REDD PROJECT IN BRAZIL NUT CONCESSIONS IN MADRE DE DIOS

Document Prepared by BOSQUES AMAZONICOS SAC

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The REDD project in Brazil nut concessions in Madre de Dios", proposed by Bosques Amazónicos SAC (BAM), is located in the eastern part of Madre de Dios in the Provinces of Tahuamanu and Tambopata.

The Department of Madre de Dios is a space of great biological diversity and of well-known international importance. Nevertheless, runs the risk of losing it wealth of forest resources and biodiversity primarily due to the deforestation caused by ranchers and farmers. The project proponent and its implementation partner, the Departmental Federation of Brazil nut Producers of Madre de Dios, are committed to reduce emissions that deforestation could produce within the project areas, and implement a socio environmental management plan that will also contribute to the economic development of the Brazil nut concessionaires.

Using the Deforestation Model developed by BAM, in collaboration with Carbon Decisions International and AIDER, the deforestation rate in the Madre de Dios department was estimated. This model was based on the analysis of three Landsat satellite images of from the years 2000, 2005 and 2008, which revealed different deforestation rates in the department. In the project area, approximately 1.23% of forested land will be lost per year.

The Project Area is comprised of a group of 405 concessions of Brazil nut covering 308,757.31 hectares. Approximately 34% of this forested area would be lost by the end of year 2041, according to the deforestation model; so a number of activities were established to avoid this scenario and achieve the main objective of "Considerably reduce greenhouse gas emissions caused by deforestation agents in the Concessions within the project area and mitigate project leakage".

For this verification period, we had to exclude all the Brazil nut harvesters who did logging because of a methodological restriction. Discounting project emissions monitored for that period, leakage, uncertainty and risk buffer; we obtain a net tradable emissions reduction of 2,149,575.66 tCO2-e because of the project activity.

The design and monitoring of the proposed REDD Project was based on the modular methodology developed by Avoided Deforestation Partners, approved by VCS on December 3, 2010. The steps defined for each of the mandatory modules were followed, in accordance with Module REDD-MF for unplanned deforestation.

1.2 Sectoral Scope and Project Type

According to the decision tree presented in the Methodology Framework, the project qualifies under the VCS category Avoided Unplanned Deforestation.

Table 1: Methodology framework

Is the forest land expected to be converted to non-forest land in the baseline case?			
YES		NO	
Is the land legally authorized and documented to be converted to non-forest?		Is the forest expected to degrade by fuel wood extraction or charcoal production, in the baseline case	
YES	**NO**	YES	NO
Avoided planned deforestation	**Avoided unplanned deforestation**	Avoided forest degradation	Proposed project is not a VCS REDD activity currently covered by the module framework

Source: REDD Methodology Framework (REDD-MF)

The REDD Project in Brazil Nut Concessions in Madre de Dios is classified as a grouped project as it includes many forest units (Brazil nut concessions) managed individually but with similar conditions. More concessions have been joining to the project since it started.

1.3 Project Proponent

Organization name	Bosques Amazónicos SAC – BAM
Contact person	Jorge Cantuarias Falconí
Title	General Manager
Address	Av. Víctor Andrés Belaúnde 147 Vía Principal 123, Oficina 201 Edificio Real Uno, Lima 27, Perú
Telephone	Phone: +(51 1)4801192
Email	jcantuarias@bosques-amazonicos.com

1.4 Other Entities Involved in the Project

Organization name	Federación de Productores de Castaña de Madre de Dios - FEPROCAMD
Role in the Project	Representing most of the concessionaires of forestry products other than wood (i.e. Brazil nuts) in Madre de Dios, and it gathers the

	associations formed by people and families working on extracting, harvesting, transforming and selling of Brazil nuts.
Contact person	David Asturima Huamantica
Title	President
Address	Psj. Samuel Pastor Mz. 7-k Lt. 6A2, AA. HH. La Selva, Puerto Maldonado, Madre De Dios
Telephone	+(51) 82 637746
Email	feprocamd12@hotmail.com

1.5 Project Start Date

The Project start date is 24/09/2009, the date when the Association Contract between BAM and FEPROCAMD was executed for the joint development of the REDD Project in Brazil nut concessions.

1.6 Project Crediting Period

The Project Crediting Period goes from 01/01/2010 up to 31/12/2040 and makes up a total of 31 years of crediting time. The start date coincides with the beginning of the first monitoring period.

1.7 Project Location

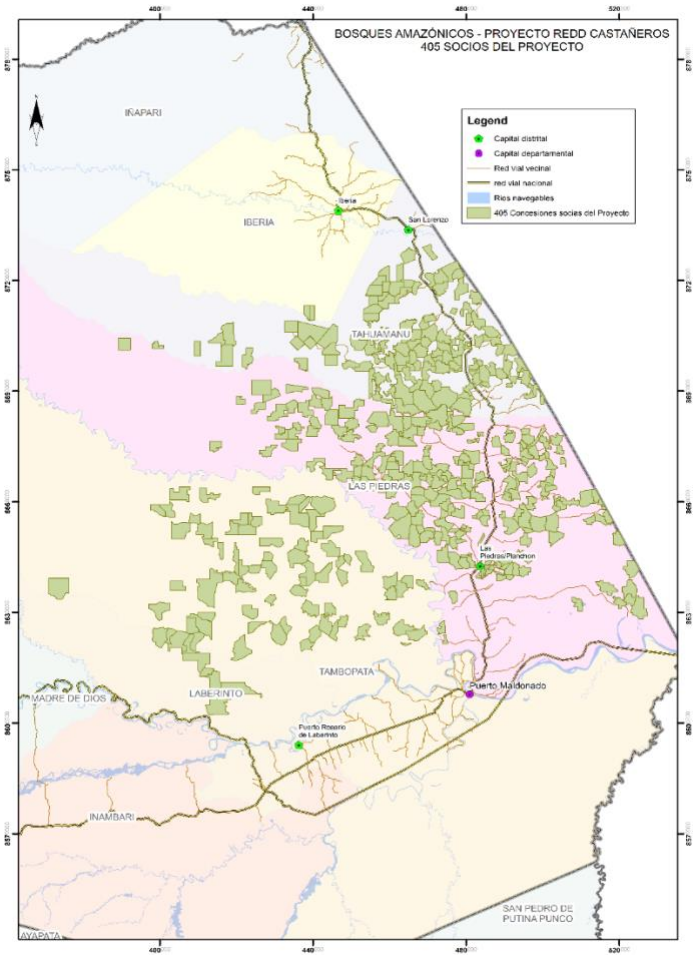
The Project is located in the eastern part of Madre de Dios, which is a Department in southeastern Peru, bordering Brazil, Bolivia and the Peruvian Departments of Puno, Cuzco and Ucayali. Within Madre de Dios, the Project is located in the Provinces of Tahuamanu (Iberia and Tahuamanu districts) and Tambopata (Las Piedras, Laberinto, Inambari and Tambopata districts).

The Project Area is formed by a set of non-timber concessions, specifically Brazil nut (BN) concessions that were granted by the Peruvian Government from year 2002, after this activity was recognized and regulated through the new Forestry and Wildlife Law of year 2011. These concessions are spread in a well-defined zone, where the majority of BN concessions (nearly 1000) are located in the region (both margins of Stretch 3 of the Inter-Oceanic Highway, most of them at the left side).

Until 2012, 405 concessionaires had joined the Project, but more joined later than that date and will be integrated in the next verification period. The areas of these concessions cover 308,757.31 hectares. The boundaries of the PA were defined based on the legal boundaries of each concession contract; nevertheless, some parts (especially the ones near the IOS and

secondary roads) were excluded because they had been deforested. The centroid coordinates of each concession are shown in Annex 1.

Map 1: location of the REDD project



Source: Self–made

1.8 Title and Reference of Methodology

The methodology used for validating the project is named *REDD Methodology Modules* (VM0007), version 1.1. It belongs to the AFOLU Sectorial Scope, was developed by Avoided Deforestation Partners and was approved by VCS on December 2010.

It is formed by several modules, but as this is an Unplanned Deforestation project, we have only used the ones most appropriate, listed in table 2.

Table 2: Information of the Modules used

	Module	Code	Version
	REDD Methodology Framework (REDD-MF)	VM0007	1.1

Always Mandatory	Methods for monitoring of greenhouse gas emissions and removals (M-MON)	VMD0015	2.0
	Estimation of uncertainty for REDD project activities (X-UNC)	VMD0017	1.0
	Methods for stratification of the project area (X-STR)	VMD0016	1.0
Baseline	Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP)	VMD0007	2.0
Leakage	Estimation of emissions from activity shifting for avoided unplanned deforestation (LK-ASU)	VMD0010	1.0
Pools	Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools (CP-AB)	VMD001	1.0
Emissions	Estimation of greenhouse gas emissions from biomass burning (E-BB)	VMD0013	1.0
	Estimation of emissions from fossil fuel combustion (E-FFC)[1]	VMD0014	1.0

Source: REDD Methodology Framework (REDD–MF)

Table 3: Information of the Tools used

	Tools	Code	Version
Risk	Tool for AFOLU non- permanence risk analysis and buffer determination (T-BAR)		3.2
Additionality	Tool for the Demonstration and Assessment of Additionality in VCS AFOLU Project Activities (T-ADD)	VT001	1.0
Significance	Tool for testing significance of GHG emissions in A/R CDM project activities (T-SIG)	EB_31	1.0

Source: REDD Methodology Framework (REDD–MF)

1.9 Participation under other GHG Programs

The project does not participate in any Emission Trading Programs and Other Binding Limits, nor other forms of environmental credit or other GHG program.

1.10 Other Forms of Credit

Not applicable.

1.11 Sustainable Development

Sustainable forestry management for non-timber forest products is one of the main targets of the sustainable development in the national and regional plans. In the Forest and Climate Change National Strategy[1], the REDD+ strategy/action plan of Peru under the UNFCCC, the Brazil

[1] http://www.bosques.gob.pe/archivo/ff3f54_ESTRATEGIACAMBIOCLIMATICO2016_ok.pdf

nut is highlighted as the second highest export value NTFP and it is mentioned in the Strategic Activity 2.5 "Develop specialized programs to promote the sustainable forestry management associated with timber, non-timber, wildlife, ecotourism and eco-business" as one of the prioritized actions to reduce deforestation. Again, in Activity 7.5 is also included because of its high social impacts for benefiting local population.

Regionally, the Brazil nut is also one of the pillars of sustainable development as can be seen in the Regional Agreed Development Plan (PDRC), where, in part thanks to the support received by this project, the strengthened Federation FEPROCAMD was chosen as one of the two representatives of civil society to the Promoting Committee to update this important document. It must be mentioned that the PDRC is the official tool to guide all the different actions to bring sustainable development in the region.

Finally, it must be said that the project was registered in the REDD+ National Registry of MINAM but, as this registry is not publicly available anymore, the project is open to register again when it is open and active again. Meanwhile, BAM participates in the meetings convoked by MINAM for the nesting process.

2 SAFEGUARDS

2.1 No Net Harm

The project will not generate negative environmental impacts; on the contrary, the project aims at preserving the ecosystem and sustainably manages the forest with respect to the traditional activities of the partners, Brazil nut and timber. The Brazil nut extraction is considered a low-impact activity that promotes forest conservation, since the activity is profitable only in undisturbed forests. Attempts to establish plantations have been made without success; for this reason, it is essential to safeguard the Brazil nut productive forests, by strengthening the techniques for forest management and provide resources to increase the Brazil nut product and sub products value and others. Likewise, the Brazil nut activity is regulated by the State and requires a General Management Plan for Brazil nuts harvesting which must be approved by the Regional Directorate of Forestry and Wildlife (DRFFS) and the POAs or DEMAs to be authorized annually. Logging is an emerging activity complementary to the Brazil nut activity, carried out by 175 of Brazil nut producers (43% of total partners of the project, with an average of 75 harvesters logging timber per year) to obtain greater revenues yearly and it is not carried out by the same Brazil nut producers who continuously harvest in the following years. Forestry requires special permits along with its respective management complementary plan approved by the DRFFS for its execution. As such, the project will provide permanent advice on how to improve the techniques of Reduced Impact Logging (RIL); construction of roads, clearing of treetops and lianas; operational safety, chainsaw handling; solid waste management, etc., to ensure forest maintenance, wildlife biodiversity and the integrity of the operators and Brazil nut producers. Likewise, the project will promote the enrichment of forest areas with native species such as Brazil nut, Cumaru and Tornillo, among others to add value to the forest. Even though this "high" number of loggers, the area under timber harvesting is lower, occupying only 30% of total project

area. The deforestation occurred in this area was excluded in accordance with the methodology, just for this verification period.

Also, the project intends to generate net positive impacts on the social and economic welfare of the community and ensure that the costs and benefits are equitably shared among the community members and groups during the life of project. For example, improvement of the organizational capacity of Brazil nut producers in order to coexist and thrive as a collective, as well as to cover its needs as an organization and solve their organizational and management problems. These capabilities are required to contribute to the sustainable management of the concessions of each associate, as well as to manage the forest agenda (collective actions) of Brazil nut producers. The income is the cash flow received by local people (among them, the Brazil nut producers) as remuneration (in case of sale or lease) and salary (if working). Likewise, it will improve the income of Brazil nut families through the job offers provided by the project throughout the process of implementation of REDD activities and in special, job offers in the construction area, implementation and start-up of the Brazil nut processing plant and the nursery.

On the other hand, the project will promote the capacity building through the increase in the information flow and knowledge related to the sustainable management of the concessions, the technical forest harvesting and the micro entrepreneurial development of the Brazil nut producer. These trainings will be provided to Brazil nut concessionaires, project workers and local people in general.

The implementation of the project and in particular the implementation of the control and surveillance system of the project areas will generate impacts that affect (limiting and preventing the access) to the deforestation agents within the project area. This displacement constitutes the leakage of the project and could trigger tensions with the project. This eventual conflict presence in the area, generated by the presence and activities of the project will be differentiated between those that are handled as from a social awareness and conviction and those demanding legal and judicial attention. Given this impact the project will develop control activities and conflict mitigation.

