

MADRE DE DIOS AMAZON REDD PROJECT

MONITORING REPORT



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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Madre de Dios Amazon REDD Project is a project whose proposed activity is to avoid unplanned deforestation of forests that are managed sustainably by the certified timber concessions “Maderera Rio Acre SAC “ and “Maderera Rio Yaverija SAC “, in the department of Madre de Dios, southeastern Peru, in the Peruvian Amazon.

Both companies have signed concession contracts with the Peruvian Government, renewable for 40 years (for a total of 80 years of contract); in May 2002 for an area of 98,932.0 hectares (49,376.0 Maderacre and 49,556.0 Maderyja). These contracts explicitly give legal rights over both areas under concession, and all the environmental services included in them. There are no current or future land-use conflicts, nor are there people living within the concession boundaries. According to the Final Verification Report of the Project under CCBA performed by SCS, Maderyja and Maderacre have exclusive rights to environmental services within the project area, including forest carbon.

The project area is located within 30 km of the South Inter-Oceanic Highway (IOH), linking Brazil with the Peruvian ports, in the Amazon region that belongs to the Vilcabamba – Amboró Corridor, one of the world’s biodiversity hotspots. The presence of the IOH is a major risk. Until its paving, Madre de Dios was an isolated region, more integrated with Brazil than with the rest of the country. To get to the nearest city, Cuzco, people had to travel two to three days, which has been reduced to only about 14 hours. This facilitates the immigration of new settlers, mainly from rural Andean areas, and the establishment of economic activities not compatible with the forest that are consequently practiced, such as slash-and-burn agriculture, cattle ranching in poor pastures, etc. Deforestation and forest degradation are the result of these activities. Similar effects are already visible in Brazil, where the Trans-Amazon Highway was completed some time ago.

In this sense, it is necessary to consolidate the sustainable management of the area, as is the case of concessions for harvesting of timber and non-timber resources, private conservation areas and protected natural areas.

The project aims to reduce land pressure in the project area and its buffer zone, to ensure sustainable forest management of both timber concessions, and to improve the living conditions of local communities through implementation of an avoided deforestation project to help generate more resources for the management of the area.

The project started on January 1, 2009, when the validation process was completed under the Climate, Community and Biodiversity Project Design Standards (CCB), thus ensuring social and environmental sustainability of the proposal. This is reinforced by the obtention of the Gold Level of the standard. As a complement, the project was also validated under the Verified Carbon Standard (VCS) on September 20, 2012, subsequently completing the verification of 2009-2012 on 21 May 2013, and afterwards achieving the verification of 2013 on 30 July 2014.

The Total emissions avoided by the project during the verification period January- December 2014, according to calculations, was 823,951.82 t CO₂-e. **And during the period 2015 was 459,479 t CO₂-e**

1.2 Sectoral Scope and Project Type

According to VCS categories, the Madre de Dios Amazon REDD Project falls under the sectoral scope 14 Agriculture, Forestry and Other Land Use, and according to the VCS AFOLU Requirements it falls under the definition of Reduced Emissions from Deforestation and Degradation (REDD), specifically under Avoiding Unplanned Deforestation and Degradation (AUDD). This is: the Project is proposing activities to reduce net GHG emissions by stopping deforestation and/or degradation of degraded to mature forests that would have occurred in any forest configuration, as a result of socio-economic forces that promote alternative uses of forest land and because of the inability of institutions to control these activities, etc. In addition, the project occurs in a frontier configuration regarding as the deforestation/degradation is caused by the expansion of roads and other infrastructure into forest lands, which improves forest access and leads to an increase of encroachment by human populations, to do subsistence farming and fuel wood gathering on previously inaccessible forest lands.

In addition to this and as required by the REDD-MF Module of the applied REDD Methodology Modules, the following decision tree was used to identify the type of VCS-eligible REDD project activity:

Is the forest land expected to be converted to non-forest land in the baseline case?			
YES ⁸		NO	
Is the land legally authorized and documented to be converted to non-forest?		Is the forest expected to degrade by fuelwood extraction or charcoal production, in the baseline case	
YES ⁹	NO	YES	NO
Avoided planned deforestation	Avoided unplanned deforestation	Avoided forest degradation	Proposed project is not a VCS REDD ¹⁰ activity currently covered by the module framework

This project is not a grouped project.

1.3 Project Proponent

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2.3

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1.4 Other Entities Involved in the Project

N/A

1.5 Project Start Date

The project activities started to be implemented on 1st January 2009. By the end of March 2008, an agreement was signed between Greenox NGO and both concessions to implement the REDD Project. The project started to be effectively implemented in 2009, with the design of social plans, biodiversity studies, specific modeling and monitoring activities required for the achievement of validation according to the CCB Standard (Climate, Community and Biodiversity).

Said validation was obtained by the end of 2009, with Gold Level qualification. This date coincides also with the completion of the pavement of the Inter Oceanic Highway, a fact that completely changed the dynamic of deforestation in the area, In terms of impact, the Inter Oceanic Highway has greatly intensified the risk of deforestation and therefore the measures that project proponents have to implement to be able to combat said risk.

1.6 Project Crediting Period

Crediting period start date: 1 January 2009.

Crediting period end date: 31 December 2046.

Project crediting period: 38 years.

1.7 Project Location

The project is located in the hydrographic basin of the Acre River, Iñapari district, Tahuamanu province in the Madre de Dios department, South East of Peru, in the Peruvian Amazon, in the boundary with Bolivia and Brazil.

The area is located 28 km to the side of the new inter-oceanic road that joins Brazil with the Peruvian ports, in the region that belongs to the Vilcabamba-Amboró Conservation Corridor in the Peruvian Amazon, one of the world biodiversity hotspots.

The following figures show the location of the Madre de Dios Amazon REDD Project.



