the Project Design Document.*

## 2. Most likely land-use change scenario, without the project

The most likely change in land use scenario as of 2009 will be determined by a lack of financing for the payment for environmental services. With regard to the projected change in land use obtained with the econometric model developed by Tattenbach et al (2006) (Table below), in the absence of the Pax Natura project, the area of interest will lose **9,750 hectares** in the ten years comprising the 2009-2019 period. This represents an **annual 3.9%** gross deforestation rate for that period. Since the econometric model was designed to estimate gross deforestation in four-year periods, forest cover loss was projected for two four-year periods plus one two-year period. (p. 23)

### Most likely land-use change scenario, without the Pax Natura project (p. 25)

Period	Index of alternative rent	Proportion of area under PES	Average area under PES (ha*year-1)	Estimated deforestation rate		Forest at beginning (has)	Forest at end (has)	Deforestation (has)	Cumulative deforestation (has)
				Quadrennial	Annual				
2000-2005*			6,518			34,213	32,919	1,294	1,294
2005-2009	0.34	0.15	5,071	0.103	0.027	32,919	29,515	3,404	4,698
2009-2013	0.34	0	0	0.148	0.039	29,515	25,141	4,374	9,072
2013-2017	0.34	0	0	0.148	0.039	25,141	21,415	3,726	12,798
2017-2019	0.34	0	0	0.148	0.039	21,415	19,765	1,650	14,448

\* Observed data. Source: Prepared by authors, based on land-use map from Landsat image, 2005 (FUNDECOR, 2005); deforestation estimates from the econometric model developed for the ACCVC by Tattenbach et al (2006).

## 3. Most likely land-use change scenario, with the project

The projected change in land use with the project is presented in the table below, and was also obtained with the econometric model developed for the ACCVC by Tattenbach et al. (2006). In this projection, expected gross deforestation with the project in the 2009-2019 period is estimated at **4,371 hectares**, or an **annual 1.6%** gross deforestation rate. (p. 23)

### Most likely land-use change scenario, with the Pax Natura project (p. 25)

Period	Index of alternative rent	Proportion of area under PES	Average area under PES (ha*year-1)	Estimated deforestation rate		Forest at beginning (has)	Forest at end (has)	Deforestation (has)	Cumulative deforestation (has)
				Quadrennial	Annual				
2000-2005*						34,213	32,919	1,294	1,294
2005-2009	0.34	0.15	5,071	0.103	0.027	32,919	29,515	3,404	4,698
2009-2013	0.34	0.26	7,625	0.08	0.021	29,515	27,145	2,370	7,068
2013-2017	0.34	0.44	12,000	0.051	0.013	27,145	25,767	1,378	8,446
2017-2019	0.34	0.47	12,000	0.048	0.012	25,767	25,144	623	9,069

\* Observed data. Source: Prepared by authors, based on land-use map from Landsat image, 2005 (FUNDECOR, 2005); deforestation estimates from the econometric model developed for the ACCVC by Tattenbach et al (2006).

According to the most likely land-use change scenario in the absence of the Pax Natura project (Table below), it is estimated that at least **1,125,000 Mg\*ha<sup>-1</sup>** of carbon will be emitted due to deforestation during the 2009-2019 period, from the aboveground biomass of the 9,750 deforested hectares. As Pax Natura is an avoided deforestation project, it is not expected that pools of greenhouse gases other than carbon will be influenced by the absence of the project. (pp. 23-24)

### Changes in the carbon pool in the project area, without the Pax Natura project (p. 26)

Year	Remaining area of forest (has)	Remaining carbon pool (Mg*ha <sup>-1</sup> )
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2009	29,515	3,406,745.11
2013	25,141	2,901,870.70
2017	21,415	2,471,817.91
2019	19,765	2,281,317.24

#### 4. Avoided deforestation by the project

In accordance with the deforestation scenarios with and without the project (9,750 hectares and 4,371 hectares, respectively), it is estimated that this project will prevent the loss of 5,379 hectares of forest in the area of influence of the Pax Natura project. This is a conservative estimate inasmuch as the econometric model estimates a reduction in gross deforestation from 3.9% annually -without the project- to 1.3% annually with the project. This reflects an increase in the proportion of the initial forest area under PES coverage from 0% to 47% in the ten years of project life. At the same time, it has been observed over time (in satellite images) that an 11 percentage point increase in PES coverage (from 15% to 26%) led to a 1.7 percentage point reduction in the deforestation rate (2.5% to 0.8%). According to the projections of the econometric model, an increase in project-fostered PES coverage, from 0% to 47%, will diminish the annual deforestation rate from 3.9% to 1.3% (2.6 percentage points). Considering an avoided deforestation of 5,379 hectares and that the aboveground biomass of an average hectare in the project area contains **115 Mg\*ha<sup>-1</sup>** of carbon, it is estimated that the project will avoid the emission of at least **2,276,526 Mg of CO<sub>2</sub>**. (pp. 36-37)

#### Composition of avoided deforestation

Pursuant to the econometric model developed by Tattenbach et al (2006), avoided deforestation in the project area attributable to the PES program implemented by FUNDECOR and FONAFIFO, consists of:

- **In situ avoided deforestation (by recruited landowners) (12,000 hectares of forest):** This is avoided deforestation produced directly in the areas that have been enrolled in the PES program, and occurs when changes in land use in those areas is reduced to zero.
- **Ex situ avoided deforestation (by landowners not recruited) (22,000 hectares of forest):** This is avoided deforestation produced outside the areas enrolled in the PES program, and results from forest owners' expectation of receiving PES in the near future. As forest owners "get into line" to obtain PES benefits, they conserve their forests without payment.