In this sense, potential negative environmental and socio-economic impacts will be minimal in the project area.

2.2 Local Stakeholder Consultation

The official communications between the technical team of BAM and our partners are developed prior coordination with the Federation, mainly in the assemblies convened by the Federation to all its bases, through radio communication. In these assemblies, the technical team reports on the progress of the REDD Project and the future activities that will be developed within the concessions; To fulfill the activities in the field, permission is asked orally and / or written to each Brazil nut harvester partner and in some cases they also accompany the BAM team in situ. For example, in the process of concession boundaries, geo-referencing of timber trees for logging, illegal logging, etc. At the end of each assembly, with the agreements reached, it is signed in the notebook for acts.

Likewise, as part of the implementation of the complaints and conflicts management system, a mailbox has been installed within the Federation in order to help solve any problem perceived by our partners or not, generated by the implementation of the Project activities. This mailbox is open every year at the end of the year in the presence of the Federation's board of directors and the BAM team, in this verification period (2013 - 2014) six complaints or conflicts have been reported.

On the other hand, BAM office is always available for any Brazil nut harvester partner that requires technical / legal support. This service is provided as part of the cooperation between Bam and the Federation; if in situ visit is required, it is scheduled and accompanied throughout the process.

2.3 AFOLU-Specific Safeguards

For AFOLU projects, provide details on the following:

Activities implemented to mitigate risks local stakeholders due to project implementation.

Any updates, where relevant, to the property and land use rights of the local stakeholders and a demonstration that the project has not negatively impacted such rights without first obtaining the free, prior and informed consent of the affected parties, and provided just and fair compensation if done so.

The processes used to communicate and consult with local stakeholders during the monitoring period, including any information about any conflicts that arose between the project proponent and local stakeholders and whether any such conflicts were resolved via the established grievance redress procedure.

For AFOLU projects with no impacts on local stakeholders, provide evidence of such.

For non-AFOLU projects, this section is not required.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The BN REDD project implemented by BAM in partnership with the Federation (FEPROCAMD) has worked actively since the start of the project (established with the sign of the agreement between both partners).

During this second verification, it has continued with the strengthening of the Federation, in terms of adding capabilities oriented to improve the situation of the BN sector in working meetings with representatives of the State, to support in the recognition and restructuring of the BN technical roundtable, seeking support and recognition for the promotion of the Brazil Nut festival and technical support to apply to projects contests sponsored by the State, for example: AGROIDEAS.

The Federation, FEPROCAMD, has also carried out permanent meetings with their members and grassroots organizations. During the four years of current verification, 74 meetings of different

types were done. 60% of them were general assemblies with a frequency of almost one general assembly per month. Some of them were decentralized workshops in small towns with a high presence of BN harvesters. This allows a higher level of participation of project partners. Finally, board meetings were intense during the first year of analyzed period but decreased during following years.

Table 4. Number of meetings between 2013 – 2016

Year of meetings	General Assemblies	Board meetings	Decentralized workshops
2013	12	11	4
2014	10	3	7
2015	12	-	-
2016	11	2	2
TOTAL	**45**	**16**	**13**

Source: Self-made.

Since the point of view of FEPROCAMD and BAM, strengthening the regional grassroots organization is key to deal with deforestation drivers as they act as a hinge channeling the threats and demands of BN harvesters toward policy makers, including regional government, forest authority, police and attorney among others.

Likewise, the Federation was registered with the SUNARP, which will look after the interests of the BN partners when the Brazil nut processing plant is put into operation. The property title of the tractors purchased to facilitate the transfer of the Brazil nut bags to a collection point was handed over to the Federation, the purchase of equipment for BN drying and a copy of the business plan and design of the Brazil nut plant were delivered to the Federation.

In addition, 30% of carbon credit certificates were awarded to the Federation so they may be traded directly by the Federation.

In terms of technical assistance, support continued to the BN partners in the zoning of each concession, delimitation of limits in concessions with conflict overlapping rights with their neighbors, preparation of documents for the use of Brazil nut or wood, as well as workshops for the adaptation to the new forestry law that came into force for this verification period.

The project has also supported to concessionaries with working capital for annual Brazil nut zafra (harvesting campaign) in order to help them to not depending from intermediates or local

companies. This has allowed an increase in prices even though it must be recognized that price of nuts depend mainly on external factors.

Other field activities, defined in the VCS PD, are already in initial stages ac can be reviewed in Annex 2. The project is also involved in inter-institutional forums as REDD roundtables (National and regional).

BAM handles a policy of promoting research in the projects it carries out, both in its Ucayali plantation and in the Brazil Nut REDD project in Madre de Dios. From the various investigations carried out, theses, articles, posters and / or summaries have been published in various scientific events and have served to encourage discussion regarding the participation of the private sector in forestry projects.

Punctually, BAM signed a strategic alliance with CIFOR so that the project could participate in the Global Comparative Study (GCS REDD +) of the Mitigation and Climate Change Program[2].

For this global study there were selected 23 initiatives REDD+ that are located in six tropical countries: Brazil, Peru[3], Cameroon, Tanzania, Indonesia and Vietnam. The objective was to compare the initiatives concerning four modules: governance of the national politics of climatic change; subnational projects of REDD+; measurement, monitoring and verification (MRV) systems of emissions; and the management of the carbon to scale of the scenary, with a transverse module dedicated to the exchange and the diffusion of knowledge. The first phase of GCS REDD+ was completed in 2013, and the second phase was completed in 2015.

In 2014, it appeared for the scientific community present in the COP 19 in Lima, the publication of the book REDD+ on the Ground: A Case Book of Subnational Initiatives across the Globe[4]. The Brazil Nut REDD Project is one of two initiatives selected for Peru and it is the only one in which the proponent of the project comes from the private sector and is done with rural families as partners through a grassroots organization. The case study on the project can be appreciated in the Chapter 8: The REDD Project in Brazil Nut Concessions in Madre de Dios, Peru with a brief outline on the scope of the project, the challenges and opportunities both for our associates and for the company and the learned lessons of the process for the implementation of the project.

Under this study innumerable publications have been detached in the later years. At level of country multilevel highlights, the investigation on Analysis of the governance in Peru (2016)[5].

[2] https://www.cifor.org/gcs/

[3] Peru was not considered in the study until Bolivia formalized its NO REDD policy in 2010.

[4] Sills EO, Atmadja S, de Sassi C, Duchelle AE, Kweka D, Resosudarmo IAP y Sunderlin WD. 2014. eds. REDD+ on the Ground: A Case Book of Subnational Initiatives across the Globe. Bogor, Indonesia: CIFOR. Available in: https://www.cifor.org/redd-case-book/

[5] Kowler LF, Ravikumar A, Larson AM, Rodriguez-Ward D, Burga C y Gonzales Tovar J. 2016. Analysis of multilevel governance in Peru: Lessons for REDD + of the study about use change land and distribution of benefits in Madre de Dios, Ucayali and San Martín. Working Paper 209. Bogor, Indonesia: CIFOR. Available in: http://www.cifor.org/publications/pdf_files/WPapers/WP209Kowler.pdf

This study is based principally on the investigation carried out in 2013 in Madre de Dios, Ucayali and San Martin in Peru. As well as in a work of direct involvement in Madre de Dios and San Martin during the years 2014-2015.

In which there were chosen 14 initiatives with low carbon emissions with the objective to realize a comparative analysis of case studies on how the political actors, at the national, regional and local level, molded the decisions of use of the soil in practice. This includes the form in which the power is distributed, the form in which the information flows, the measurement in which the processes of decision making are participatory and if you those processes and results are legitimate.

3.2 Deviations

3.2.1. Methodology Deviations

For this verification, the module VMD0010 (LK-ASU) v. 1.1 approved in March 2015. Specifically, in STEP 2 about Estimation of the proportions of area deforested by immigrant and local deforestation agents in the baseline, the methodology requires that the data used is valid for 5 years since the information was generated. For the first verification the 2007 census was used, so in this period it loses its validity.

Due to the fact that there are no official sources that provide us with the proportion of migrants, we chose to generate this data, for which a random census was taken of at least 10% of the communities within 2 km of the Project area. Twenty-eight population centres were evaluated, 365 people between men and women, resulting in 8% being migrants.

According to the methodology, a Participatory Rural Appraisal must be done every 2 years to monitor forest degradation (fires and illegal wood) in project area but this could not be done within the next 2 years of last PRA. It was realized by the middle of 2018. The data found at that PRA shows some correspondence with the data of the first verification, for this reason that data will be used because it is more reliable.

Even though it is a deviation, we consider that this is more conservative as if the PRA would have done every two years, the trees harvested illegally in recent years (between 2016 to 2018) wouldn't have detected and the emissions from forest degradation by illegal logging would have been lower than what has been found during the field work of PRA 2018. Regarding accuracy, the field work has considered, based on information given by the own concessionaries, to register all the trees that they are aware that have been cut illegally, including the trees that did not require the opening of new roads but that used the roads already opened for BN harvesting. So, in that sense, for the sample taken, the accuracy is the highest, as it is based on the measurement of the 100% of trees reported.

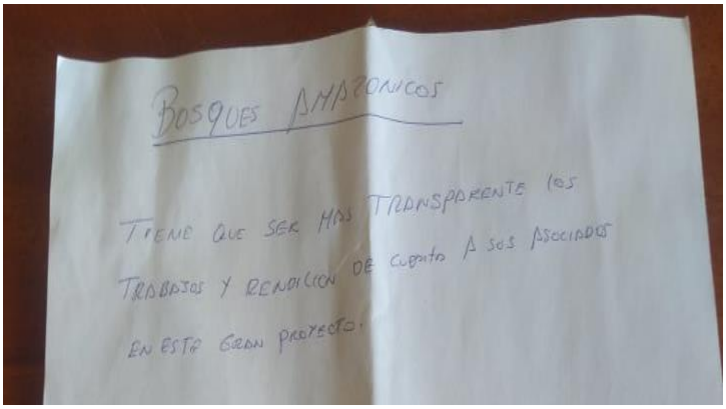
3.2.2. Project Description Deviations

With respect to the implementation of the System of Complaints and Conflicts, according to the flowchart presented in the PDD, the mailbox should have been installed in the provincial municipalities of Tahuamanu and Tambopata, and after receiving the signed complaint should be sent for communication to the project manager for internal evaluation. However, in practice it was not feasible to install it in each municipality because they are governmental entities and the Project cannot use these facilities. So, it was decided to install it in the Federation, because it is the authority that brings together the largest number of Brazil nut dealers.

During this period, many claims were received as it can be seen in the following pictures:

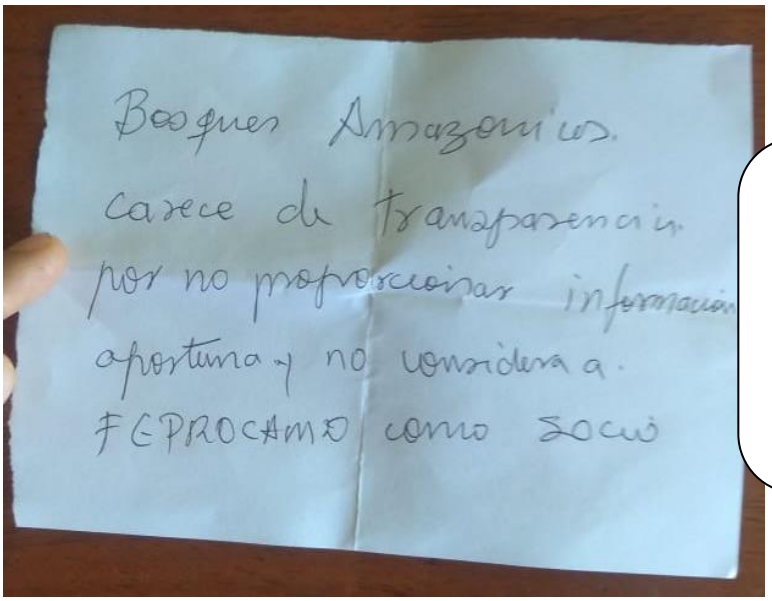
Announcement

There has settled a mailbox of claims and suggestions. And a complaints book.



Bosques Amazónicos

The works and account capitulation has to be more transparent to the associates in this great project.



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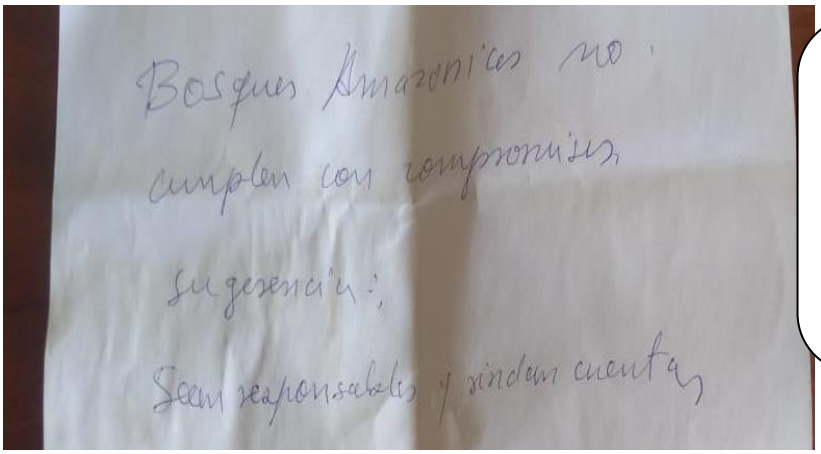
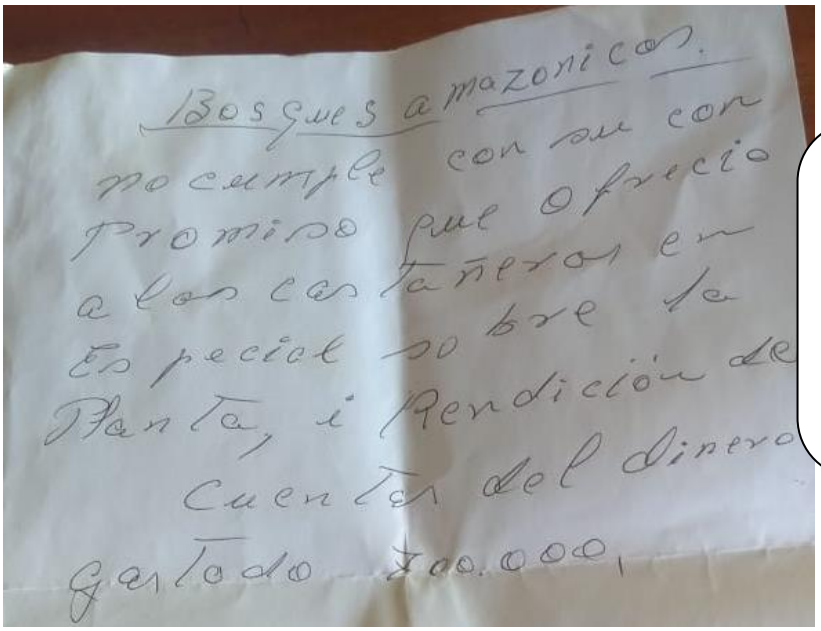
It lacks transparency for not providing opportune information, and does not consider FEPROCAMD as a partner.