Fig. 1: General location of the Madre de Dios Amazon REDD Project

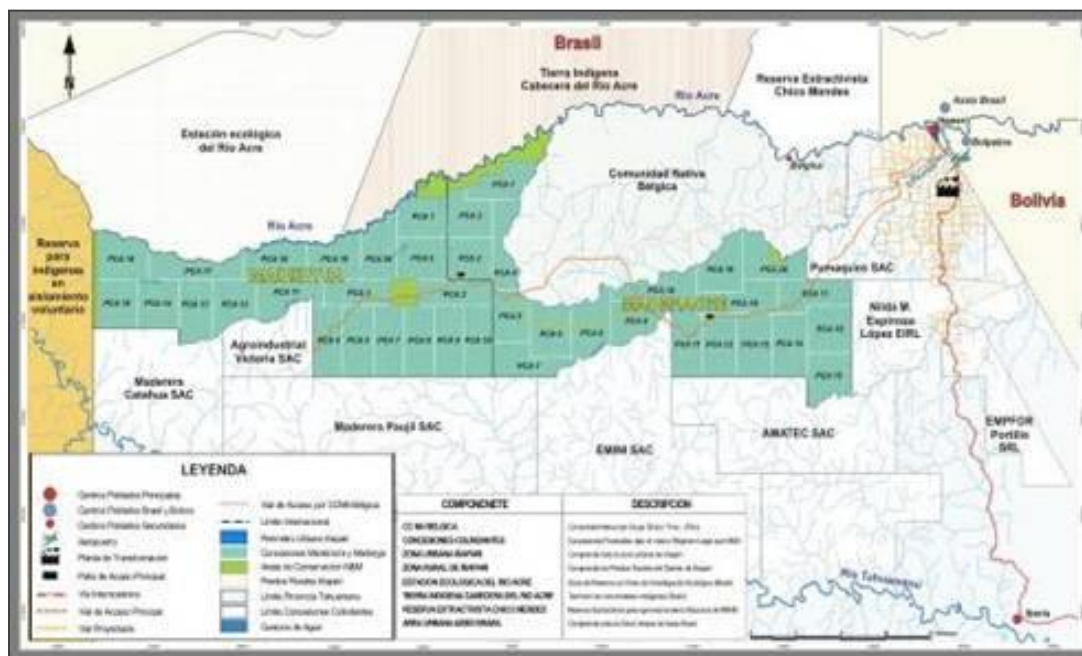


Fig. 2: Location of the Madre de Dios Amazon REDD Project and its limits

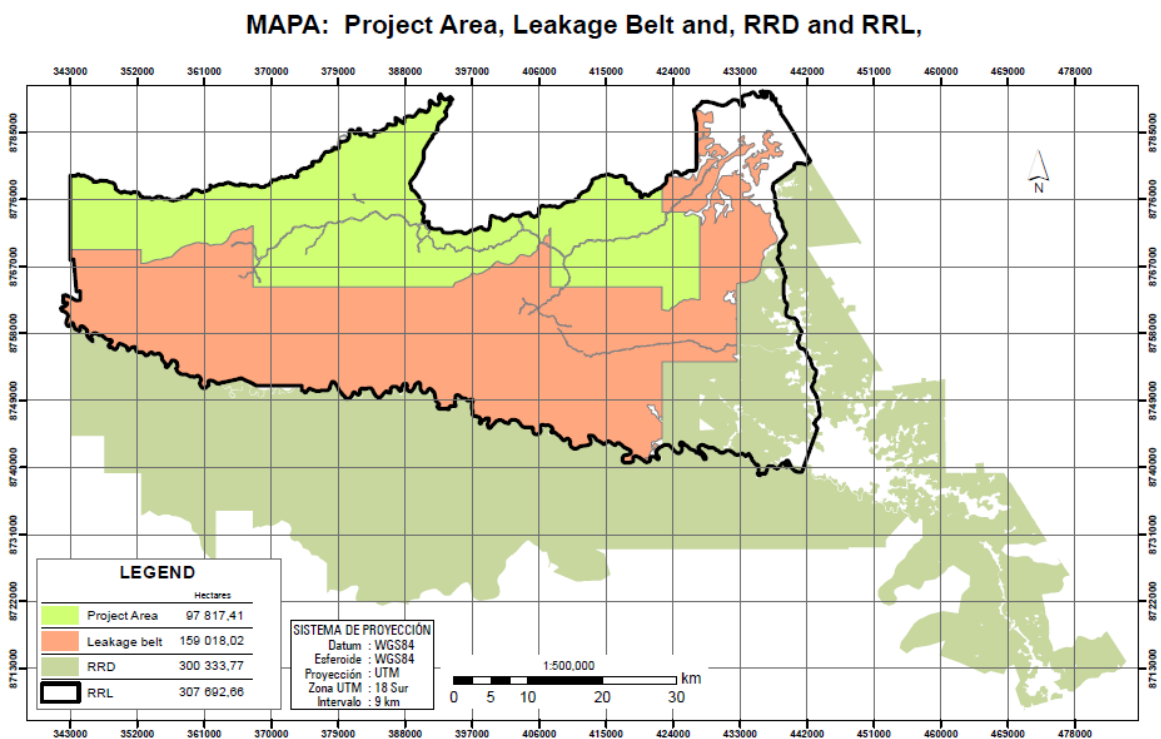


Fig. 3: Map of the Project Boundaries

In the following chart, the GPS coordinates of each polygon vertex is presented:

Chart 1: Polygon vertexes of the project area

Vertex	East	North
1	438521	8787582
2	446766	8774269
3	432562	8764691
4	432562	8754249
5	422557	8754249
6	422557	8746086
7	420910	8740962
8	322540	8777024
9	323813	8783623
10	333038	8790865

Total area of project, leakage belt and reference region:

Chart 2: Project Area, Leakage Belt and Reference Regions

Type	TOTAL
PA	97,817.41
LB	159,018.02
RRL	307,692.66
RRD	300,333.77

The determination of the regions detailed above was carried out taking into account the requirements of the BL-UP Module of the REDD Methodology Modules. See BL-UP module for a detailed description and explanation of the project area, leakage belt and project zone determination.

1.8 Title and Reference of Methodology

AFOLU Requirements: VCS Version 3.5

Methodology Information:

- Approved VCS Methodology VM0007
- REDD Methodology Modules (REDD-MF)
- Version 1.2
- Developed by Avoided Deforestation Partners

Modules Information:

- Estimation of carbon stocks in the above- and belowground biomass in live tree and non-tree pools (CP-AB), v1.0
- Estimation of carbon stocks in the long-term wood products pool (CP-W), v1.0

- Estimation of baseline carbon stock changes and greenhouse gas emissions from unplanned deforestation (BL-UP), v2.0
- Estimation of emissions from activity shifting for avoided unplanned deforestation (LK-ASU), v1.0
- Estimation of greenhouse gas emissions from biomass burning (E-BB), v1.0
- Estimation of emissions from fossil fuel combustion (E-FFC), v1.0
- Methods for monitoring of greenhouse gas emissions and removals (M-MON), v2.1
- Methods for stratification of the project area (X-STR), v1.0
- Estimation of uncertainty for REDD project activities (X-UNC), v2.0

Tools Information:

- Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities (Approved VCS Tool VT001), v1.0
- AFOLU non-permanence risk analysis and buffer determination, v3.3
- Tool for testing significance of GHG emissions in A/R CDM project activities (EB_31), v1.0

1.9 Other Programs

N/A

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Project started in January 1st, 2009. This was the year of the CCB Validation (result of a process that began in April 2008) and the year in which the Interoceanic Highway's construction ended.

Nevertheless, Maderacre and Maderyja were established in 2002. Since then, they have managed 100,000 hectares of Forest Concessions. Those forests have been certified under the FSC standards since January 2007. The concessions practice forest management for timber sustainable exploitation. This contributes to reduce the deforestation index in the area, through the custody of the area, executing low impact logging and promoting local population's development.

The project was validated in October 2012. The REDD Project has kept the forest concessions' FSC Certification during the monitoring periods 2009-2012, 2013, 2014 and during the monitoring period 2015, already for 9 years now. The following activities were carried out in the concessions as part of the forest management system:

- Fauna monitoring, with the aim of evaluating the ecosystem's performance after the forest management implementation.
- Monitoring of sample trees growth.
- Monitoring of forest dynamic, structure and composition, using Permanent Monitoring Plots.
- Monitoring of forest natural regeneration capacity, with focus on exploited timber species.
- Identification and monitoring of High Value Conservation Forests Areas, in order to keep them free of timber exploitation.
- Forest management quality control, identifying impacts in terms of deforestation and degradation.

- Custody plan implementation in the concessions: installation of control posts, signalization, patrol routes¹
- Timber chain of custody, in order to assure correct (legal) lumber origin.

All of these activities are needed to assure a good forest management of the area, to renew the FSC certification every year², as well as to implement appropriately the Madre de Dios Amazon REDD Project.

The General Forest Management Plan for both forest concessions have been updated, including the REDD objectives.

The following activities have been carried out in the social area during this monitoring period:

- Implementation of the “environmentally friendly productive projects” Program
- The friendly productive projects with the environment’s Monitoring program³
- Support to Belgica Native Community’s Health and Education Program⁴
- Support to Community in general.

¹ “Maderacre and Maderyja Custody Plan”, 2015

² FSC Certificates: SW-FM/COC-002175 for Maderyja SAC and SW-FM/COC-002176 for Maderacre SAC

³ Environmentally friendly Projects implementation Report, 2015

⁴ Support to Belgica Native Community is registered by Support acts signed by the Community’s President

Chart 3: Monitoring of REDD Project's Objectives

Objective	Activity	Monitoring
1) Contribute to the sustainable development of rural producers living in the buffer zone of the project	Socialization and dissemination of the project goals	The Project has done the following dissemination's activities: • REDD Project and Environmentally friendly Projects Contest Presentation to the Community in general (January 2015) • REDD Project and Environmentally friendly Projects Contest Presentation in Villa Primavera (January 2015) • REDD Project and Environmentally friendly Projects Contest Presentations in Belgica Native Community (March 2015) • REDD Project Presentation at Social Advisory Committee (March 2015) • REDD Project at Public Meeting for the Start of the Year's Activities at the Forest Concessions (April 2015) • REDD Project Experience Presentation at Environmental Ministry's Biodiversity Day (May, 2015) • REDD Project at Citizen participation workshop (August 2015) • REDD Project Presentation at World Forest Congress (South Africa, September 2015) • Environmentally friendly projects Contest Results Presentation and Next Steps with winners (August, 2015) • Workshop on Climate Change, Greenhouse and Photosynthesis, in Belgica Native Community. (October, 2015) • REDD Project and ANIA NGO Advisory Program to develop Villa Primavera's winner Project (November, 2015) • REDD Project and ANIA NGO Workshop on Enviromental Education in Villa Primavera (November, 2015)