For the Pax Natura project, of the estimated 5,379 hectares of avoided deforestation, **3,816 hectares** correspond to *in situ* avoided deforestation, supplemented by **1,563 hectares** of *ex situ* avoided deforestation. The table below shows the calculations for in situ avoided deforestation, considering an **annual 3.9%** gross deforestation rate for the without-the-project scenario. (p. 37)

#### Deforestation avoided in situ from the 12,000 ha of forest recruited into the project (p. 38)

Year	Recruited area (has)		Area not recruited (has)	Cover without project (has)	Cover with project (has)	Avoided deforestation (has)
	Recruited area	Accumulated recruited area				
2008	0	0	12435	12435	12435	0
2009	5000	5000	7143	11946	12143	197
2010	3500	8500	3500	11477	12000	470
2011	3500	12000	0	11026	12000	451

<b>2012</b>	0	12000	0	10592	12000	433
<b>2013</b>	0	12000	0	10176	12000	416
<b>2014</b>	0	12000	0	9776	12000	400
<b>2015</b>	0	12000	0	9392	12000	384
<b>2016</b>	0	12000	0	9022	12000	369
<b>2017</b>	0	12000	0	8668	12000	355
<b>2018</b>	0	12000	0	8327	12000	341
<b>Total</b>						3816

## 5. Leakage, permanence and project emissions

Project implementation is not expected to produce deforestation leakage since it will not displace forest owners through the purchase of land; owners join the program voluntarily; and the project does not involve activities that will change land use (crops for reforested area).

In addition, deforestation is not expected to displace to adjoining areas since the Pax Natura project is set within the CARFIX project which, in turn, is set within FONAFIFO's nationwide PES program. (p. 38)

The evidence provided by Tattenbach et al (2006) regarding the existence of avoided deforestation outside the properties enrolled in FONAFIFO's payment for environmental services program (ex situ avoided deforestation) suggests that the net effect is positive, which makes the deforestation displacement effect less than the forest conservation effect of the positive policy (PES).

Deforestation leakage, limited to the emissions produced by project vehicles, was not calculated because its impact was considered negligible since it is amply exceeded by the carbon produced by the ex situ avoided deforestation, which is not being sold on any market. (p. 39)

Even though the project was designed for a 10-year period, the commitment to emission mitigation is long term given that Costa Rica's environmental policies state that the country will be "carbon neutral" by 2021, two years after the present project comes to an end (assuming it begins in 2009). This ensures the State's commitment from now on to the international community to maintain the country's forest cover and, therefore, forest cover in the project area. This will require ongoing implementation of actions to prevent land-use changes and to protect water resources and biodiversity. (p. 36)

## 6. Accounting of gases other than CO2

Gases other than CO2 are not expected to comprise more than 15% of the net change in greenhouse gas emissions in the project area. This is because the project area is, for the most part, covered by natural forest (74.8%); there is some livestock on grazing lands but at a density so low that it can be defined as subsistence level. Moreover, there are no commercial plantations of agricultural crops that would represent a source of emissions other than carbon due to the use of fertilizers or agrochemicals. This project involves no activities associated with burning, or with the use of agrochemicals. No wetlands will be altered, nor will any lands be prepared in a way involving removal. (p.36)

## **Monitoring**

p. 35, 36, 39,

The project will be monitored to ensure that its objectives and design are implemented as originally established, and to collect information to enable timely decision-making should corrective measures be necessary. To this end, the project will monitor the following:

- Change in land use and above-ground biomass:

- Every three/four years, changes in land use in the project area will be monitored using satellite images and GIS technology; the information obtained will be reviewed by FSC forest certification or green seal auditors.
- Permanent sampling plots will be established in the different life zones represented in the recruited areas. The plots will measure 30m x 100m, and all trees and palms greater than 10 cm in diameter at breast height (dbh) will be measured, in accordance with Adler's measurement standards (1980). All trees will be numbered, their dbh will be measured in centimeters, and their species will be recorded.
- The project will also document changes in tropical forest dynamics that may increase carbon emissions due to increased tree mortality caused by water stress.
- **Permits to fell trees on agricultural lands:** Permits to fell trees on agricultural lands will be monitored to ensure proper compliance with the permit and that it not be used to deforest adjacent forests.
- **Registry of management plan files:** Each property enrolled in the project will have a management plan or technical study, which is required for registering in FONAFIFO's Payment for Environmental Services program. In addition, FSC standards require that the implementing organization keep files for each project participant, duly organized into a folder (digital or physical), that includes a historical record of the activities to be carried out in the management unit. Each management unit should have a technical assistance contract registered with the Professional Association of Agricultural and Forest Engineers of Costa Rica indicating the name of the professional responsible for ensuring proper execution of activities in the forest area and for updating the management plan.
- **Long term sustainability:** Ongoing implementation of actions to prevent land-use changes and to protect water resources and biodiversity will be monitored.
- **Communities:** The following strategy will be used to monitor benefits received by the communities: Establish a baseline for PES-income in the area (pre-project); Monitor PES income in the area; and monitor water quality at the outlets that supply the communities in the project area. (p. 42)
- **Biodiversity:** *(Note: The protocols for monitoring biodiversity impact are given in Annex 6)*
  - At the landscape level, efforts will monitor improvements in or deterioration of representativity (percentage representativity of phytogeographic units outside public lands), connectivity (percentage of the area of biological corridors receiving PES), function (percentage protection of aquifers), and composition (number of hectares assigned to GRUAS II prioritized sites) in the forests enrolled in the program. (p. 43)
  - The following indicators were selected for plants: diversity and regeneration of seedlings of interest; for birds: biodiversity and presence of key species; and for dung beetles: diversity. These indicators are related to attributes of system composition; no more than 10% of the farms that obtain PES will be analyzed. The sampling performed in year one will be regarded as the baseline; the same farms will be monitored in years four, seven and ten. Maps and satellite images will be provided by FUNDECOR or FONAFIFO. (p. 44)

## Reporting

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No data

## Verification

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## **Risks and risk management**

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### **Obstacles to project implementation**

- **Financial risk:** The main obstacle to project implementation is financial. According to the analytical model cited by Walker (2004) and used by Tattenbach et al (2006) to model deforestation in the ACCVC, an area's deforestation is determined by its rent. This is defined as the rent from alternative use of forest lands (alternative rent) minus rent from forest lands. In the absence of policies to improve the rent of forest lands, forests will be eliminated in favor of other activities. Therefore, the following are considered obstacles to project implementation:
  - **Access to funds for avoided deforestation projects:** Limited funds are available for avoided deforestation projects. FONAFIFO does not have the Project Design Documents needed to market carbon rights generated under the PES program in the limited voluntary market. The Clean Development Mechanism (CDM) excludes Reduced Emissions from Deforestation and Degradation (REDD) projects, at least until 2012. Nor is there any guarantee that REDD projects will be eligible for CDM after 2012.
  - **Increased rent for alternative uses of forest land:** An increase in alternative rent spurred by a greater demand for land to produce biofuels will shrink the scope and/or competitiveness of the PES program. (p. 22)
- **Institutional risk:** The institutional risk associated with the project is minimal inasmuch as FONAFIFO has 10 years' experience implementing a PES program, making successful use of the resources, and it is duly grounded in Costa Rican environmental legislation. Moreover, the PES system has a monitoring and assessment arrangement that makes use of external audits, which has ensured proper execution of resources, including those secured through the present project.
- **Risk associated with catastrophic events:** The risk associated with catastrophic events (fires, volcanic activity, hurricanes, earthquakes) is not seen in the historical records or natural history of the area. The presence of vegetation including trees measuring more than 100 cm in diameter, combined with the presence of shade-tolerant plant species, suggests the absence of events causing massive loss of cover in the last 100 years in the project area. The country's experience with seismic activity suggests that loss of cover due to this type of event is restricted to landslides in steep-sloped areas, especially alongside river beds. Landslides of this nature occurred during the Limón and Cinchona earthquakes (May 1991 and January 2009, respectively).
- **Risk associated with illegal activity:** Finally, the risk that project participants will engage in illegal activity that threatens forests, water resources or biodiversity will be controlled by semi-annual monitoring visits by FUNDECOR's specialists to the forests covered by the PES program. Any irregularities observed during these visits will be reported by the project's forest auditor (*regente forestal*) to FONAFIFO, which will proceed to terminate the contract with the project participant. If a contract is annulled, the money must be paid back and a complaint will be filed with the competent judicial authorities to ensure enforcement of the corresponding sanctions. Forest auditors who do not fulfil their obligations will be subject to suspension or disqualified from serving as forest auditor. The Professional Association of Agricultural and Forest Engineers periodically reviews the work of forest auditors. (pp. 29-30)

## **Progress and plans**

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No information

**Links:**

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***Project-related documents***

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[CCBA Validation Statement](#)

[Final CCBA Project Validation Report](#)

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**Others**

[Costa Rican Rainforest preserved by Utah Businessmen as Conservation and Education Model](#)

[U. and Salt Lake City going green on gases](#)

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