Bosques Amazonicos does not fulfill its commitments. Suggestion:

Be responsible and accountable.



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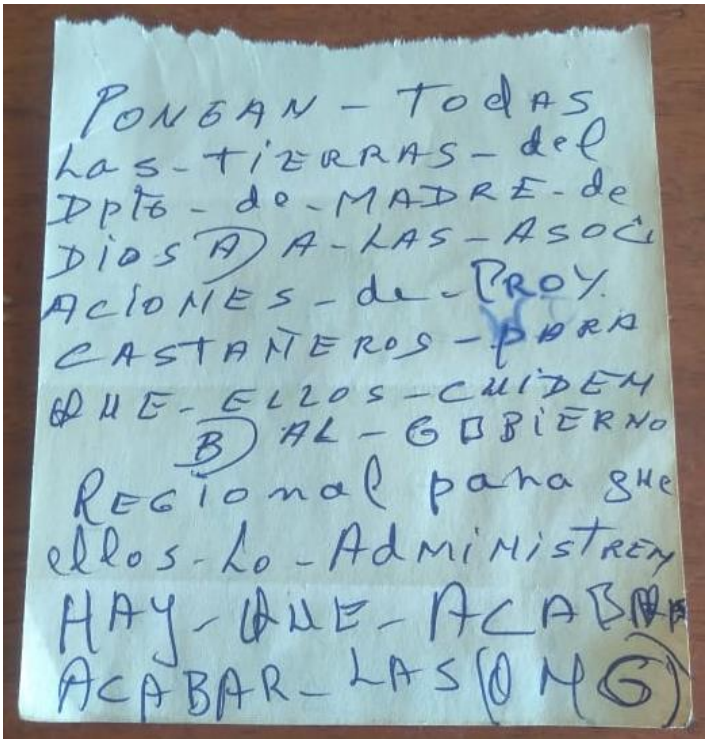
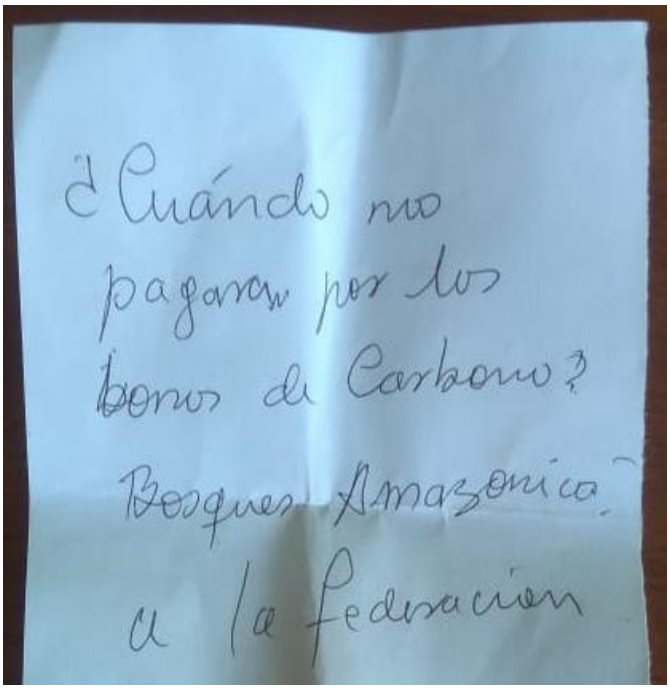
It does not fulfill its commitment that it offered to the castañeros, especially on the plant. Accountability of money spent 700,000.



Put all the lands of the department of Madre de Dios: A) To the castañeros project associations for them to take care of. B) To the Regional Government for them to administer it. We must end the NGOs.



When will they pay for the Carbon bonds?

Bosques Amazonicos to the Federation.

Related to activities:

A1. Implementation of the forest monitoring and surveillance system

Monitoring was done communally through "word of mouth". When the partners detected deforestation agents, they communicated directly with FEPROCAMD, who, through the lawyer who works there, provided them with legal support through the corresponding complaints and their follow-up.

Attached: *Denuncia tala, denuncia tala 2, solicitud espacio*

A2. Training deforestation agents in alternatives and sustainable production initiatives

Attached we can find the comprised: Capacitaciones 2014 – 2015 - 2016

A3. Implementation of a forest nursery

It will be implemented through the current genetic improvement program, which after 15 years of research in native species has generated that we accumulate a genetic capital made up of more than 850,000 trees developed from the selection of the best specimens from multiple provenances in Peru. In 2019, we finalized the selection of 20,000 trees "plus" or the best genetic load, with a view to finally choosing the 10 best trees that we will clone from this year, 2020.

The genetic improvement program is being worked on in cooperation with the Technological Institute of Costa Rica (TEC), one of the leading institutions in research of native species worldwide and is being led by Dr. Olman Murillo, PhD with 35 years of experience in genetic improvement processes.

This knowledge will be transmitted to FEPROCAMD to finally reach each of the concessionaires and, in this way, enrich the forest with native species and contribute to sustainability and local development.

Attached: *Propuesta programa mejoramiento genético BAM 2020*

A4. Enrichment by planting native species

Through the aforementioned in point A3, the selected species will be taken to the forest with the help of the FEPROCAMD.

A8. Implementation of a Brazil nut processing plant

The feasibility study for the implementation of a Brazil nut processing plant was carried out according to the reality of the area in 2009. In parallel, it was identified that many of the existing companies were taking advantage of the need for working capital of the Brazil nut trees at the beginning of each harvest season (known as the Brazil nut harvest). This in order to give an advance to the bag carriers (barriqueros) since they entered the concession for two months or more, and they had to leave this advance to their families so that they could subsist the time they were absent. Also, they needed to buy the groceries so that they did not have to be leaving the concession so frequently, because if they did, they incurred an expense that affected their profit from the Brazil nut harvest.

As in most cases, the Brazil nuts are rural people, they did not have working capital and they were forced to resort to companies and intermediaries, who, in exchange for facilitating this advance (habilito), committed them to the future production of Brazil nuts or prices lower than those of the market or in shell, when it is known that the greatest profit is to sell the peeled Brazil nut.

For this reason, BAM evaluated that the greatest impact that the project could have for the Brazil nut trees was to give them these capital advances with the commitment that they return it with the sale of Brazil nut. Thus, they did not compromise their production and could sell it to the highest bidder and in the conditions they desired. This had a gigantic positive impact for the Brazil nut growers who, additionally, joined together to auction their production and achieved an increase in profits during that period, which received the advances from BAM.

It also helped strengthen FEPROCAMD.

3.3 Grouped Projects

For this 2013-2014 verification period, no new BN concessionaires have been included as project partners.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Map of Forest / Non-forest Coverage in the Reference region.
Data unit	n/a
Description	Map that shows the stratification and location of forest and non-forest areas in the Reference Region at the beginning of the accreditation.
Source of data	Landsat satellite images.
Value applied	n/a
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have the adequate resolution and they are an available tool to all public.
Purpose of Data	Through the accuracy assessment. (QA/QC)
Comments	The stratification is based on the Ecological and Economic Zoning of the Region of Madre de Dios, that was developed by the IIAP in 2009 and it is used by the regional government as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other areas that are access roads (rivers, bridges, alternate roads, the Interoceanic Highway).

Data / Parameter	Map of Forest Coverage in the Project Area.
Data unit	n/a
Description	Map that shows the stratification and location of forest areas in the Project area at the beginning of the accreditation.
Source of data	Landsat satellite images.
Value applied	n/a
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have the adequate resolution and they are an available tool to all public.
Purpose of Data	Through the accuracy assessment. (QA/QC)
Comments	The stratification is based on the Ecological and Economic Zoning of the Region of Madre de Dios, that was developed by the IIAP in

	2009 and it is used by the regional government as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other areas that are access roads (rivers, bridges, alternate roads, the Interoceanic Highway). To date there is no other use but forest usage.

Data / Parameter	Map of Forest Coverage in the Leakage Belt.
Data unit	n/a
Description	Map that shows the stratification and location of forest in the Leakage belt at the beginning of the accreditation.
Source of data	Landsat satellite images.
Value applied	n/a
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have the adequate resolution and they are an available tool to all public.
Purpose of Data	Through the accuracy assessment. (QA/QC)
Comments	The stratification is based on the Ecological and Economic Zoning of the Region of Madre de Dios, that was developed by the IIAP in 2009 and it is used by the regional government as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other non-forested areas that used as access roads (rivers, bridges, Interoceanic Highway, alternate roads).

Data / Parameter	Deforested Area in the Project Area
Data unit	Ha
Description	Total deforested area during the term of reference (until 2009).
Source of data	Valued taken from the Landsat 7 satellite images, used by the Deforestation Model of Madre de Dios.
Value applied	18,753
Justification of choice of data or description of measurement methods and procedures applied	The Landsat images have the adequate resolution and they are an available tool to all public.
Comments	n/a

Data / Parameter	Carbon stock of the sources in the forest stratum.
Data unit	T CO_2 e / ha
Description	Carbon stock by stratum in baseline before deforestation.
Source of data	Determined from carbon stock estimation carried out in Madre de Dios: - Carbon Stock – Belgium Community (Madre de Dios). - Forest concession of forest stocks MADERYJA and MADERACRE. Carbon stock - REDD Project Bahuaja –Sonene.
Value applied	BTI 389.84 tCO_2 / ha PA 929.23 tCO_2/ ha BPT 499.63 tCO_2/ ha BT 944.24 tCO_2/ ha P 753.99 tCO_2/ ha BCB 1020.43 tCO_2/ ha BPCB 453.65 tCO_2/ ha
Justification of choice of data or description of measurement methods and procedures applied	Inventories have been carried out in nearby areas and with forest stratum similar to the project in the region of Madre de Dios. The next steps were followed: - Parcels were built in the different stratum. - DBH (Diameter Breast Height) and HT (Total Height) were taken from each individual found. - It was determined the aerial biomass based in the Chavé formula for trees and Winrock for palm trees. Factor 0.24 was used to determine the root biomass according to module CP-AB.
Comments	The exact data for each stratum is found in module CP-AB.

Data / Parameter	Change in the land use.
Data unit	%
Description	Percentages of the project area that will change the land use after deforestation.
Source of data	Determined according to the studies of land use carried out in the region of Madre de Dios. CDC, UNALM, SZF, INRENA 2007.
Value applied	54 % Farming 4 % Farmland 40 % Pasture 2 % Infrastructure

Justification of choice of data or description of measurement methods and procedures applied	The study mentioned has been carried out in areas that include the Project Area, or next to them. Furthermore, this data is updated and actors that are also in our areas have been considered.
Comments	n/a

Data / Parameter	Emissions by biomass burning
Data unit	T CO_2 e
Description	Tons of CO_2 equivalents, coming from emissions of CH_4 and N_2O by forest burning and agriculture residues.
Source of data	Factors of module E-BB were used (table 2.6 and 2.5) for tropical forest. Likewise, it was used the combustion factor of table 2.6 by agriculture biomass burning. The deforested forest percentage that is burnt has been taken from official sources[6].
Value applied	Used values: - 55 % of the deforested forest is burnt. - Combustion factor Tropical Humid Forest = 0.5 Agriculture Residues (Corn) = 0.8 - Emission Factor Tropical Forest = 6.8 (CH_4) and 0.2 (N_2O) Agriculture Residues = 2.7 (CH_4) and 0.07 (N_2O).
Justification of choice of data or description of measurement methods and procedures applied	The percentage of 55% is moderate. Some experts consulted consider that 100% of hectares that are torn down are burnt.
Comments	n/a

4.2 Data and Parameters Monitored

DATA AND PARAMETERS FOR BASELINE RENEWAL

Data / Parameter	Regional Forest / Non-forest Cover Benchmark Map
Data unit	Ha

[6]Deforestation map of the Peruvian Amazon – 2000. MINAM (2009).