Identification and selection of proposals for the environmentally friendly productive projects	The Project carried out the following activities: a) Mapping of the properties (actors) of influence b) Identification of the most relevant area to work with c) Environmentally Friendly productive Projects' Contest Launch d) Dissemination of the Contest (Belgica Native Community, Villa Primavera and Iñapari) e) Reception of Candidate's Projects f) Environmentally Friendly productive Projects' winners selection g) Communication of results
Development of the skills and capacities of the members of the associations linked to the selected projects	The project carried out the following activities : • Advise for the business plan structure according to each Project winner • Working closely and together with Project winner in order to seek for financing funds • Children's Forest Methodology (TINI) for kids and parents from Comunidad Villa Primavera The skills and capabilities will be developed even more during the implementation phase of the project.
Design of the project profiles of the selected projects	Once the projects were selected, the following activities were carried out for the design of the Projects' profile: - Structured interviews and information collection with each Project proponent, including Belgica Native Community's women and Villa Primavera Community and Forest field visit. - Diagnosis of the real situation of the initiative - Processing and information background of each project in order to understand "Lessons Learned" - Identification of actors involved in the Projects - Synopsis of each Project Currently the profiles of each project have been already developed and some are in the implementation stage.
Look for financing and/or co-financing for the approved profiles	The following actions were taken: - Identification and mapping of potential funds for the selected Projects - Fund raising Research - Approach and presentation of projects to institutions with Funds available - First approach and monitoring to potential funds selected The first fund raised has been for Villa Primavera Community's Project: "I learn and I keep Biodiversity". Results: Aid fund of USD 20,000 from "Fondo de Las Americas" to develop the Project.

	Agreement accomplished with ANIA NGO, which will be in charge of the budget execution and covers the additional funding needed to fulfill the Fund's requirements. ANIA also puts a field assistance and supplies the TINI Methodology (Children's Forest Methodology). The Belgica Native Community Project is been developed in alliance with Planet Urgence. For other Projects, we are working in the documentation needed to apply for Funds from the Govermental Program: Public Investment Program for Strengthening Environmental and Social Management of indirect impacts of the South Interoceanic Highway - Stage II
Support in the implementation of the approved projects	At the report's closing date, 2 of the 4 selected projects were already in first stage of implementation: 1) Bélgica Native Community Handcraft Project Strategic Partner: Planet Urgence Objective: Handcraft's Skills development and business capacity building Activities done: • Meetings and field visits, as well as implementation of trainee programs with the participation of European volunteers experts in design and administration who contributed to build capacity within the native community. • Samples collected to show them to potential organizations interested to support this initiative • Contact with LAN Airline to invite them to support the initiative See Appendix 1 for pictures 2) Villa Primavera Community <i>"I learn and I keep Biodiversity" Project</i> Strategic Partner: ANIA NGO Objective: Establish and consolidate a "Children's Educational Forest" in the Villa Primavera Community, following ANIA's methodology, so that families can include in their life and customs the value of nature and biodiversity. Activities done: Meetings and field visits. Workshop done to create the "Children Educational Forest's" Vision See Appendix 2 for pictures The other 2 Winner Projects are in the stage of desing and looking for strategic allies and funds.

	Monitoring of the projects	The monitoring is done permanently, with a formal report every semester. The monitoring includes the follow up of the following items: - Forest area conserved by project developers. - Activities carried out as part of the presented project. - Interviews with actors involved in the development of the Projects.
2) Reduce the vulnerability of the project area from external factors of deforestation and degradation	Review and update of the custody plan	The forest concessions' custody plan has been reviewed and updated for both concessions, completing the Project's total area
	Installation of control post PCA 5 Maderacre	Up to today, there are 5 control posts installed ⁵ . All of them are operative, even the ones in the buffer zone.
	Delimitation of 100% of the concessions boundaries	Part of the project area has natural boundaries (permanent water courses). Besides this, a 100% of the non natural limits have been marked with pedestrian trails. Annual maintenance is done in sectors of these pedestrian trails.
	Installation of "Hitos" in the concessions vertexes	The "Hitos" were installed in 100% of vertexes by now
	Improve the signaling within the concessions	We have installed signals that inform about the concessions perimeter, access, and that it is prohibited to hunt and fish inside the area. Every year we renew the ones that need it.
	Periodic and annual patrolling within vulnerable sectors ⁶	Patrolling actions to vulnerable sectors identified within the concessions were conducted: 1 land patrol over the limits with forest concessions AMATEC SAC, Isabelita and CORFOREST. Periodic Patrolling in the Tahuamanu River to avoid illegal logging and non-authorized deforestation in the zone. None of the patrolling actions reported the violation of boundaries and there was no evidence of invasion.
	Annual monitoring of possible invasions using satellite images	The report of the analysis of satellite imagery, for this period, does not report the occurrence of invasions within the Madre de Dios Amazon REDD project area. Meanwhile, the patrolling in the areas of highest risk showed no invasion or violation of the boundaries.
	In-field verification of sectors identified as potential points of invasion (due to deforestation)	The report of the analysis of satellite imagery, for this period, does not report the occurrence of invasions within the Madre de Dios Amazon REDD project area.

⁵ The Control Posts keep an Incident Record Book. We have a Training Report for the personnel in charge of the Control Posts (2015).

⁶ Patrolling Report 2015 and River Patrolling Report 2015

	Development and implementation of mechanisms for the dissemination of environmental education among children, adolescents and communities involved in the project	The Project has done the following dissemination's activities with the children and the Community in general: - REDD Project and Environmentally Friendly Projects Contest Presentation to the Community in general (January 2015) - REDD Project and Environmentally Friendly Projects Contest Presentation in Villa Primavera (January 2015) - REDD Project and Environmentally Friendly Projects Contest Presentations in Belgica Native Community (March 2015) - REDD Project Presentation at Social Advisory Committee (March 2015) - REDD Project at Public Meeting for the Start of the Year's Activities at the Forest Concessions (April 2015) - Environmentally Friendly projects Contest Results Presentation and Next Steps with winners (August, 2015) - Workshop on Climate Change, Greenhouse and Photosynthesis, in Belgica Native Community. (October, 2015) - REDD Project and ANIA NGO Advisory Program to develop Villa Primavera's winner Project - REDD Project and ANIA NGO Workshop on Enviromental Education in Villa Primavera The concession has a cooperation agreement with the local school.⁷
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⁷ Maderacre and Iñapari's Low and High School Agreement, 2015

Whereas in the second objective (“Reduce the vulnerability of the project area from external factors of deforestation and degradation”), the Project has also significant improvement. In total, 5 permanent control posts are working:

- 1 located in the access to the Project Area, in the Maderacre Concession
- 1 located in the access to the Project Area, in the Belgica Native Community Sector
- 1 located in the Amatec Concession (buffer zone)
- 2 located in the Tahuamanu River (buffer zone)

It is very important to highlight that there is a very good relationship with Bélgica Native Community.

The following custody activities were carried out:

- Operation of permanent Guard Posts in the concessions’ access.
- Maintenance of pedestrian trails along the concessions non-natural borders.
- Periodic patrol in the non-natural perimeter (through the pedestrian trail).
- Maintenance of Signals in the access to the concessions and in the most relevant sectors
- Financial support for education and health in the Community

Some figures of the social impact measurement:

- Direct impact in Iñapari’s population (1,500 habitants approximately), through direct and indirect employment.
- Local employment is prioritized. In the case of Maderacre concession 45% of the employees are from the Region.
- Direct impact in Belgica Native Community, through support in health and Education
- No conflicts have been registered with the Community
- The generation of trust within the population of Iñapari and communities around them, based on the recognition of the environmentally friendly initiatives and their ability to strengthen the men, women and children through their participation.

Regarding other potential risks apart from illegal presence in the area, the forest concessions have worked in industrial security capabilities, with annual training workshops, including all of its personnel. In the field operations, every camp has an extinguisher, fuel management guides, among other measures taken. Non-fire events have occurred in this monitoring period (neither in the forest concessions registry).

In addition, the Project gives a lot of importance to the continual training of its workers, such as: Industrial Safety, Basic First Aid, Identification and Protection of Forests with High Conservation Values, Wildlife Monitoring, Forestry Certification, Low-impact Harvest, among many other. A very relevant topic for the Project is the “initial approach to intercultural principles and respect to local communities”, in which all employees were formed during the Forest Certification trainings and/or during the introduction trainings when initially hired.

Finally, the Project has made important agreements with national and international universities to do forest research inside the Project area.

Field visits, Meetings, Presentations and Workshops in Villa Primavera Community



Field visits, Meetings, Presentations and Workshops in Bélgica Native Community



Field visits and Meetings to the Touristic Project





As a result of the monitoring work, we obtained the following results for deforestation action inside the Project area or Leakage Belt.

Chart 4: Results on deforestation monitoring

RRL	Types of forest	Area (ha)	Interpretation of deforestation on 2012(ha)	Interpretation of deforestation on 2013(ha)	Interpretation of deforestation on 2014 (ha)	Interpretation of deforestation 2015 (ha)	Total
Types of forest in the leakage belt	Hilly forest	134515.75	1,079.99	-	-	87.28	133,348.48
	Terrace forest	17183.17	1,155.28	-	16.84		16,011.05
	Others	1622.92	3.23	-	-		1,619.69
	Bamboo	3103.45	437.12	-	-		2,666.33
	Tree Swamps	2592.74	17.89	-	-		2,574.85
	TOTAL AREA SIG	159,018.02	2,693.51	-	-		156,324.51
Types of forest in the project area	Hilly forest	79290.19	0.00	-	-		79,290.19
	Terrace forest	9845.75	0.00	-	-		9,845.75
	Others	130.59	0.00	-	-		130.59
	Bamboo	8550.87	0.00	-	-		8,550.87
	TOTAL AREA SIG	97,817.40	0.00	-	-		97,817.40

2.2 Deviations

2.2.1. Methodology Deviations

- a) The VCS Standard states that "The monitoring report describes all the data and information related to the monitoring of GHG emission reductions or removals. In the VCS Monitoring Report Template must use this and adhere to all instructional text within the template."

While employing "VM0007, REDD Methodology Modules (REDD-MF) version 1.2, during the validation, in order to obtain the Madre de Dios Amazon Redd Project validation, the methodology showed that the buffer allocation should be calculated using equation 4 in which the final function of the formula was:

VM0007, Version 1.2
Sectoral Scope 14

$$Buffer_{UNPLANNED} = \left(\left(\Delta C_{BSL,unplanned} - \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{FC,i,t} + N_2 O_{direct,i,t}) \right) - \left(\Delta C_{P,(Unplanned\ Deforestation\ Areas)} - \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{FC,i,t} + N_2 O_{direct,i,t}) \right) \right) * (1 - Buffer\%) \quad (5)$$

and in this occasion the team observed that was incorrect. The Madre de Dios Amazon REDD Project, during the validation and during all verifications audits used the following equation:

VM0007, Version 1.4
Sectoral Scope 14

$$Buffer_{UNPLANNED} = \left(\left(\Delta C_{BSL,unplanned} - \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{FC,i,t} + N_2 O_{direct,i,t}) \right) - \left(\Delta C_{P,(Unplanned\ Deforestation\ Areas)} - \sum_{t=1}^{t^*} \sum_{i=1}^M (E_{FC,i,t} + N_2 O_{direct,i,t}) \right) \right) * (Buffer\%) \quad (5)$$

This is the correct equation and this equation is showed in the recently version 1.4

The deviation relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology. This deviation does not impact negatively the conservativeness of the quantification of GHG emission reductions or removals, and relates only to the criteria and procedures for monitoring or measurement, and does not relate to any other part of the methodology

This monitoring report template v3.3 requires that the user "Describe and justify any methodology deviations applied during this monitoring period. **During this monitoring period, we used the same deviation for the buffer and a new methodological deviation for some of the field data, because due to climatic factors, some field data which are needed for the calculations, could not be taken.**

b) During this monitoring period we employed a new deviation to estimationsome data field.

This deviation does not negatively impact the conservativeness of the quantification of GHG emission reductions or removals, because when we use the carbon stock to know how many emissions go to the atmosphere we employ the total carbon / ha.

A methodological deviation was employed in primary roads. Within Maderacre concession, the primary road area in PCA 13 was calculated based on measures taken on the field: length and width. Within PCA 12, primary road area was also calculated based on length and width measures taken on the field. In the case of Maderacre, all data for primary roads was measured on the field. In the case of Maderyja, field measures were taken for PCA 13 (both length and width) while no primary roads were done in PCAs 3 and 4.

With respect to secondary roads, a methodological deviation was employed. Within Maderacre concession, width and length measures were taken on the field in the case of PCA 13. For PCA 12 length measures were taken on the field and width was considered the same as in PCA 13, since the same machinery was employed. Within Maderyja concession, width and length measures were taken for PCA 13 and width in the case of PCAs 3 y 4. Length for PCAs 3 and 4 was estimated considering the volumen extracted in each PCA, since secondary roads are constructed according to the volumen and location of the wood that will be extracted.

Another methodological deviation was employed for the calculation of logging decks.

Within Maderacre concession, all data were taken, that is to say width and length of all 204 logging decks existent in PCA 13 and PCA 12 ecisstente 67 logging decks, were established and the area was estimated based on the area established in PCA 13.

For skid trails, there are no methodological deviations, although field data could not be taken due to meteorological conditions (rain), it is a fact that forest does not die in skid trails, it is merely trampled. The data, however were estimated based on volume and assuming the forest died, being therefore, very conservative.

Withing Maderacre concession, total length was taken for each sub-sample in the case of PCA 13 and total length was estimated in relation to the total of area of said PCA. In the case of PCA 12, no information was available and therefore it was estimated based on the data from PCA 13:

Length: x
m/ha in PCA 12 = (25.4 m/ha in PCA 13 / 10 136 ha. Total area for PCA 13) * 9697 ha. Total area for PCA 12

Within Maderyja concession measures were estimated for all PCAs (13, 3 and 4) based on the data from PCA 13 from Maderacre, relating m/ha from PCA 13 in Maderacre and total area of PCA 13 in Maderacre with the total area of each PCA in Maderyja.

PCA	m/ha	Area PCA (ha)
13 ma	25.40	10136.00
13 my	5.87	2344.00
3 my	5.07	2022.11
4 my	6.09	2431.31

In the case of Maderacre concession, width was taken on the field for PCA 13 and for PCA 12, the same width than for PCA 13 was considered since the machinery was the same in both PCA.

In the case of Maderyja, width was measured on the field for 10 sub-samples. Based on these measures, skid trail estimation was carried out. This estimation was done based on the fact that the same machinery was employed in all width trails.

In the following chart, field data and other estimated data are detailed

Chart 5. Field Data and Estimated data

Infrastructure	Parameter	Maderacre			Maderyja			
		PCA 13	PCA 12	Observation	PCA 13	PCA 3	PCA 4	Observation
Principal Road	mean width	16.35	14.44	Data field	20.56			There aren't principal road in pca 3 and pca 4
	Length	2497	9386	Data field	30036			Data field
	Área (ha)	4.08	13.55	Total in all forestry stratum	61.75			Data field
Secunday Road	mean width	11.6	11.6	The same width that pca 13	18.86	16.43	17.81	Data field
	Length	109868	36182	Total in all forestry stratum	18669	5055.43	2407.56	Projection data with volumen pca 13 My
	Área (ha)	127.45	41.97	Total in all forestry stratum	35.20	8.31	4.29	
Skid trail	length/ha muestral	25.4	24.30	Calculated based on length/ha in PCA 13 and Total Area of PCA	5.87	5.07	6.09	Calculated based on length/ha in PCA 13 and Total area of PCAs
	mean width	5.15	5.15	The same width that pca 13	2.81	2.85	3.57	Data field
	Volumen	35851.56	11,392.90	Total in all forestry stratum	12421.59	3363.68	1601.89	Data field
Infrastructure	Parameter	Maderacre		Observation	Maderyja			Observation
		PCA 13	PCA 12		PCA 13	PCA 3	PCA 4	
Logging deck	Area (ha)	9.46	3.11	In pac 12 we only taked number of logging deck. We estimated the area wirh pac 13 parameter	2.70	0.74	0.06	Data field

2.3 Grouped Project

N/A

3 DATA AND PARAMETERS

3.1. Data and Parameters Available at Validation

Data Unit / Parameter:	Regional Forest / Non-forest Cover Benchmark Map
Data unit:	Ha
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.
Value applied:	n/a
Justification of choice of data or description of measurement methods and procedures applied:	The Landsat images have an adequate resolution and they are an available tool to all public
Purpose of the data	Determination of baseline scenario
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)

Data Unit / 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-8 satellite image. Sensor OLI.
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.
Any Comment	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 y 8

Data Unit / 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-8 satellite image. Sensor OLI.
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
Any 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 Unit / Parameter:	A_i
Data unit:	Ha
Description:	Total area of each stratum i .
Source of data:	Landsat-8 satellite image. Sensor OLI.
Justification of choice of data or description of measurement methods and procedures applied:	Frequency at a minimum every 10 years prior to baseline renewal
Any Comments	Ex-ante it is assumed that strata area will remain constant.