Description	Map that shows the stratification and location of forest and non-forest areas in the Reference Region RRD at the beginning of the accreditation.
Source of data	Landsat satellite images.
Description of measurement methods and procedures to be applied	The Landsat images have an adequate resolution and they are an available tool to all public.
Frequency of monitoring/recording	At minimum 3 times over the 10 years leading up to baseline renewal.
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Through the accuracy assessment.
Comments	The stratification was based on the Ecological and Economic Zoning of the Region of Madre de Dios. It was developed by the IIAP in 2009 and the regional government uses it as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other areas that are access roads (rivers, bridges, alternate roads, the Interoceanic Highway).
Used in equations	3

Data / Parameter	Project Forest Cover Benchmark Map.
Data unit	Ha
Description	Map that shows the stratification and location of forest areas in the Project area at the beginning of the accreditation (100% forested).
Source of data	Landsat satellite images.
Description of measurement methods and procedures to be applied	The Landsat images have an adequate resolution and they are an available tool to all public.
Frequency of monitoring/recording	At minimum every 10 years prior to baseline renewal.
Value monitored	

Monitoring equipment	
QA/QC procedures to be applied	Through the accuracy assessment.
Comments	The stratification was based on the Ecological and Economic Zoning of the Region of Madre de Dios. It was developed by the IIAP in 2009 and the regional government uses it as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other areas that are access roads (rivers, bridges, alternate roads, the Interoceanic Highway). To date there is no other use but forest usage.
Used in equations	3, 8

Data / Parameter	Leakage Belt Forest Cover Benchmark Map.
Data unit	Ha
Description	Map that shows the stratification and location of forest in the Leakage belt at the beginning of the accreditation (100% forested).
Source of data	Landsat satellite images.
Description of measurement methods and procedures to be applied	The Landsat images have an adequate resolution and they are an available tool to all public.
Frequency of monitoring/recording	At minimum every 10 years prior to baseline renewal.
Value monitored	
Monitoring equipment	
QA/QC procedures to be applied	Through the accuracy assessment.
Comments	The stratification was based on the Ecological and Economic Zoning of the Region of Madre de Dios. It was developed by the IIAP in 2009 and the regional government uses it as its official source. Non-forest has been determined as beach and water bodies areas. In addition, there are other non-forested areas that used as access roads (rivers, bridges, Interoceanic Highway, alternate roads).

Used in equations	3

Data / Parameter	A_i
Data unit	Ha
Description	Total area of each stratum *i*.
Source of data	Landsat satellite images.
Frequency of monitoring/recording	Frequency at a minimum every 10 years prior to baseline renewal.
Value monitored	
Monitoring equipment	
Comments	Ex-ante it is assumed that strata area will remain constant.

Data / Parameter	$A_{RRD, unplanned, hrp}$
Data unit	Ha
Description	Total deforested area during the term of reference (until 2009) in the RRD.
Source of data	Valued taken from the Landsat 7 satellite images, used by the Deforestation Model of Madre de Dios.
Description of measurement methods and procedures to be applied	The Landsat images have the adequate resolution and they are a free and available tool to all public.
Value monitored	-
Monitoring equipment	
Comments	Monitored for purpose of baseline revisions.

Data / Parameter	*CF*
Data unit	t C t^{-1} d.m.
Description	Carbon fraction of dry matter.
Source of data	Value taken from IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3
Description of measurement methods	The value chosen is 0.49 t C t-1 d.m. for Tropical Forests.

and procedures to be applied	
Value monitored	-
Monitoring equipment	
Comments	n/a
Used in equations	19

Data / Parameter	C*Fj*
Data unit	t C t^{-1} d.m.
Description	Carbon fraction of biomass for tree species j
Source of data	Value taken from IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3.
Description of measurement methods and procedures to be applied	The value chosen is 0.49 t C t-1 d.m. for Tropical Forests.
Value monitored	-
Monitoring equipment	
Comments	n/a
Used in equations	11

Data / Parameter	D*j*
Data unit	t d.m. m^{-3}
Description	Basic wood density in t d.m. m^{-3} for species *j*.
Source of data	National species-specific densities. For species-specific wood densities not available, it is used the mean wood density value Regional average (0.60 t d.m.m-3- tropical America) from Reyes 1992 and Brown, S. 1997.
Description of measurement methods and procedures to be applied	Species densities have been taken from different sources of national species-specific researches being the main ones: - Evaluation of mechanical and physical properties and probable uses of the wood of 20 species in Jenaro Herrera, Loreto – Perú (Aróstegui and Acevedo).

	- Summary of technical information of 32 tree species. Peruvian Confederation of Wood. 2008. CPM. CITE Madera. Global wood density database. (Chavé et al., 2009).
Value monitored	
Monitoring equipment	
Comments	n/a
Used in equations	11

Data / Parameter	D_{mn}
Data unit	t d.m. m^{-3}
Description	Mean wood density of commercially harvested species.
Source of data	National species-specific densities. For species-specific wood densities not available, it is used the mean wood density value Regional average (0.60 t d.m.m-3- tropical America) from Reyes 1992 and Brown, S. 1997.
Description of measurement methods and procedures to be applied	Species densities have been taken from different sources of national species-specific researches being the main ones: - Evaluation of mechanical and physical properties and probable uses of the wood of 20 species in Jenaro Herrera, Loreto – Perú (Aróstegui and Acevedo). - Summary of technical information of 32 tree species. Peruvian Confederation of Wood. 2008. CPM. CITE Madera. Global wood density database. (Chavé et al., 2009).
Value monitored	-
Monitoring equipment	
Comments	n/a
Used in equations	19

Data / Parameter	f_j (X,Y)
Data unit	t d.m. $tree^{-1}$
Description	Allometric equation for species j linking measured tree variable (s) to aboveground biomass of living trees, expressed as t d.m. $tree^{-1}$

Source of data	The Chavé formula for trees and Winrock for palm trees.
Description of measurement methods and procedures to be applied	Both formulas have been taken from: - Pearson, T., Walker, S. and Brown, S. 2005. Sourcebook for Land Use, Land-Use Change and Forestry Projects. Winrock International and the World Bank Biocarbon Fund. 57pp. Chave, J, et. Al. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecología 145: 87-99.
Value monitored	
Monitoring equipment	
Comments	The validation of the equations will be performed with either of both methods presented in VMD0015 module: - Limited Measurements - Destructive sampling
Used in equations	35

Data / Parameter	Carbon stock in all pools in the forest stratum.
Data unit	T CO_2 e / ha
Description	Carbon stock by stratum in baseline before deforestation.
Source of data	Determined from carbon inventories carried out in the Project Area.
Value applied	BTI 389.84 T CO_2 / ha PA 929.23 T CO_2/ ha BPT 499.63 T CO_2/ ha BT 944.24 T CO_2/ ha P 753.99 T CO_2/ ha BCB 1020.43 T CO_2/ ha BPCB 453.65 T CO_2/ ha
Description of measurement methods and procedures to be applied	- The inventory was made in year 2011 inside the Project Area. - Parcels were built in the different stratum. - DBH and HT were taken from each individual found. - It was determined the aerial biomass based in the Chavé formula for trees and Winrock for palm trees. - Factor 0.24 was used to determine the root biomass according to module CP-AB.
Value monitored	908.10
Monitoring equipment	
Comments	The exact data for each stratum is found in module CP-AB.

Data / Parameter	Change in the land use.
Data unit	%
Description	Percentages of the project area that will change the land use after deforestation.
Source of data	Determined according to the studies of land use carried out in the region of Madre de Dios. CDC, UNALM, SZF, INRENA 2007.
Value applied	54 % Farming 4 % Farmland 40 % Pasture 2 % Infrastructure
Description of measurement methods and procedures to be applied	The study mentioned has been carried out in areas that include the Project Area, or next to them. Furthermore, this data is updated and actors that are also in our areas have been considered.
Value monitored	
Monitoring equipment	
Comments	n/a

Data / Parameter	Emissions by biomass burning.
Data unit	T CO_2 e
Description	Tons of CO_2 equivalents, coming from emissions of CH_4 and N_2O by forest and agriculture residues burning.
Source of data	Factors of module E-BB were used (table 2.6 and 2.5) for tropical forest. Likewise, it was used the combustion factor of table 2.6 by agriculture biomass burning. The deforested forest percentage that is burnt after deforestation has been taken from official sources[7].
Value applied	Used values: - 55 % of the deforested forest is burnt. - Combustion factor. Tropical Humid Forest = 0.5 Agriculture Residues (Corn) = 0.8 - Emission Factor Tropical Forest = 6.8 (CH_4) and 0.2 (N_2O)

	Agriculture Residues = 2.7 (CH_4) and 0.07 (N_2O).
Description of measurement methods and procedures to be applied	The percentage of 55% is moderate. Some experts consulted consider that 100% of hectares that are torn down are burnt.
Value monitored	6,010.00
Monitoring equipment	
Comments	n/a

DATA AND PARAMETERS MONITORED FOR VERIFICATION

Data Unit / Parameter:	Project Forest Cover Monitoring Map.
Data unit:	ha
Description:	Map evidencing the stratification and location of the forest in the Project area at the beginning of each verification period. It has to be evidenced if within the Project area there are deforested areas.
Source of data:	Satellite images and field verification of deforested areas if any (GPS).
Description of measurement methods and procedures to be applied:	By using satellite images covering the Project Area it would be determined if there are any variations in the forest stratum identified in the project area. In case there are deforested areas it would be verified in field and confirmed by using GPS.
Frequency of monitoring / recording:	Every 5 years with images. Verification of deforested areas will be permanent in field by the surveillance carried out by the monitoring equipment.
Value monitored	172,384.84
Monitoring equipment	*Software GIS, available satellite images, GPS, professional monitoring equipment in field.*
QA/QC procedures to be applied:	*Permanent verification of the area of the project surfaces.*
Comments:	*Stratification is the same as the one used at the beginning of the term.*

Data Unit / Parameter:	Leakage Belt Forest Cover Monitoring Map.
Data unit:	Ha
Description:	Map evidencing the stratification and location of the forest in the Leakage Belt at the beginning of each verification period. It has to be evidenced if there are deforested areas.
Source of data:	Satellite images and field verification of deforested areas if any (GPS).
Description of measurement methods and procedures to be applied:	By using satellite images covering the Leakage Belt it would be determined if there are any variations in the forest stratum identified in the Leakage Belt. In case there are deforested areas it would be verified in field and confirmed by using GPS.
Frequency of monitoring/recording:	Every 5 years with images.
Value monitored:	*706,555.52*
Monitoring equipment:	*Software GIS, available satellite images, GPS, professional monitoring equipment in field.*
QA/QC procedures to be applied:	*Permanent verification of the area of the project surfaces. Also, through the accuracy assessment.*
Any comment:	*Stratification is the same as the one used at the beginning of the term.*
Used in equations:	3, 8.

Data Unit / Parameter:	Degradation PRA Results
Data unit:	t CO2
Description:	The PRA will be executed from interviews and/or surveys to local actors with the purpose of identifying the existence of depredation potential within the area of the project due to: • Extraction of firewood. • Illegal logging If the >= 10% of the surveys indicate that there is a risk of depredation then the procedures to verify and estimate the depredation should be executed. An additional result of the PRA would be the penetration

	distance that should be applied to calculate the area with depredation potential (buffer area).
Source of data:	PRA
Description of measurement methods and procedures to be applied:	It would be developed according to the provisions set forth in the M-MON.
Frequency of monitoring/recording:	Every 2 years.
Value monitored:	6,135. Not significant.
Monitoring equipment:	*PRA sociologist in charge with focusing criteria.*
QA/QC procedures to be applied:	There would be templates to carry out surveys and/or interviews.
Any comment:	n/a
Used in equations:	Section 5.2.2.1

Data Unit / Parameter:	Results of Limited Degradation Survey
Data unit:	Stumps.
Description:	Verification of degradation processes in the project area.
Source of data:	Field measurements.
Description of measurement methods and procedures to be applied:	If PRA indicates there is degradation potential, then the procedures to verify the degradation occurrence should take place. Sampling transects are distributed across the buffer area with the purpose of identifying if there are new tree-stumps. Transects should cover a surface of no less than 1% of the buffer area.
Frequency of monitoring/recording:	Each time the PRA indicates there is degradation potential to the project area.
Value monitored:	17
Monitoring equipment:	GPS, compass, tape line.
QA/QC procedures to be applied:	Trained staff for field measurement.
Any comment:	n/a
Used in equations:	3

Data Unit / Parameter:	$A_{burn, i, t}$
Data unit:	Ha
Used in equations:	Section 2.2.2
Description:	Area burnt in stratum *i* at time t. The monitoring will be carried out, if there is any record of any burnt area within the project area, on each stratum and year of the project.
Source of data:	Field measurements.
Description of measurement methods and procedures to be applied:	If there is a record of a burning, it will be indicated the type of forest and burnt area to determine the GHG emissions (CH_4 and N_2O). If possible, the new use of the land will also be indicated.
Frequency of monitoring/recording:	Every time there is an occurrence.
Value monitored:	154.37
Monitoring equipment:	GPS
QA/QC procedures to be applied:	n/a
Any comment:	Ex-ante burnt areas (baseline) have been determined by interviewing experts and by what it is known in the region of Madre de Dios. The obtained value will be used in the EBB module.

Data Unit / Parameter:	$A_{DefPA, i, t}$
Data unit:	Ha.
Description:	Deforested area in the Project area by type of forest.
Source of data:	Satellite images.
Description of measurement methods and procedures to be applied:	The images used will be compatible with the ones already used in the estimations ex-ante in order to be compared.
Frequency of monitoring / recording:	Every 5 years with satellite images. Constant monitoring in field.
Value monitored:	154.37
Monitoring equipment:	*Software GIS, available satellite images, verification in field with GPS and professional equipment.*
QA/QC procedures to be applied:	n/a

Any comment:	If there is a change in the land use, the new use and GHG emission (CH_4 or N_2O) will be registered by arboreal and agricultural biomass burning, and incorporation of nitrogen. This will be registered and recorded.

Data Unit / Parameter:	$A_{DefLB, i, t}$
Data unit:	Ha.
Description:	Deforested area in the Leakage belt by type of forest.
Source of data:	Satellite images.
Description of measurement methods and procedures to be applied:	The images used will be compatible with the ones already used in the estimations ex-ante in order to be compared.
Frequency of monitoring/recording:	Every 5 years with satellite images. Constant monitoring in field.
Value monitored:	998.44
Monitoring equipment:	*Software GIS, available satellite images, verification in field with GPS and professional equipment.*
QA/QC procedures to be applied:	n/a
Any comment:	*Deforestation shall be confirmed at least every five years in the Leakage belt and verified with what is determined in baseline in order to assess if there is any leakage or not caused by the project.*

Data Unit / Parameter:	$A_{DegW, i}$
Data unit:	Ha
Description:	Area under potential degradation process. Buffer area resulting from PRA, if it shows that there is potential degradation in the Project Area.
Source of data:	GIS delineation and ground trothing.
Description of measurement methods and procedures to be applied:	The buffer area shall be composed from all access points. The length is obtained from the PRA results, and the width shall be equal to the length.
Frequency of monitoring/recording:	Must be repeated each time the PRA indicates a potential for degradation
Value monitored:	12,331

Monitoring equipment:	GIS software
QA/QC procedures to be applied:	n/a
Any comment:	There is no evidence of degraded areas or parcels ex-ante within the project area.

Data Unit / Parameter:	$A_{DECKS, i, t}$
Data unit:	ha
Description:	Area of logging decks in stratum *i at time* t.
Source of data:	Field measurements.
Justification of choice of data or description of measurement methods and procedures applied:	A systematic sampling to ensure all decks within area logged are identified and a conservative estimate of area produced.
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied:	At least every 5 years.
Any comment:	Ex-ante estimations will be based on field measurements once FSC is implemented.
Used in equations:	18

Data Unit / Parameter:	$A_{DistPA, q, l, t}$
Data unit:	ha
Description:	Area impacted by natural disturbance in the project stratum *i* converted to natural disturbance stratum *q* at time *t*; ha.
Source of data:	Satellite images and GPS coordinates.
Justification of choice of data or description of measurement methods and procedures applied:	Minimum monitoring unit equal to a minimum of 11 Landsat pixels or one hectare.
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied:	At least every 5 years.

Any comment:	Ex ante estimations of emissions from natural disturbances will be based on historic incidence of such event in the Project region.

Data Unit / Parameter:	$A_{ROAD, I, t}$
Data unit:	ha
Used in equations:	17
Description:	Area of roads in stratum *i* at time *t*.
Source of data:	Field measurements.
Justification of choice of data or description of measurement methods and procedures applied:	The area of roads is based on the length of roads times the average width of roads. Both length and width of roads will be estimated through systematic samplings, with sufficient number of measurements, and a precision equal or less than 15% of the mean at 95% confidence interval.
Value monitored	0
Monitoring equipment	
QA/QC procedures to be applied:	At least every 5 years.
Any comment:	Ex-ante estimations will be based on field measurements once FSC is implemented.
Used in equations:	17

Data Unit / Parameter:	$A_{RRL, forest, t}$
Data unit:	Ha
Used in equations:	n/a
Description:	Remaining area of forest in RRL.
Source of data:	Satellite images.
Description of measurement methods and procedures to be applied:	The images used will be compatible with the ones already used in the estimations ex-ante in order to be compared.
Frequency of monitoring/recording:	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event.
Value monitored	1,586,769.5
Monitoring equipment	

QA/QC procedures to be applied:	n/a
Any comment:	There is no evidence of degraded areas or parcels ex-ante within the project area.

Data Unit / Parameter:	AP_i
Data unit:	Ha.
Used in equations:	8
Description:	Total degraded area verified by sampling plots.
Source of data:	Ground measurement.
Description of measurement methods and procedures to be applied:	The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone.
Frequency of monitoring/recording:	Every time the Limited Degradation Survey indicates degradation (existence of stumps), or at least every 5 years.
Value monitored:	566.89
Monitoring equipment:	GPS, field equipment: tape line, compass. And field staff.
QA/QC procedures to be applied:	Trained staff for field measurement.
Any comment:	There is no evidence of depredated areas or parcels ex-ante within the project area.
Used in equations:	8

Data Unit / Parameter:	$C_{DegW,\,i,\,t}$
Data unit:	T CO_2 –e
Description:	Biomass carbon of removed trees through degradation process within the project area.
Source of data:	Field measurement.
Description of measurement methods and procedures to be applied:	With the tree-stumps identified during the evaluation of sampling parcels of the buffer area, the following procedures should be considered: - Take the diameter of the tree-stumps that will be assumed as DBH. In case they are too big (for example, due to buttress roots), then the specimen should be identified and place other individuals of the same species standing next to it. Then,

	measure their DBH and tree-stumps diameter. With this data, DBH should be estimated as from the tree-stumps diameter of the individuals deforested. - With DBH data, the carbon stock of individuals deforested is calculated using an allometric equation, yet to be defined. - It will be assumed that all stock will be send to the atmosphere.
Frequency of monitoring/recording:	Every time there is a degradation event or at least every 5 years.
Value monitored:	*309.85*
Monitoring equipment:	*GPS, field equipment: tape line, compass. And field staff.*
QA/QC procedures to be applied:	n/a
Calculation method:	Through an allometric equation, using the DBH as one of its variables.
Any comment:	n/a
Used in equations:	8

Data Unit / Parameter:	$C_{AB_tree_dest,i}$
Data unit:	T CO_2-e ha^{-1}
Description:	Carbon stock in aboveground tree biomass assumed to be killed per unit area resulting from the creation of the skid trail per stratum.
Source of data:	CP-AB and documentation stating maximum size tree able to be killed during skid trail creation.
Description of measurement methods and procedures to be applied:	It is assumed that $C_{AB_tree_dest,i} = C_{AB_tree,i}$ in the baseline.
Any comment:	n/a
Frequency of monitoring/recording:	Every 5 years.
Value monitored:	0
Monitoring equipment:	

Data Unit / Parameter:	$C_{BB_tree_dest,i}$
Data unit:	T CO_2-e ha^{-1}

Description:	Carbon stock in belowground tree biomass assumed to be killed per unit area resulting from the creation of the d trail per stratum.
Source of data:	$C_{AB_tree_dest,i}$
Description of measurement methods and procedures to be applied:	Estimation of belowground biomass will be performed following the procedures set in module CP-AB.
Value monitored:	0
Monitoring equipment:	
Any comment:	The root-to-shoot ratio 0.24 is used (same used in baseline carbon stock calculations).
Frequency of monitoring/recording:	Every 5 years.
Used in equations:	15

Data Unit / Parameter:	F_{LU}
Data unit:	Dimensionless
Description:	Land use factor before or after conversion.
Source of data:	Stock Change Factors are provided in Tables 5.5, 5.10, and 6.2 of the IPCC 2006GL Volume 4.
Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored:	0
Monitoring equipment:	
Any comment:	n/a
Used in equations:	16

Data Unit / Parameter:	F_{MG}
Data unit:	Dimensionless
Description:	Management factor before or after conversion.
Source of data:	Stock Change Factors are provided in Table 5.5, 5.10, and 6.2 of the IPCC 2006GL Volume 4.

Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored:	0
Monitoring equipment:	
Any comment:	n/a
Used in equations:	16

Data Unit / Parameter:	F_I
Data unit:	Dimensionless
Description:	Input factor before or after conversion.
Source of data:	Stock Change Factors are provided in Table 5.5, 5.10, and 6.2 of the IPCC 2006GL Volume 4.
Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored:	0
Monitoring equipment:	
Any comment:	n/a
Used in equations:	16

Data Unit / Parameter:	L_{sk}
Data unit:	m
Description:	Length of skid trail sk.
Source of data:	Field measurements.
Description of measurement methods and procedures to be applied:	A systematic sampling with random start within a sampled known logged area within the project boundary will produce an estimate of the length of skid trails created. The total length of skid trails in the project area equals the mean length of skid trails per unit area times the total area logged.
Value monitored:	0
Monitoring equipment:	

Any comment:	n/a
Frequency of monitoring/recording:	Every 5 years.
Used in equations:	13

Data Unit / Parameter:	$V_{EXT, z, i, t}$
Data unit:	m^3
Description:	Volume extracted from logging stratum *z* in stratum *i* at time *t*.
Source of data:	Records and reports (based on field measurements) documenting amount of wood extracted within project boundary.
Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored	0
Monitoring equipment:	
Any comment:	n/a
Frequency of monitoring/recording:	Every 5 years.
Used in equations:	10

Data Unit / Parameter:	$V_{EXT, j, z, i, t}$
Data unit:	m^3
Description:	Volume of timber extracted of species j for logging stratum z, in stratum i at time t.
Source of data:	Records of wood extracted.
Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored:	0
Monitoring equipment:	
Any comment:	n/a
Used in equations:	11

Data Unit / Parameter:	W_{SKID}
Data unit:	m
Description:	Mean width of skid trails.
Source of data:	Field measurements.
Description of measurement methods and procedures to be applied:	This parameter did not was applied because the concessionaires who was logging were temporarily excluded of the project (for this monitoring period).
Value monitored:	0
Monitoring equipment:	
Any comment:	n/a
Used in equations:	14

Data Unit / Parameter:	Sequestered carbon in Forest Enrichment areas in forest concessions.
Data unit:	T CO_2 / year
Description:	Sequestered carbon in trees due to Forest Enrichment in concessions (Project Area).
Source of data:	Growth Register in Permanent Parcels. Growth in DBH and growth in height.
Description of measurement methods and procedures to be applied:	Annual entries of reforested species will be kept on enrichment parcels with the purpose to know which is the annual increase volume and then take it to T CO_2/ha (through allometric equations or other indirect calculation).
Frequency of monitoring/recording:	Annual.
Value monitored:	Measured in field.
Monitoring equipment:	Tape line, GPS.
QA/QC procedures to be applied:	n/a
Calculation method:	Allometric equations or any other indirect validated calculation.
Any comment:	n/a

4.3 Monitoring Plan

The purpose of the monitoring is to have all information necessary to assess the development of the Project activities, possible deviations between what was estimated and what is real, and finally, the calculation (ex-post) of net GHG reductions attributed to the project and the leakage occurred.

This document presents the parameters evaluated to be used in the calculation ex-ante, and parameters to be evaluated during the life of the project, especially on each Monitoring and Evaluation of the Baseline.

The Monitoring will be carried out a maximum of every 5 years, and the Revision of Baseline every 10 years. During each period all data will be gathered according to the occurrence of each programmed activity (PRA, training courses, etc.) and of those that will be avoided (fires, degradation, use of fertilizers, etc.).

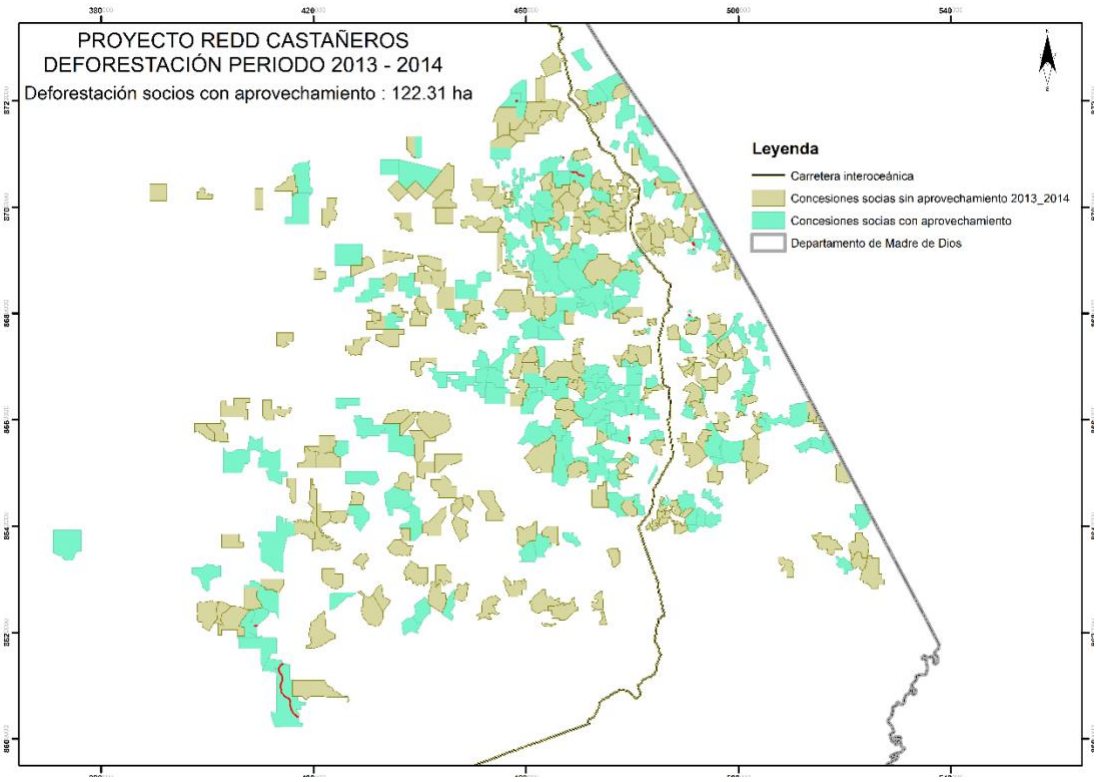
The gathering of information will be carried out directly in field, and indirectly by using satellite images, as well as representative studies of the area and official information if necessary.

The Monitoring has been carried out following the guidelines of module M-MON (Approved VCS Module VMD0015).

It is important to mention that 175 concessionaires were temporarily excluded of the project for this monitoring period because they were harvesting wood.

This exclusion does not mean that we have not monitored those areas and ensured that the approach used (the temporal exclusion) respects the principle of conservativeness, as showed in the map below:

Map 2. Deforestation in the project area 2013 - 2014



Gold polygons are the project instances that are not accounted for the current verification period, while green polygons represent the project instances that are accounted. As can be seen in the map, deforestation analysis has been done for the whole project zone, independently if the instance will be accounted or not. Deforestation in the current period may be recognized by the red pixels.

Quantitatively, deforestation in temporarily excluded areas during the current verification period was 122.31 hectares, which accounted for 112,831.12 tCO2e of gross emissions as can be seen in table 5.