Data Unit / Parameter:	$A_{RRD, unplanned, hrp}$
Data unit:	Ha
Description:	Total deforested area during the term of reference (until 2008) in the RRD

Source of data:	Value taken from the Landsat-8 satellite image. Sensor OLI., used by the Deforestation Model of Madre de Dios.
Justification of choice of data or description of measurement methods and procedures applied:	The Landsat images have the adequate resolution and they are a free and available tool to all public
Any Comments	Monitored for purpose of baseline revisions.

Data Unit / 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 ⁸
Value applied:	0.49 t C t ⁻¹ d.m. ⁹
Justification of choice of data or description of measurement methods and procedures applied:	for Tropical Forests and wood, tree d>10 cm
Purpose of the data	Calculation of baseline emissions
Comments	n/a

Data Unit / Parameter:	D _j
Data unit:	t d.m. m ⁻³
Description:	Basic wood density in t d.m. m ⁻³ for species <i>j</i> .
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.
Justification of choice of data or description of measurement methods and procedures 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).

⁸ <https://www.ipcc.ch/meetings/session25/doc4a4b/vol4.pdf-pag> 172

⁹ http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

	- Summary of technical information of 32 tree species. Peruvian Confederation of Wood. 2008. CPM. CITE Madera. - Global wood density database. (Chavé et al., 2009).
Purpose of the data	Calculation of project emissions
Any Comments	n/a

Data Unit / 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.
Justification of choice of data or description of measurement methods and procedures 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).
Purpose of the data	Calculation of project emissions
Any Comments	n/a

Data Unit / 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.

Value applied:	$B = \rho \cdot \exp(-1.499 + 2.148 \cdot \ln(\text{DBH}) + 0.207 \cdot (\ln(\text{DBH}))^2 - 0.0281 \cdot (\ln(\text{DBH}))^3)$ in Kg (dry)..Chavé $B = 6.666 + 12.826 \cdot \ln(H) \cdot \ln(H)$ in Kg (dry)...palm $B = 47.022$ Kg (dry)...bamboo
Justification of choice of data or description of measurement methods and procedures 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. Oecologia 145: 87-99.
Purpose of the data	Calculation of baseline emissions
Any Comments	The validation of the equations will be performed with either of both methods presented in VMD0015 module: - Limited Measurements - Destructive sampling

Data Unit / 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:	<table> <tr> <td>Hill Forest</td><td>505.10</td></tr> <tr> <td>Terrace Forest</td><td>547.81</td></tr> <tr> <td>Bamboos</td><td>604.48</td></tr> <tr> <td>Tree swamp</td><td>543.42</td></tr> <tr> <td>DP</td><td>18.63</td></tr> <tr> <td>DA</td><td>31.75</td></tr> <tr> <td>DI</td><td>-</td></tr> <tr> <td>DC</td><td>31.63</td></tr> </table>	Hill Forest	505.10	Terrace Forest	547.81	Bamboos	604.48	Tree swamp	543.42	DP	18.63	DA	31.75	DI	-	DC	31.63
Hill Forest	505.10																
Terrace Forest	547.81																
Bamboos	604.48																
Tree swamp	543.42																
DP	18.63																
DA	31.75																
DI	-																
DC	31.63																
Justification of choice of data or description of measurement methods and procedures applied:	- The inventory was made 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.
Purpose of the data	Calculation of baseline emissions
Comments	The exact data for each stratum is found in module CP-AB.

Data Unit / 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:	<table> <tr> <td>Clean cultivation</td><td>4%</td></tr> <tr> <td>Grasslands</td><td>54%</td></tr> <tr> <td>Agriculture and livestock</td><td>40%</td></tr> <tr> <td>Infrastructure</td><td>2%</td></tr> </table>	Clean cultivation	4%	Grasslands	54%	Agriculture and livestock	40%	Infrastructure	2%
Clean cultivation	4%								
Grasslands	54%								
Agriculture and livestock	40%								
Infrastructure	2%								
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.								
Purpose of the data	Calculation of baseline emissions								
Comments	n/a								

Data Unit / 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 ₂ O 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 ¹⁰
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 ₂ O) Agriculture Residues = 2.7 (CH ₄) and 0.07 (N ₂ O).
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
Purpose of the data	Calculation of baseline emissions
Comments	n/a

3.2. Data and Parameters Monitored

Data Unit / Parameter:	Project Forest Cover Monitoring Map
Data unit:	
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:	Analysis and Classification of Satellite Images
Frequency of monitoring/recording:	Every year with images. Verification of deforested areas will be permanent in field by the surveillance carried out by the monitoring equipment.
Value monitored:	See Map
Monitoring equipment:	Software GIS, available satellite images, GPS, professional monitoring equipment in field.

¹⁰Deforestation map of the Peruvian Amazon – 2000. MINAM (2009)

QA/QC procedures to be applied:	Permanent verification of the area of the project surfaces. Compliance Technical Quality Parameters on the Selection and processing of images including truthing
Purpose of the data	Calculation of project emissions
Calculation method	Where relevant, provide the calculation method, including any equations, used to establish the data/parameter
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:	Analysis and Classification of Satellite Images and visit field
Frequency of monitoring/recording:	Every year with images to report monitoring.
Value monitored	See Map
Monitoring equipment:	Software GIS, available satellite images, GPS, professional monitoring equipment in field.
QA/QC procedures to be applied:	Verification of the area of the project surfaces. Also, through the accuracy assessment, during monitoring. Verification of the area of the surfaces of the projects. In addition, through evaluating the accuracy during monitoring. Compliance Technical Quality Parameters on the Selection and processing of images including field truthing. Staff Training and Technical Specialists
Purpose of the data	Calculation of leakage
Calculation method	VCS module Estimation of emissions from activity shifting for avoided
Comments	Stratification is the same as the one used at the beginning of the term.

Data Unit / Parameter:	Degradation PRA Results
Data unit:	Surveys and/or interviews.
Description:	The PRA will be executed from interviews and/or surveys to local actors with the purpose of

	identifying the existence of degradation potential within the area of the project due to: - Extraction of firewood. - Illegal logging If $\geq 10\%$ of the surveys indicate that there is a risk of degradation then the procedures to verify and estimate the degradation should be executed. An additional result of the PRA would be the penetration distance that should be applied to calculate the area with degradation potential (buffer area).
Source of data:	Current 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.(the same that the last year)
Value monitored:	There is no degradation in this period
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.
Purpose of the data	Calculation of project emissions
Calculation method	Used PRA each two year
Comments	n/a

Data Unit / Parameter:	Results of Limited Degradation Survey
Data unit:	Existence of stumps
Description:	Verification of degradation processes in the project area
Source of data:	Field measurements
Description of measurement methods and procedures to be applied:	This period don't verify the degradation
Frequency of monitoring/recording:	Each two years the PRA indicates there is or there isn't degradation potential to the project area.
Value monitored:	PRA indicate that evidence of degradation is non-existent
Monitoring equipment:	GPS, compass, tape line, interviews.
QA/QC procedures to be applied:	Trained staff for field measurement
Purpose of the data	Calculation of project emissions
Calculation method	PRA
Comments	n/a

Data Unit / Parameter:	$A_{burn, i, t}$
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Data unit:	Ha
Used in equations:	Section 2.2.2
Description:	Area burnt in stratum i at time t. There isn't any burnt area within the project area.
Source of data:	Field measurements, and satellite images
Description of measurement methods and procedures to be applied:	there isn't a record of a burning. (If there is: it will be indicated the type of forest and burnt area to determine the GHG emissions (CH ₄ and N ₂ O). If possible, the new use of the land will also be indicated)
Frequency of monitoring/recording:	Every time there is an occurrence.
Value monitored	There are no burned areas in this period
Monitoring equipment:	GPS
QA/QC procedures to be applied:	n/a
Purpose of the data	Calculation of project emissions Calculation of leakage
Calculation method	
Comments	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 / Monitoring field
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:	All moment, constant monitoring area in field. We need information to every verification event. With satellite images every year.
Value monitored:	According with the results of satellite image analysis, there is no deforestation inside PA
Monitoring equipment:	Software GIS, available satellite images, verification in field with GPS and professional equipment with monitoring the perimeter and inside of the area.
QA/QC procedures to be applied:	n/a
Purpose of the data	Calculation of project emissions
Calculation method	-