Table 5. Emissions related to deforestation in the 175 temporarily excluded areas.

Stratum	*CpDef,PA,i,t*	*Cpdeg,PA,i,t*	*CpDist,PA,i,t*	*GHGp-e,i,t*	*Cp,Enh,i,t*	TOTAL
BTI	157.56	-	-	8.34	-	165.90
PA	-	-	-	-	-	-
BPT	1,453.93	-	-	-	-	1,453.93
BT	108,890.25	-	-	994.07	-	109,884.32
P	-	-	-	-	-	-
BCB	-	-	-	-	-	-
BPCB	1,261.49	-	-	65.48	-	1,326.97
Total	**111,763.23**	**-**	-	**1,067.89**	-	**112,831.12**

Source: Self-made

These numbers were largely lower than the values for predicted deforestation in the baseline scenario. For the same area (the 175 temporarily excluded concessions) and the same years (2013-14), the expected forest loss in the baseline scenario was 4,353.4, as can be seen in Table 6.

Table 6. Annual deforested areas in each forest class for the 175 temporarily excluded concessions.

Annual areas deforested in each forest class within the Project Area									
Strata i		BTI	PA	BPT	BT	P	BCB	BPCB	SUM
T	Year	Ha	ha	ha	ha	ha	Ha	ha	
1	2013	38.8	52.4	22.2	1,894.9	16.1	32.8	160.8	2,218.0
2	2014	25.2	48.9	10.1	1,883.3	12.6	45.4	108.9	2,134.4

Source: Self-made

This accomplishes the principle of conservativeness: the real forest loss in the not accounted area was less than the projected forest loss in the baseline scenario. So, the exclusion of these areas in the current accounting is conservative.

STEP 1. Selection and analyses of sources of land-use and land-cover (LU/LC) change data

The remotely sensed spatial data to be used for monitoring periods and baseline renewal is Landsat images from sensors 5TM and 7TM, which have a resolution of 30 x30 m.

The selection and acquisition of the most adequate satellite images will be accomplished by:

- Search of images in the web sites of *National Institute for Space Research from Brazil* (INPE) and *USGS Global Visualization Viewer*.
- Selection of 5TM and Landsat 7TM satellite images with less than 10% cloud cover over the desired areas. This will be achieved by comparing quick looks and their %CC reported for each quadrant, shown in both websites. If not possible, then images with the lowest overall percentage of cloud cover will be selected and a mosaic constructed.

As stated in the methodology, if a new source with higher resolution becomes available or if the used source is no longer available, then a change of source will only occur if the new data complies with the requirement set in the module.

The data collected and analyzed will cover:

- For the monitoring period: The Project Area and Leakage Belt, in the year of verification.
- For Baseline renewal: The entire RRD, in the same year of baseline renewal or no further in the past than the year prior to it.

STEP 2. Interpretation and analysis

Monitoring deforestation

For the estimation of net carbon stock change as a result of deforestation, the following criteria will be considered:

- The forest strata will remain the same in the entire baseline period.
- The selected pools for the baseline estimation will be maintained in the entire baseline period. All carbon pools excluded are counted as zero.
- The carbon stocks in the forest strata and the post-deforestation land-uses will be maintained across the baseline.

$\Delta C_{p,DefPA,i,t} = \sum(A_{DefPA,u,i,t} * \Delta C_{pools,P,Def,u,i,t})$ = 126,161.94 t CO_2

Details in the attached: Cp Estimations in Castañeros REDD Project 2nd monitoring report

$\Delta C_{p,DefLB,i,t} = \sum(A_{DefLB,u,i,t} * \Delta C_{pools,P,Def,u,i,t})$ = 692,989.05 t CO_2

Details in the attached: Leakage Estimations in BAM 2013-2014

Where: $\Delta C_{pools,P,Def,u,i,t} = C_{BSL,i} - C_{P,post,i} - C_{WP,i}$

Monitoring degradation

The Project Area will be monitored to account any emissions due to degradation activities, which are represented by:

- Degradation through extraction of trees for illegal timber or fuelwood and charcoal.
- Degradation through extraction of trees for selective logging from forest management areas possessing FSC certificate.

$$\Delta C_{P,Deg,i,t} = \Delta C_{P,DegW,i,t} + \Delta C_{P,SelLog,i,t}$$

Degradation through extraction of trees for illegal timber or fuelwood and charcoal

Step 1. Delineation of area that is potentially subject to degradation:
The roads for illegal logging can be found in the a*ttached: illegal logging roads* and have the following lengths: 1,616 m, 568 m, 1,640 m and 205 m. and following the methodology (width by length) we find the table in the attached "Arboles ilegales", the buffer is 566.89.

The buffer is obtained by multiplying the illegal road (interpreted as degradation penetration) by a similar value (as the methodology states that a width similar to length). So, it gives 566.89 ha.

Step 2. After that, the methodology requires to sample plots across degradation area covering at least 1% of buffer access, it means, at least 5.66 ha. In this case, as mentioned in Section 3.2.1. Methodology deviations, the PRA was realized by the middle of 2018 and we counted all the trees that were illegally harvested in the whole 4 concessions selected. Then, under this approach, the "sampled area" would be the total area of the 4 concessions, which equals to 4,298.76. On the other side, the total potentially affected area by degradation caused by illegal logging is, according to PRA, the 40% of total concessions. Considering that, for current vintage, the accounting project area is 233,761.20 ha, the 40% equals 93,504.5 ha.

Step 3: The methodology states that in the case of the emissions from degradation is significant, an additional sampling must be done and they must be discounted from the net VCUS. The methodology establishes to use the T-SIG tool to determine significance. We have used the "Tool for testing significance of GHG emissions in A/R CDM project activities" (Version 01)" for this analysis.

$$RC_{E_i} = \frac{E_i}{\sum_{i=1}^{I} E_i}$$

So, first we need to determine the emissions from degradation to add to other sources of emissions and determine its significance.

Step 3. Following the indications of M-MON, we have used the equations approved during validation for estimating the carbon pool in trees (CP-AB) in the baseline scenario.

TREES SPECIES EQUATION

For the calculation of biomass of tree species, the allometric equation *Biomass-Diameter Regression (Model II)* proposed in Chavé et al (2005)[5] for *Moist Forest*[6] was applied. This equation was validated by the author using datasets from previous studies in several tropical countries.

B = ρ*exp(-1.499 + 2.148*Ln (DBH) + 0.207*(Ln (DBH)) ^2 – 0.0281*(Ln (DBH)) ^3) in Kg (dry)

Where,
P = Density by species (gr/cm3)
DBH = Diameter at breast height, (cm)

The 17 trees harvested illegally in the 4 concessions, with Chave equation, represent a total emission of 309.85 tCO2e
Step 4: Then, if degradation is occurring, we have to apply the equation (8).

$$\Delta C_{P,DegW,i,t} = A_{DegW,i} * \frac{C_{DegW,i,t}}{AP_i}$$

Where $A_{DegW,i}$ is total degraded area and AP is sample plots area.

So, the equation determines that $\Delta C_{P,DegW,I,t}$ is:

309.85 * (233,761.20 * 40% * 13% /4,298.76) = 6,740 tCO2e.

Step 5: Finally, applying the T-SIG, we obtain the following results:

$\Delta C_{P,DegW,I,t}$ + $\Delta C_{P,Def}$ as 6,740 + 321,220.87 = 327,960.51 tCO2e, where $\Delta C_{P,DegW,I,t}$ is 2.06% and, according to T-SIG, it is not significant and must be discarded and not monitored in more detail.

Monitoring degradation due to selective logging of forest management areas possessing a FSC certificate

On the other hand, degradation and thus reduction of carbon stocks resulting from the selective logging in areas holding a FSC certificate is expected to happen, as being one of the proposed activities, and will be included in the ex-post estimations. It will be monitored as early as it is approved and implemented.

For these reasons, the ex-ante with-project case estimation is set to zero.
$\Delta C_{P,Deg,i,t} = 0$

Monitoring areas undergoing natural disturbance

Natural disturbances such as forest fires, pests, decease outbreaks and extreme weather (flooding) do not have significant presence in the Project area according to INDECI, therefore they are not estimated.

Monitoring areas undergoing carbon stock enhancement

No carbon stock enhancement is occurring in the baseline and the with-project scenario. This activity won't be monitored, in order to be conservative.

$C_{P,Enh,i,t} = 0$

Monitoring project emissions

Where significant, non-CO_2 gas greenhouse emissions occurring within the project boundary must be evaluated.

$$GHG_{P,E,i,t} = E_{FC,i,t} + E_{BiomassBurn,i,t} + N_2O_{direct\text{-}N,i,t}$$

N_2O and CH_4 emissions from agriculture and forest biomass burning

To estimate ex-ante biomass burnt in forests, it was calculated (according to MINAM, 2009) that 55% of the deforested forest is burnt. This index will be the same for the entire baseline period.

For the case of agriculture biomass burnt, it has been determined based on traditional management of farmland that stubble burning is made every year in all parcels at the end of the harvest period. In the calculations ex-ante, Corn is used as farmland reference because is the most representative crop of the area. However, for real estimations it can be taken as reference the crop that is actually in the parcel when known or the one with major representation in the area. This reference crop should be corroborated for baseline renewal.

Table 7. GHG Emissions for biomass burning in Forest Strata:

Strata	*Aburn,i,t* (ha)	B (t d.m./ha)	E*Biomass Burn CH4 (T CO2)*	E*Biomass Burn N2O (T CO2)*	Total E*Biomass Burn* in Forest *(T CO2)*
Flooded terraces forest (1)	-	174.99	-	-	-
Swamp trees (2)	9.60	417.09	285.89	124.13	**410.02**
High and mid terrace with bamboo (paca) forest (3)	3.60	224.27	57.65	25.03	**82.67**
Terraces forest (4)	114.14	423.83	3,454.04	1,499.65	**4,953.69**
Bamboos (Pacal) (5)	-	338.44	-	-	-
Low hills forest (6)	-	458.03	-	-	-
Low hills with bamboo (paca) forest (7)	27.03	203.63	392.99	170.63	**563.61**
TOTAL	154.37		**4,190.56**	**1,819.43**	**6,010.00**

STEP 3. Documentation

For each monitoring period, the procedures detailed in steps 1 and 2 above will be documented providing the following information:

a) Data sources and pre-processing
Type, resolution, source and date of acquisition of the remotely sensed data that will be used; description of corrections performed; projection and parameters used to georeference the images; error estimate of geometric correction; software used and software version; etc.

b) Data interpretation
Definition of land classes and categories; standardized description of each category; all information corresponding to the interpretation process already described in step 2.

c) Accuracy assessment
Accuracy assessment technique used; coordinates and description of the ground-truth data collected for the assessment; and final classification accuracy assessment.

d) Changes in Data sources and pre-processing / Data classification
If changes will be made to the original data or use of data in next periods:
- Each change and its justification shall be explained and recorded; and
- When data from new satellites are used, the documentation must follow a) to c) above.

Organization and Responsibilities

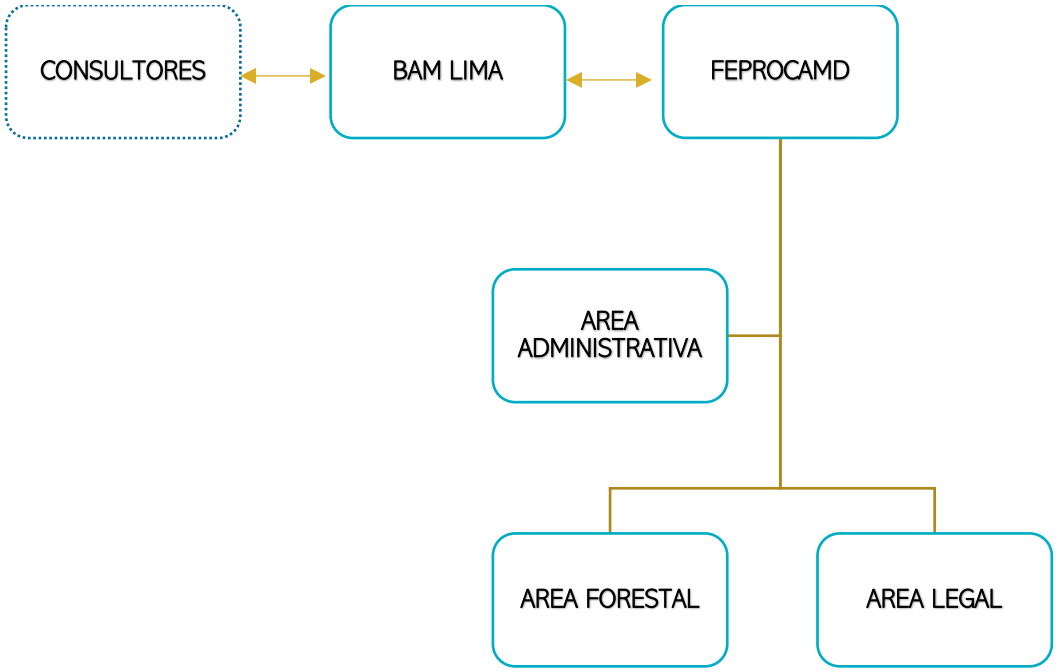
The design and execution of the Project and its Monitoring is handled by a multidisciplinary technical team, duly qualified and with experience in Project development.

In addition, it is supported by recognized institutions related to the Amazon investigation as the IIAP and AIDER. Specialists in forest, social, and economic areas lead the team, who are in charge of defining the objectives and provide guidelines to the correct development of the activities.

During the previous monitoring period the BAM's team was active and was in charge of the implementation, with the head of monitoring and a team of specialists in charge of gathering all parameter information that will be monitored to evaluate the performance of the project.

For this verification period 2013-2014, the regional management in Madre de Dios - BAM is deactivated to allow FEPROCAMD to take responsibility for the technical - legal area of the project. In addition, a team of consultants was hired to prepare the monitoring report based on the information provided by FEPROCAMD, leaving the organizational structure as follows.