Comments	There aren't deforestation during this period inside PA
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Data Unit / Parameter:	ADefLB, i, t																																															
Data unit:	Ha.																																															
Description:	Deforested area in the Leakage belt by type of forest																																															
Source of data:	Landsat-8 satellite image. Sensor OLI. And monitoring with personal field																																															
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:	For every monitoring report. Constant monitoring in field																																															
Value monitored:	Results Table: <table><tr><th>Stratum / Post-defo LU</th><th>Agriculture</th><th>Farming</th><th>Secondary forest</th><th>Pastures</th><th>Infras-structure</th></tr><tr><td>Hilly forest</td><td>18.92</td><td>68.37</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Terrace forest</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Others</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Bamboo</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Tree Swaps</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>TOTAL (ha)</td><td>18.92</td><td>68.37</td><td>0</td><td>0</td><td>0</td></tr></table>						Stratum / Post-defo LU	Agriculture	Farming	Secondary forest	Pastures	Infras-structure	Hilly forest	18.92	68.37	0	0	0	Terrace forest	0	0	0	0	0	Others	0	0	0	0	0	Bamboo	0	0	0	0	0	Tree Swaps	0	0	0	0	0	TOTAL (ha)	18.92	68.37	0	0	0
Stratum / Post-defo LU	Agriculture	Farming	Secondary forest	Pastures	Infras-structure																																											
Hilly forest	18.92	68.37	0	0	0																																											
Terrace forest	0	0	0	0	0																																											
Others	0	0	0	0	0																																											
Bamboo	0	0	0	0	0																																											
Tree Swaps	0	0	0	0	0																																											
TOTAL (ha)	18.92	68.37	0	0	0																																											
Monitoring equipment:	Software GIS, available satellite images, verification in field with GPS and professional equipment																																															
QA/QC procedures to be applied:	Look the area in satellite images and ratified with personal field the area and use soil. Compliance with technical parameters of quality in the selection and processing of images including truthing. Training of technical and specialist personnel.																																															
Purpose of the data	Calculation of leakage																																															
Calculation method																																																
Comments	it was confirmed that deforestation for the period monitored in leakage belt .																																															

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 validation data.
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 two years the PRA indicates a potential for degradation
Value monitored	PRA results indicates that evidence of degradation is non-existent
Monitoring equipment:	GIS software , field staff, GPS, Wincha
QA/QC procedures to be applied:	n/a
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	There is no evidence of depredated areas or parcels ex-ante within the project area.

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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.
Description of measurement methods and procedures to be applied	Field measurements of all logging decks and one pca estimated.
Frequency measurement:	Every year
Value monitored:	Hilly forest: 15.94 ha Terrace forest: 0.76 ha
Monitoring equipment	Equipment used to monitor the data/parameter: GPS, wincha and personal field.
QA/QC procedures to be applied	GPS was calibrated. Development of evaluation protocols or guidelines. Training of technical <i>and specialist personnel</i> .
Purpose of the data	Calculation of project emissions
Calculation method	Width and large with wincha and know the number of logging deck in PCA.
Comments	Ex-ante estimations of emissions are based on average size and number of decks produced due to logging in the region.(see chart 5)

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.
Description of measurement methods and procedures to be applied	Interpretation of Landsat-8 satellite image. Sensor OLI.
Frequency measurement:	Every monitoring report
Value monitored	Zero, there is no disturbance during this period
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	
Calculation method	-
Comments	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 and estimated
Description of measurement methods and procedures to be applied	Length and width of roads known in field registries. See the file Guia M&E -REDD
Frequency measurement:	Every year
Value monitored	There are two types of roads: 1) Primary Roads: Hilly forest: 79.18 ha Terrace forest: 0.18 ha 2) Secondary Roads: Hilly forest: 215.54ha Terrace forest: 1.69 ha
Monitoring equipment	GPS and wincha
QA/QC procedures to be applied	GPS was calibrated. Development of evaluation protocols or guidelines. Training of technical <i>and specialist personnel</i>
Purpose of the data	Calculation of project emissions
Calculation method	With field data, average width by the total length. All width was taken in field, some length was estimated (see chart 5)
Comments	Ex-ante estimations are based on average length of roads produced per unit area due to logging in the region

Data Unit / Parameter:	ARRL, forest, t
Data unit:	Ha
Description:	Remaining area of forest in RRL
Source of data:	Landsat-8 satellite image. Sensor OLI.
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	See Map
Monitoring equipment	Satellite imagen
QA/QC procedures to be applied:	n/a
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data Unit / Parameter:	AP _i
Data unit:	Ha
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).
Value monitored:	Zero, PRA showed no degradation pressure
Monitoring equipment:	GPS, field equipment: tape line, compass. And field staff.
QA/QC procedures to be applied:	Trained staff for field measurement.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

Data Unit / Parameter:	C _{DegW, i, t}
Data unit:	T CO ₂ –e

Description:	Biomass carbon of removed trees through degradation process from plots measured in stratum.
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 sent to the atmosphere.
Frequency of monitoring/recording:	Every time there is a degradation event or at least every 5 years. This period the PRA was negative
Value monitored:	Zero
Monitoring equipment:	GPS, field equipment: tape line, compass. And field staff.
QA/QC procedures to be applied:	n/a
Purpose of the data	Calculation of project emissions
Calculation method:	Through an allometric equation, using the DBH as one of its variables
Comments	n/a

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. As baseline, and it permits the methodology (pag 15 M-MON)
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.

Frequency of monitoring/recording	Specify measurement and recording frequency
Value monitored	Hilly forest 407.34 t CO ₂ /ha Terrace forest 441.78 t CO ₂ /ha
Monitoring equipment	-
QA/QC procedures to be applied	the same that validation
Purpose of the data	Carbon emission by skid trails, road and logging deck
Calculation method	It can be assumed that all diameter trees are destroyed and therefore the aboveground and belowground tree biomass destroyed by the skidder equates to the mean aboveground biomass carbon stock of trees in the stratum
Comments	n/a

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 skid 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.
Frequency of monitoring/recording	Specify measurement and recording frequency
Value monitored	Hilly forest: 97.76 TCO ₂ /ha Terrace forest: 106.03 TCO ₂ /ha
Monitoring equipment	-
QA/QC procedures to be applied	the same that validation
Purpose of the data	Carbon emission by skid trails, road and logging deck
Calculation method	It can be assumed that all diameter trees are destroyed and therefore the aboveground and belowground tree biomass destroyed by the skidder equates to the mean aboveground biomass carbon stock of trees in the stratum
Comments	The root-to-shoot ratio 0.24 is used (same as used in baseline carbon-stock calculations).

Data Unit / Parameter:	L _{sk}
Data unit:	M

Description:	Length of skid trail sk.
Source of data:	Field measurements and estimated
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 in PCA 13 Ma, and estimated with total area of PCA and Lskd PCA 13. 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.
Frequency of monitoring/recording:	Every year
Value monitored	Lsk was monitored in the field for PCA 13 in Maderacre and PCA 12 Maderacre ; PCAs 13, 3 and 4 in Maderyja, were estimated based on its total area of PCAs : Hilly forest: 523,631.55 m Terrace forest: 8,284.99 m
Monitoring equipment	Gps, personal field
QA/QC procedures to be applied	Development of evaluation protocols or guidelines. Training of technical <i>and specialist personnel</i>
Purpose of the data	Skid trail area
Calculation method	Field data and estimated. Some Lsk can't take in field by rain. These Lsk was estimated (see chart 5)
Comments	n/a

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	Documentation includes: - Delineation of the location. - Total area logged in the Project area. - Methods used to measure the amount of wood extracted. - Methods to estimate and catalog the volume of wood felled and extracted.
Frequency of monitoring/recording:	Avery year

Value applied	Hilly forest and Terrace forest in Maderacre and Maderyja: 46,772.01 m ³ 17,859.61 m ³ See the excel "Cp Estimations in M&M" (spreadsheet GLG - Extracted timber)
Monitoring equipment	wincha, GPS and field personal.
QA/QC procedures to be applied	Development of evaluation protocols or guidelines. Training of technical and specialist personnel.
Purpose of the data	Volume extracted in this period
Calculation method	Data taken in field used to know the volume per tree and then the volume total. the general equation= $\pi \cdot (D^2/4)$
Comments	n/a