Figure 1: Organizational structure of the team for this monitoring period.



Information Management

To minimize the impact of changes in BAM staff members, all the information from validation and each verification, including the modules and calculation spreadsheets that are not accessible in VERRA webpage, will be uploaded in the cloud. They explain clearly the followed steps, according to the methodology.

There will also be forms for each parameter that will allow documenting them clearly and consistently through time.

Even though they are standard forms, additional information considered as relevant by the field operator can be included.

Furthermore, unique procedures will be fixed for the management, processing and archive of the gathered information with the purpose to secure information and availability to any subsequent revision.

4.4 Baseline Emissions

Estimation of carbon stock and changes per stratum

Carbon stocks of the forest

The equation used to calculate the carbon stocks in the forest strata is:

$$C_{BSL} = C_{AB_tree,i} + C_{BB_tree,i} + C_{AB_non\text{-}tree,i} + C_{BB_non\text{-}tree,i} + C_{DW,i} + C_{LI,i} + C_{SOC,i}$$

Where:

C_{BSL}	Carbon stock in all carbon pools in forest stratum *i*; t CO_2-e ha^{-1}
$C_{AB_tree,i}$	Carbon stock in aboveground tree biomass in forest stratum *i*; t CO_2-e ha^{-1}
$C_{BB_tree,i}$	Carbon stock in belowground tree biomass in forest stratum *i*; t CO_2-e ha^{-1}
$C_{AB_non\text{-}tree,i}$	Carbon stock in aboveground non-tree biomass in forest stratum *i*; t CO_2-e ha^{-1}
$C_{BB_non\text{-}tree,i}$	Carbon stock in belowground non-tree biomass in forest stratum *i*; t CO_2-e ha^{-1}
$C_{DW,i}$	Carbon stock in dead wood in stratum *i*; t CO_2-e ha^{-1}
$C_{LI,i}$	Carbon stock in litter in the forest stratum *i*; t CO_2-e ha^{-1}
$C_{SOC,i}$	Carbon stock in soil organic carbon in the forest stratum *i*; t CO_2-e ha^{-1}
i	1,2,3,.... *M* strata

Table 8. Carbon stocks for each stratum are presented in following table.

n °	*ID*	Name	*Above Ground* t CO_2 -e ha^{-1}	*Below Ground* t CO_2 -e ha^{-1}	*Cstock* t CO_2 -e ha^{-1}
001	BTI	Flooded terraces forest	314.39	75.45	389.84
002	PA	Swamp tres	749.38	179.85	929.23
003	BPT	High and mid terrace with bamboo (paca) forest	402.93	96.70	499.63
004	BT	Terraces forest	761.48	182.76	944.24
005	P	Bamboos (Pacal)	608.06	145.93	753.99
006	BCB	Low hills forest	822.93	197.50	1020.43
007	BPCB	Low hills with bamboo (paca) forest	365.85	87.80	453.65

The carbon stocks have been obtained from the forest inventory applied to the project area strata during validation period.

Estimation of post-deforestation carbon stocks

To establish the carbon stocks for each post-deforestation land use, information from several studies[8] made in the Peruvian Amazon was gathered and compared. We also checked the information provided in the Agricultural National Census of 2007, and based on the cultivated area of each crop (table 33), we established that the main crops of the region were Rice and Corn (preferred for having more carbon stock), and that the most common pasture was *Brachiaria decumbens.*

The following values were determined for each land use class:

Table 9. Carbon stocks per activity.

n °	*ID*	Name	*Above Ground* t CO_2-e ha^{-1}	*Below Ground* t CO_2-e ha^{-1}	*Cstock* t CO_2-e ha^{-1}
008	DP	Deforestation for Pastures	15.11	3.52	18.63
009	DF	Deforestation for Farming*	28.82	2.93	31.75
010	DI	Deforestation for Infrastructure	0.00	0.00	0.00
011	DA	Deforestation for Agriculture (Corn)	28.82	2.93	31.75
012	DM	Deforestation for Illegal Mining	0.00	0.00	0.00

Estimation of the sum of baseline carbon stock changes

Based on land use change from initial forest strata to final post-deforestation land uses, and considering the changes in respective stocks, we estimated the total change in carbon stocks for the reference period of the Project Area and Leakage Belt. In both cases, no timber harvest is carried out in the process of deforestation and therefore C_{wp} was not accounted.

The equations used for that end are:

$$\Delta C_{TOT} = C_{BSL} - C_{post} - C_{wp}$$
$$C_{BSL} = \sum\sum ((C_{BSL,i)} * A_{unplanned,i,t})$$
$$C_{post} = \sum\sum ((C_{post,i)} * A_{unplanned,i,t})$$

Where:

ΔC_{TOT}	Sum of the baseline carbon stock change in all pools up to time *t**; t CO_2-e
C_{BSL}	Total forest carbon stock in areas deforested; t CO_2-e
C_{post}	Total post-deforestation carbon stock in areas deforested; t CO_2-e
C_{wp}	Total carbon stock in harvested wood products; t CO_2-e
$C_{BSL,i}$	Carbon stock in all carbon pools in the forest stratum *i*; t CO_2-e
$A_{unplanned,i,t}$	Area of unplanned deforestation in forest stratum *i* at time *t*; ha
$C_{post,i}$	Carbon stock in all carbon pools in the post-deforestation stratum *i*; t CO_2-e
$A_{unplanned,i,t}$	Area of unplanned deforestation in post-deforestation stratum *i* at time *t*; ha
t	1,2,3,... *t* years elapsed since the projected start of the REDD project activity
I	1,2,3, ... *M* strata

The results for all the years in the baseline period are presented in the following tables for Project Area and Leakage Belt. Considering only the 230 Brazil nut harvesters that are part of this verification period, the baseline projections (in hectares and in tCO2e) per stratum are in following table. This is obtained by cutting the baseline maps per year with the 2013-2014 project area (only the 230 BN harvesters).

Table 10. Total Forest Carbon stock in areas deforested in Project Area

Carbon stock changes in initial (pre-deforestation) forest classes in Project Area															Total C stock change in initial forests	
Strata i	BTI		PA		BPT		BT		P		BCB		BPCB		Cumulative	Annual
Year	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	Ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	t CO_2-e	t CO_2-e
2013	15	5,699	145	134,438	484	241,790	7,101	6,704,781	56	42,570	223	227,365	591	268,250	7,624,893	1,405,201
2014	15	5,699	180	167,228	576	287,630	8,344	7,879,045	70	52,832	247	251,542	707	320,848	8,964,824	1,339,931

Based on the percentage calculated and used during validation of the share of each post-deforestation land use, the total deforested area is allocated between the different post-deforestation strata every year and, with the carbon stocks of each post-deforestation land use, the total post deforestation carbon stock in deforested areas in Project Area is obtained:

Table 11. Total post-deforestation carbon stock in areas deforested in Project Area

Carbon stock changes in final (post-deforestation) non forest classes in Project Area												Total C stock change in final post-deforestation classes	
Strata f		Deforestation for Pastures		Deforestation for Farming*		Deforestation for Agriculture (Corn)		Deforestation for Infrastructure		Deforestation for Illegal Mining		Cumulative	Annual
t	Year	Ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	t CO_2-e	t CO_2-e
4	2013	4,461	83,110	3,360	106,695	280	8,892	200	-	312	-	198,696	37,602
5	2014	5,250	97,812	3,955	125,569	330	10,464	235	-	367	-	233,845	35,149

So, the net baseline carbon stock change in Project Area is obtained by discounting the carbon stocks in post-deforestation classes from carbon stocks in initial forest classes in baseline scenario only in the 2013-2014 Project Area (i.e. the 230 BN harvesters area).

Table 12. Sum of the baseline carbon stock change in all pools in Project Area

Classes		Total C stock change in initial forests		Total C stock change in final post-deforestation classes		Total baseline carbon stock change in Project Area	
		cumulative	annual	cumulative	annual	annual	Cumulative
t	Year	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	tCO_2-e	tCO_2-e
4	2013	7,624,893	1,405,201	198,696	37,602	1,367,599	7,426,197
5	2014	8,964,824	1,339,931	233,845	35,149	1,304,782	8,730,979

The same procedure is followed for the Leakage Belt but remaining that the Leakage Belt area in this verification period contains all the Brazil nut concessions that have not been included in the Project Area, including the 175 BN concessionaries that are part of the REDD+ project but that were excluded for this verification because they did logging during the current verification period.

Table 13. Total Forest Carbon stock in areas deforested in Leakage Belt

Carbon stock changes in initial (pre-deforestation) forest classes in Leakage Belt															Total C stock change in initial forests	
Strata i	BTI		PA		BPT		BT		P		BCB		BPCB		Cumulative	Annual
Year	ha	t CO_2-e	Ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	t CO_2-e	t CO_2-e
2013	775	302,051	2,650	2,462,513	998	498,441	24,788	23,405,805	262	197,266	397	405,347	1,411	640,324	27,911,747	5,290,285
2014	901	351,182	3,119	2,898,148	1,187	593,142	29,273	27,640,203	358	270,243	477	487,137	1,773	804,292	33,044,347	5,132,600

Table 14. Total post-deforestation carbon stock in areas deforested in Leakage Belt

Carbon stock changes in final (post-deforestation) non forest classes in Leakage Belt												Total C stock change in final post-deforestation classes	
Strata f		Deforestation for Pastures		Deforestation for Farming*		Deforestation for Agriculture (Corn)		Deforestation for Infrastructure		Deforestation for Illegal Mining		Cumulative	Annual
t	Year	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	ha	t CO_2-e	t CO_2-e	t CO_2-e
4	2013	16,199	301,785	12,202	387,426	1,017	32,287	726	-	1,132	-	721,498	138,781
5	2014	19,206	357,811	14,468	459,351	1,206	38,281	861	-	1,343	-	855,443	133,945

Table 15. Sum of the baseline carbon stock change in all pools in Leakage Belt

Classes		Total C stock change in initial forests		Total C stock change in final post-deforestation classes		Total baseline carbon stock change in Leakage Belt	
		Cumulative	Annual	Cumulative	Annual	Annual	Cumulative
t	Year	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e	tCO_2-e	tCO_2-e
4	2013	27,911,747	5,290,285	721,498	138,781	5,151,503	27,190,249
5	2014	33,044,347	5,132,600	855,443	133,945	4,998,656	32,188,905

Estimation of the sum of baseline greenhouse gas emissions

The emissions of GHG as a consequence of deforestation activities within the project area in baseline, are determined according to module by the sum of CO_2 emissions of the combustion of fossil fuel by

stratum each year, the greenhouse gas emissions different to CO_2 by biomass burnt by stratum per year and the direct emissions of N_2O by application of nitrogen within the project area.

$$GHG_{BSL,E} = \sum\sum (E_{FC,i,t} + E_{BiomassBurn,i,t} + N_2O_{direct\text{-}N,i,t})$$

Where:

$GHG_{BSL,E}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline; t CO_2-e
$E_{FC,i,t}$	CO_2 emission from fossil fuel combustion in stratum *i* in year *t*; t CO_2-e
$E_{BiomassBurn,i,t}$	Non- CO_2 emissions due to biomass burning as part of deforestation activities in stratum *I* in year *t*; t CO_2-e
$N_2O_{direct\text{-}N,i,t}$	Direct N_2O emissions as a result of nitrogen application on the alternative land use within the project boundary in stratum *i* in year *t*, t CO_2-e

Emissions of CO_2 by combustion of fossil fuel

The estimation of CO_2 by combustion of fossil fuel, according to module E-FFC is optional. However, its quantification is proposed if CO_2 emissions of combustion of fossil fuel with project are larger than the estimated emissions in baseline.

There is no information about the number of machinery, equipment, trucks, etc. that would be incorporated annually as a consequence of agriculture or farming activities during baseline (after deforestation) in the project area. In the other hand, there is strong evidence that these activities are carried in self-consumption/ small-scale way[9], which is supposed to minimally use fuel consuming' machinery. Therefore, it was decided not to measure the variable. This is a conservative approach. Likewise, the module indicates that fossil fuel is an optional source of emission.

Emissions of N_2O due to nitrogen application

No application of fertilizers is supposed in the post-deforestation activities given their traditional management.

With those assumptions, and the hectares of deforested area per stratum and the deforested area converted to agriculture, we obtain the following non-CO2 emissions:

Table 16. GHG Emissions (CH_4 and N_2O) due to forest burning in Project Area as part of deforestation activities

		GHG emissions due to biomass burning in forest strata as part of deforestation activities inside Project Area											
		Biomass Burnt per Forest Strata = Area (ha) x 0.55*** x AG biomass (t/ha)								Total GHG Emissions			
Strata i		BTI	PA	BPT	BT	P	BCB	BPCB	Total	CH_4		N_2O	
AG Biomass t/ha		174.99	417.09	224.27	423.83	338.44	458.03	203.63	Cumulative	Cumulative	Annual	Cumulative	Annual
T	Year	t	t	T	T	t	t	t	t	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
4	2013	1,407	33,189	59,692	1,655,229	10,509	56,130	66,224	1,882,380	134,402	24,769	58,354	10,754
5	2014	1,407	41,284	71,008	1,945,123	13,043	62,099	79,209	2,213,173	158,021	23,619	68,608	10,255

Table 17. GHG emissions (CH_4 and N_2O) due to biomass burn in agriculture in Project Area

GHGs Emissions from Biomass Burning (from Agricultural wastes) in Project Area						
		Burnt Areas*	CH_4		N_2O	
			Cumulative	Annual	Cumulative	Annual
T	Year	ha	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e
4	2013	280.0	212.44	40.20	81.30	15.39
5	2014	329.6	250.02	37.58	95.69	14.38

These are the expected emissions in the baseline scenario for the current verification area from biomass burning in the forest area and in the agriculture post-deforestation area. They will be summed to estimate the total net baseline emissions for the current verification area.

Calculation of net emissions

The previous calculations are summarized with the following equations:

$$\Delta C_{BSL,unplanned} = \Delta C_{BSL,PA,unplanned} + GHG_{BSL,E}$$
$$\Delta C_{BSL,PA,unplanned} = \Delta C_{TOT,PA}$$
$$\Delta C_{BSL,LK,unplanned} = \Delta C_{TOT,LB}$$

Where:

$\Delta C_{BSL,unplanned}$	Net greenhouse gas emissions in the baseline from unplanned deforestation; t CO_2-e
$\Delta C_{BSL,PA,unplanned}$	Net CO_2 emissions in the baseline from unplanned deforestation in the project area; t CO_2-e
$\Delta C_{BSL,LK,unplanned}$	Net CO_2 emissions in the baseline from unplanned deforestation in the leakage belt ; t CO_2-e

$GHG_{BSL,E}$	Greenhouse gas emissions as a result of deforestation activities within the project boundary in the baseline; t CO_2-e
$\Delta C_{TOT,PA}$	Sum of the baseline carbon stock change in all pools up to time *t**in the project area, t CO_2-e
$\Delta C_{TOT,LB}$	Sum of the baseline carbon stock change in all pools up to time *t**in the leakage belt, t CO_2-e

The total net GHG emissions in the Project Area in the baseline from unplanned deforestation are 8,957,953.94 t CO_2-e (monitoring period)

For Leakage Belt, the values found for $\Delta C_{BSL,LK,unplanned}$ will be used in LK-ASU module for subsequent calculations.

The Final result for the emissions in Project Area can be seen in the next table:

Table 18. Net GHG Emissions in the Baseline from Unplanned Deforestation Cumulative.

T	Year	Total Sum of carbon stock change in baseline (t CO_2) $\Delta C_{BSL,PA,unplanned}$	Greenhouse Gas Emissions in the Project Area in baseline (t CO_2 -e) $GHG_{BSL,E}$	Net GHG Emissions in the Baseline from Unplanned Deforestation Cumulative (t CO_2 -e) $\Delta C_{BSL,unplanned}$
4	2013	7,426,196.96	193,049.43	7,619,246.39
5	2014	8,730,979.37	226,974.57	8,957,953.94

In this table we can see the GHG emissions reductions per year in the project area, thus, showing the impact this project has in Madre de Dios. Without the project activity, the cumulative CO2 in the area would have been 7,619,246.39 for 2013 and 8,957,953.94 t CO2 e for 2014, a total amount of 2,741,885.01 t CO2 e could have been emitted.

It must be remained that future deforestation will be monitored permanently following the procedures described in M-MON module, which follows the technical parameters that have been used by IIAP during the preparation of historic reference period maps. These results will be compared with deforested areas in baseline scenario to calculate the real net emission reductions generated by the project.

Spreadsheet used: "Castañeros REDD Project Calculations MODIFIED 2013-2014"

4.5 Project Emissions

$$\Delta C_P = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(\Delta C_{P,DefPA,i,t} + \Delta C_{P,Deg,i,t} + \Delta C_{P,DistPA,i,t} + GHG_{P-E,i,t} - \Delta C_{P,Enh,i,t} \right)$$

Table 19. Project emissions per stratum.

Stratum	*CpDef,PA,i,t*	*Cpdeg,PA,i,t*	*CpDist,PA,i,t*	*GHGp-e,i,t*	*Cp,Enh,i,t*	TOTAL
BTI	-	-	-	-	-	-
PA	8,615.82	-	-	420.09	-	9,035.91
BPT	1,684.38	-	-	86.45	-	1,770.83
BT	104,457.68	-	-	5,013.38	-	109,471.06
P	-	-	-	-	-	-
BCB	-	-	-	-	-	-
BPCB	11,404.07	-	-	591.97	-	11,996.03
Total	**126,161.94**	**-**	-	**6,111.89**	-	**132,273.83**

Source: Self–made
Spreadsheet *"Castañeros REDD Project Calculations MODIFIED 2013-2014*

In the case of deforestation, the methodology establishes that the same procedure followed above is applicable, estimating the real deforested area per stratum.

4.6 Leakage

$$\Delta C_{P,DefLB,i,t} = \sum_{u=1}^{U} \left(A_{DefLB,u,i,t} * \Delta C_{pools,P,Def,u,i,t} \right)$$

First, we processed satellite image to obtain and locate deforested in areas by stratum and determine the type of activity that has been established after deforestation: In the Leakage Belt, results are below:

Table 20. Deforested area in Leakage Belt during the monitoring period.

AdefLB,u,i,t						
U / i	Pastures (8)	farming (9)	Infraestructure (10)	Agriculture (11)	Secundary Forest (12)	TOTAL
Flooded terraces forest (1)	-	66.87	-	81.56	-	**148.43**
Swamp trees (2)	-	-	3.29	32.38	-	**35.67**
High and mid terrace with bamboo (paca) forest (3)	-	-	-	179.21	-	**179.21**
Terraces forest (4)	134.96	29.91	114.75	210.28	0.06	**489.96**

Bamboos (Pacal) (5)	-	-	-	-	-	-
Low hills forest (6)	-	-	-	15.76	-	15.76
Low hills with bamboo (paca) forest (7)	91.28	-	-	38.13	-	129.41
TOTAL	226.24	96.78	118.04	557.32	0.06	998.44

All the deforested data collected by satellite analysis were put by stratum and crossed with the activity that caused it. This was extracted from the spreadsheet Leakage estimations BAM 2013 – 2014.xls

In the following table, we discount the carbon stock in the post-deforestation stratum from the carbon stock in the pre-deforestation stratum. We produced a matrix as follows:

Table 21. Carbon pools per stratum

ΔCpools,P,Def,u,i,t (CO2/ha)					
u / i	Pastures (8)	farming (9)	Infraestructure (10)	Agriculture (11)	Secundary Forest (12)
Flooded terraces forest (1)	371.21	358.09	389.84	358.09	311.08
Swamp trees (2)	910.60	897.48	929.23	897.48	850.47
High and mid terrace with bamboo (paca) forest (3)	481.00	467.88	499.63	467.88	420.87
Terraces forest (4)	925.61	912.49	944.24	912.49	865.48
Bamboos (Pacal) (5)	735.36	722.24	753.99	722.24	675.23
Low hills forest (6)	1001.80	988.68	1020.43	988.68	941.67
Low hills with bamboo (paca) forest (7)	435.02	421.90	453.65	421.90	374.89

Here, we crossed the carbon pools per stratum with the activity that is taking place. This was extracted from the spreadsheet Leakage estimations BAM 2013 – 2014.xls

By multiplying the hectares of land change by the net loss of carbon stock per hectare in each cell of the matrix, we obtain the following emissions in the leakage belt area.

Table 22. Net carbon stock change as a result of deforestation is equal to the area deforested multiplied by the emission per unit area.

Period 2013 - 2014			
Stratum i,u	*Adef,LB,u,i,t*	*ΔCpools,P,Def,u,i,t*	ΔCp,defLB,i,t
	ha	t CO2/ha	t CO2
1,8	-	371.21	-
1,9	66.87	358.09	23,945.72
1,10	-	389.84	-
1,11	81.56	358.09	29,206.11
1,12	-	311.08	-
2,8	-	910.60	-

2,9	-	897.48	-
2,10	3.29	929.23	3,057.17
2,11	32.38	897.48	29,060.44
2,12	-	850.47	-
3,8	-	481.00	-
3,9	-	467.88	-
3,10	-	499.63	-
3,11	179.21	467.88	83,849.35
3,12	-	420.87	-
4,8	134.96	925.61	124,919.68
4,9	29.91	912.49	27,292.43
4,10	114.75	944.24	108,350.99
4,11	210.28	912.49	191,877.39
4,12	0.06	865.48	51.93
5,8	-	735.36	-
5,9	-	722.24	-
5,10	-	753.99	-
5,11	-	722.24	-
5,12	-	675.23	-
6,8	-	1,001.80	-
6,9	-	988.68	-
6,10	-	1,020.43	-
6,11	15.76	988.68	15,581.65
6,12	-	941.67	-
7,8	91.28	435.02	39,708.99
7,9	-	421.90	-
7,10	-	453.65	-
7,11	38.13	421.90	16,087.20
7,12	-	374.89	-
	998.44		**692,989.05**

As showed in Table 20, by multiplying a deforested area in a determined stratum with its related carbon pool, we obtained the net carbon stock change, resulting in 692,989.05 t CO_2e.

Net CO_2 emissions due to unplanned deforestation displaced from the project area to leakage belt

$$\Delta C_{LK-ASU-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned}$$

Table 23. Net CO_2 emissions from PA to LB.

$\Delta C_{P,LB}$	$\Delta C_{BSL,LK-unplanned}$	$\Delta C_{LK-ASU-LB}$
692,989.05	10,150,158.81	-

With the difference between the projected deforestation with the real deforestation we obtained the net CO_2 emissions and, according to module LK-ASU, when it is less than 0, it must be set as 0.

Net CO_2 emissions due to unplanned deforestation displaced outside the leakage belt

$$\Delta C_{LK-ASU,OLB} = PROP_{CS} * (\sum_{t=1}^{t^*} A_{LK-OLB,t})$$

As a first step, we need to calculate $A_{LK-OLB,t}$:

$$A_{LK-OLB,t} = A_{LK-IMM,t} - A_{LK-ACT-IMM,t}$$

$A_{LK-IMM,t}$			$A_{LK-ACT-IMM,t}$				$\Delta A_{LK-OLB,t}$	$\Delta C_{LK-ASU,OLB}$
$PROP_{IMM}$	**$A_{BSL,PA-unplanned,t}$**	**Total 1**	**$PROP_{IMM}$**	**$A_{Def,PA-i,t}$**	**$A_{Def,LB-i,t}$**	**Total 2**		
from Step 2 LK-ASU	Baseline estimations	Eq 7 LK-ASU	from Step 2 LK-ASU	from M-MON	from M-MON	Eq 8 LK-ASU	Eq 9 LK-ASU	Eq 10 LK-ASU
0.05	3,154.15	164.56	0.05	154.37	998.44	60.15	104.42	75.01

The $PROP_{IMM}$ comes from the spreadsheet Encuestas data.xls, while the expected baseline deforestation in the monitoring period was extracted from the spreadsheet Castañeros REDD Project Caltulations MODIFIED_2013-2014.xls. Both values need to by multiply and resulted in 164.56, according to equation 7 LK-ASU, to get $A_{LK-IMM,t}$

Then, we used equation 8 (LK-ASU) to obtain ALK-ACT-IMM,t by multiply $PROP_{IMM}$ with the sum of $A_{Def,PA-i,t}$ and $A_{Def,LB-i,t}$, obtaining 60.15.

Finally, the difference between $A_{LK-IMM,t}$ and ALK-ACT-IMM,t resulted in $\Delta A_{LK-OLB,t}$, which was 365.35.

After that, according to equation 4 of LK-ASU, we calculated $PROP_{CS}$

$PROP_{CS}$ (Eq 4 LK-ASU)		
C_{OLB}	C_{LB}	**Total 3**
379.78	528.68	**0.72**

C_{OLB} is the average stock per ha established in the 2nd Communication on Climate Change. Step 4C of LK-ASU and C_{LB} is the weighted average is the AG biomass (t CO2/ha) per stratum in Leakage Belt.

With the division of C_{OLB} and C_{LB} we obtained 0.72.

Then, $\Delta C_{LK-ASU,OLB}$ was the multiplication of $PROP_{CS}$ and ΔALK-OLB,t resulting in 75.01.

Greenhouse gas emissions as a result of leakage of avoided deforestation activities

$$GHG_{LK,E} = \sum_{t=1}^{t^*} \sum_{i=1}^{M} \left(E_{BiomassBurn,i,t} + N_2O_{direct-N,i,t} \right)$$

There are no GHG emissions in LB because no leakage prevention activities were done.

Net greenhouse gas emissions due to activity shifting leakage for projects preventing unplanned deforestation Net CO_2 emissions

$$\Delta C_{LK\text{-}AS,unplanned} = \Delta C_{LK\text{-}ASU\text{-}LB} + \Delta C_{LK\text{-}ASU\text{-}OLB} + GHG_{LK,E}$$

$\Delta C_{LK\text{-}ASU\text{-}LB}$	$\Delta C_{LK\text{-}ASU,OLB}$	$GHG_{LK,E}$	$\Delta C_{LK\text{-}AS,unplanned}$
-	75.01	-	**75.01**

This is the result of the net GHG emissions due to activity shifting leakage for the project. No emissions were displaced from the project area to leakage belt and no GHG emissions as a result of leakage avoided deforestation.

4.7 Net GHG Emission Reductions and Removals

Table 24. Emissions and removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation	VCUs eligible for issuance
2013 – 2014	2,741,885.01	132,273.83	75.01	2,488,825.11	339,249.45	2,149,575.66

Source: Self–made

Spreadsheets "VCU Estimations 2013-2014".

While the resulting degradation from the PRA resulted in 1.38% if compared to the total hectares, it was not discounted from the total emissions.

According to M-MON, if degradation results less than 5% of the total emissions it would be considered not significant, so it would not be discounted from the Net GHG emissions reductions,

so, after all calculations, the emissions went from an initial 2,741,885.01 to 132,273.83 t CO_2 e and, after the uncertainty and risk buffer, the net GHG emission reductions were 2,149,575.66 t CO_2 e.

APPENDIX X: TECHNICAL DOCUMENTS

1. *BAM Monitoring Report 2013-2014*
2. *Non permanence Risk Report*
3. *Castañeros REDD Project Calculations 2013-2014*
4. *Cp estimations in Castañeros REDD Project 2nd monitoring report*
5. *Encuestas Data*
6. *Leakage estimations in BAM 2013-2014*
7. *Nuevas áreas y estratos 2da verificación*
8. *VCUs estimations 2013-2014*

Files repository:

https://1drv.ms/u/s!AmjfuqLva5QCmHDo8vhjP9slqEv7?e=3z3tld