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	Systematic sampling with a random start to produce an average width of skid trails, to PCA 13 Maderacre was 5.15 m, put on the same to pca 12. Systematic sampling with a random start to produce an average width of skid trails, to PCA 13 was 2.81 m; PCA 3 was 2.85 m and PCA 4 was 3.57 m.
Frequency of monitoring/recording	Every year
Value monitored	5.15m / 2.81 m/2.85m and 3.57 m.
Monitoring equipment	GPS, wincha and field personal
QA/QC procedures to be applied	Development of evaluation protocols or guidelines. Training of technical <i>and specialist personnel</i>
Purpose of the data	Carbon emissions by skid trail
Calculation method	Take in field with wincha the width
Comments	n/a

3.3. Monitoring Plan

The Madre de Dios Amazon REDD Project involves two adjacent timber concessions, included within the "Permanent Production Forest" of the Madre de Dios region. It has a total official area of

98,927.3811 hectares covered by natural tropical forests with the presence of “Paca” (native bamboo). This type of forest is characterized by a great diversity of flora and fauna of Amazonian species. The physiographic type corresponds mainly to “Low Hills”.

Although the management of the area for the production of forest products, mainly wood under an FSC scheme, is in charge of the two forest concessions, both constitute a single unit for the implementation of the Madre de Dios Amazon REDD Project. In this sense, the implementation of the activities related to the monitoring component of the project is performed by a single technical team.

The main goal of this Monitoring Plan is the collection of the data that allow the verification of the deforestation and the degradation within the project area and its leakage belt throughout time, regularly updating the emissions estimations as well as the generation of sufficient and timely information to make the necessary adjustments to the strategies included in the VCS Madre de Dios Amazon REDD Project PD Template.

The Monitoring Plan is focused in the following two main components:

1. Monitoring of the Madre de Dios Amazon REDD Project objectives.

- a) OUTCOME 1: Contribute to the sustainable development of rural producers living in the buffer zone of the project.
- b) OUTCOME 2: Reduce the vulnerability of the project area from external factors of deforestation and degradation.

This component will be conducted through the assessment of compliance with the activities proposed for each objective.

2. Monitoring of the parameters described in the item 4.2. of this Monitoring Plan (Data and Parameters Monitored):

- c) Forest cover map – Strata within the project area
- d) Forest cover map – Strata within the project leakage belt
- e) Results of the PRA
- f) Degradation results
- g) Burned area
- h) Deforested area within the project area
- i) Deforested area within the project leakage belt
- j) Potentially degraded area within the project area
- k) Degraded area within the project area
- l) Carbon stock loss due to degradation

¹¹ * Total number of hectares stratified by the IIAP for the Ecological Economic Zoning, which was based on the Forest Map of the National Geographic Institute (IGN) and which has available shapes. This data was employed in the development of all the maps required by the applied methodology. The area according to CIEF – Peru Digital (98,932 has), which was employed for the concession contracts and therefore in the FSC Certificates, the FMP and the PDD submitted to the CCBA does not have available shapes. If the images are compared, it can be appreciated that in the upper part there is no perfect overlap between the two profiles.

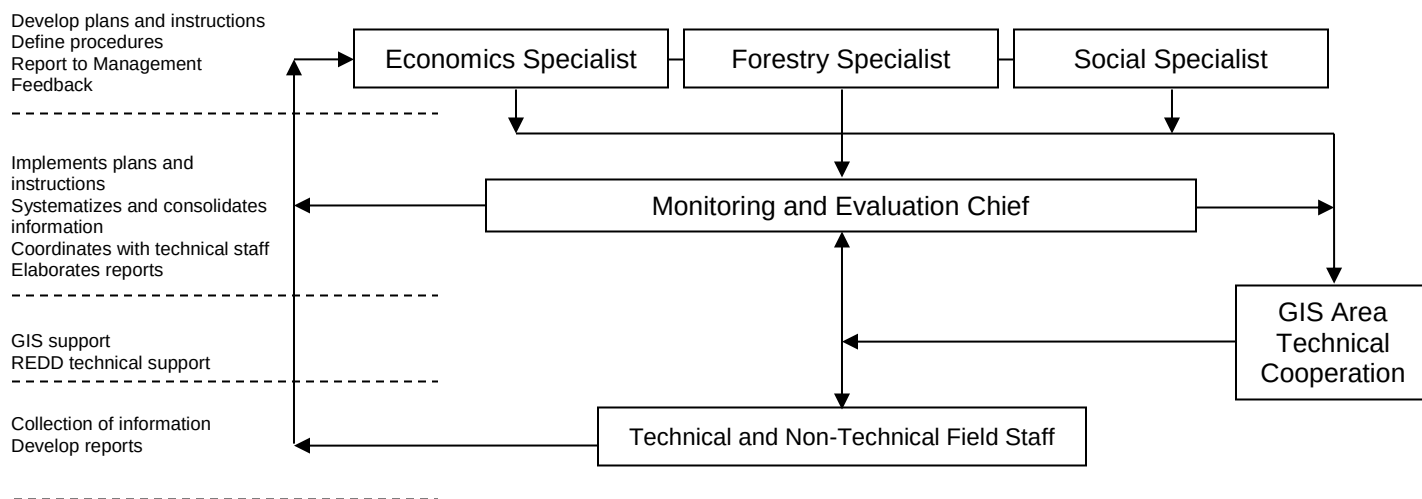
- m) Emissions due to biomass burning (if deforestation within the project area occurs – land use change to agriculture and burning of the forest)
- n) Emissions due to nitrogen incorporation (if deforestation and fertilizer are employed in the new land uses).
- o) Carbon stock in wood products

ORGANIZATIONAL STRUCTURE

The Madre de Dios Amazon REDD Project counts with a skilled and experienced technical team for its implementation and its monitoring component. In addition to this, it also counts with the technical advice of Greenoxx NGO, Tatiana Lapeyre and Lizardo Fachín and other specialist consultant in carbon projects (Ecos Development Group Sac), all of them experienced institutions in the development of conservation and sustainable use of resources projects and projects involving the use of environmental services such as REDD Projects.

The development of the Monitoring Plan is in charge of a multidisciplinary team, led by an Economist, a Forestry Specialist and a Social Specialist, allowing the integral address of the different components of the plan. Its implementation is responsibility of the Monitoring and Evaluation Chief, who must articulate it with the technical and non-technical field staff, the same that carry out the in-field measurements and the corroboration of the laboratory information. There is also a GIS Area for mapping support. Additionally, BAM NGO, Tatiana Lapeyre and Lizardo Fachín (Eco Development Group sac) provides support for the development of the modeling and specialized items that are required for the monitoring of the project.

Following, the information flow of the monitoring system is detailed:



INFORMATION MANAGEMENT: DATA COLLECTION, PROCESSING AND REPORT

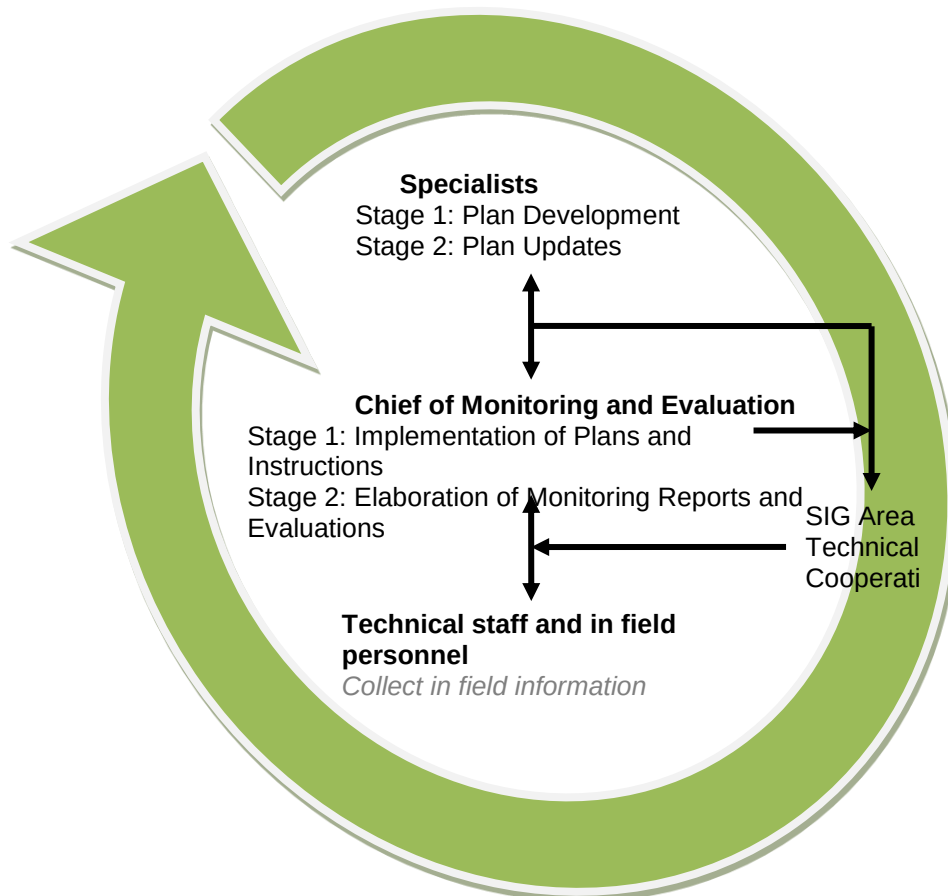
The project is based in the premise of the “Adaptative Management”, in this sense every intervention on the forest is sustained in previous information collected in field as a knowledge basis. Based on this knowledge is that Management Plans, Operative Plans and the rest of the necessary instructions for the implementation of the project, the interventions on the forest and the treatment of the social component are defined.

The permanent implementation of the Monitoring Plan allows the identification of the tendencies of the different parameters, including those that are useful to evaluate the compliance with the objectives of the Project. The knowledge that is generated allows the adaptation of the system (plans and the rest of the instructions).

The information collected in field by the technical staff is systematized by the Monitoring and Evaluation Chief, who at the end of the year (November-December) presents the Monitoring Report for the period to the specialists who together with other members of the project, will elaborate the Operative Plan of the following period, identifying additionally which manuals of instructions or protocols should be updated or adapted to the occurring changes. Since the following up in the implementation of the project is permanent, if important changes occur, the system can be updated during the same period, without having to wait for the report at the end of said period.

Following, the information flow in the framework of the adaptative management of the project is presented:

ADAPTATIVE MANAGEMENT



PLANIFICATION AND MONITORING

Forms have been defined for the collection of the field data that is currently within the concessions, processes and forms have been defined for those variables to be monitored. The collected data have been systematically digitalized in Excel type spreadsheets, also designed according to the information requirements. The calculations have been made in said spreadsheets using the correspondent formulas and afterwards the necessary reports are delivered as the basis for the elaboration of the consolidated Monitoring Report.

All the field monitoring processes should be documented, all the established sample units or plots should be georeferenced and systematized within the GIS.

The physical and digital files which store the data generated during the monitoring process will be accessible in the two modalities described before (physical files and digital files), being kept in the project offices in the locality of Iñapari and in Maderacre's central office in Lima, Perú throughout the Madre de Dios Amazon REDD Project duration and for at least two years after the end of the project crediting period.

The information management comprises the following steps or processes:

Step 1: Selection and Analysis of the Source of Land Use Change

1.1 For the monitoring period of 5 years, the following actions will be carried out:

- a) The collected and analyzed data should cover the entire project area and leakage belt. Available data for the year when verification occurs.
- b) For the calculation of each category of land use change:
 - The area of each category within the project area will be calculated and where required within the leakage belt.
 - The forest cover maps of reference for the project area and leakage belt will be updated.
 - The remaining forest area within the project zone will be updated.

1.2 For the monitoring period of 10 years. Baseline review:

- a) Use of middle resolution images (30 m x 30 m or less, if available) at the end of the period where the baseline will be renewed.
- b) The collected and analyzed data should cover:
 - The entire reference region: available data for the year of baseline renewal or not less than a year earlier.
 - For the processing of the data change for the Great Land Use Capacity (in Spanish Capacidad de Uso Mayor de las Tierras), will be georeferenced and geometrical corrections will be made as well as clouds and shadows detections.
 - The area of each category within the reference region, project area and where required within the leakage belt will be calculated.
 - The forest cover maps of reference for the reference area, project area and leakage belt will be updated.

- The total deforested areas during the first 10 years will be estimated in order to adjust the baseline and the deforestation rate if necessary.

Note: The indications of the correspondent Module of the REDD Methodology Modules will be taken into account with respect to clouds for the determination of maps. A classification accuracy of 90% or more will be sought.

Step 2: Interpretation and Analysis

2.1 Monitoring of Deforestation

- a) Deforested area within the Project Area (PA) per stratum.
- b) Deforested area within the Leakage Belt (LB) per stratum.
In both cases it must be specified to what type of Land Use (LU) the deforested areas have been changed. For the baseline re-calculation it should be established or indicated if the percentages of land use change are still the same as in the initial baseline.
- c) Carbon stock in carbon pools:
 - Carbon stock in each stratum defined in the baseline is maintained. It will be reassessed for the baseline review (in 10 years).
 - Carbon stock of each land use is maintained. It will be reassessed for the baseline review (in 10 years).
- d) Volume of timber harvested in each concession, per stratum and per year.
- e) Deforested area within the Reference Region (for the baseline review).

2.2. Monitoring of Degradation

The Madre de Dios Amazon REDD Project counts with a Custody System in the process of implementation (control posts, defined boundaries, regular patrolling, etc.). In this sense, it is expected that there will be no degradation by wood extraction due to illegal logging or firewood or coal production. If this occurs within the concessions, this degradation will be discounted.

A Participatory Rural Appraisal (PRA) will be conducted in order to determine whether degradation occurs. In this sense, these steps will be followed:

- a) Degradation due to illegal logging:
 - The PRA will be conducted every 2 years. The first PRA was done in 2011-2012, the last PRA was conducted in March, 20, 2015). If the results indicate that the project area has no pressure from this type of degradation, then it will be assumed that: $\Delta C_{p,Deg,i,t} = 0$.
 - If the results of the PRA indicate that there is potential for degradation, then it must:
 - Obtain a "penetration distance" in the PRA (distance that the degradation agents can enter from the nearest access points).
 - Identify the most important access points to the vulnerable area.
 - From said points, draw the distances and create a Buffer Area with a width equal to length.
 - Transects will be established to evaluate the buffer zone. The assessed area should not be lesser than 1% of the buffer area.

- If stumps are not found (harvested trees), then it is assumed that $\Delta C_{p,Deg,i,t} = 0$ and the assessment is repeated every 2 years.
 - If stumps are found, then a systematic assessment is carried out. For this, plots are distributed systematically, being the area to assess $\geq 3\%$ of the buffer area.
 - Take into account the diameter of the stumps, which will be assumed as their DBH. If they were very large (e.g. due to buttresses), then the species of the stump is identified and standing trees of the same species are located. Afterwards, their DBH and stump diameter are measured and a ratio between DBH/stump diameter is calculated. With this ratio, the DBH from the stump diameter of the cleared individuals that were found is estimated.
 - With the DBH data, the carbon stock of the harvested trees is calculated, using the allometric equation that was employed for the estimation of the tree carbon stocks in the baseline (Chavé Equation).
 - It will be assumed that all stock will be lost to the atmosphere.
 - This assessment must be repeated every 5 years.
- b) Degradation due to fire:
- Burned areas must be measured in the field using GPS.
 - In order to calculate the emissions from this, the E-BB Module of the approved VCS REDD Methodology Modules shall be followed.

2.3 Monitoring of areas of increased carbon stocks

The increase in carbon stocks is assumed to be zero, thus it does not require monitoring.

2.4 Monitoring of project emissions

The Non-CO₂ GHG emissions will be calculated:

- a) N₂O and CH₄ from the burning of agricultural and forest biomass. It is carried out in those areas of land where use change occurred. For the ex-ante calculations of the biomass burned within the forest, it was estimated (through expert consultation) that 50% of the deforested forest was burned. In the case that deforestation within the project area occurs, a new percentage will be established (based on real measurements that will be made or literature support). It will be indicated what was done for the baseline recalculation (every 10 years).
- b) N₂O emissions due to the use of fertilizer within deforested areas. In the case that deforestation and N₂O use occur during the project lifetime, the amount of nitrogen fertilizer used per deforested hectare shall be determined.

SATELLITE IMAGES ANALYSIS AND INTERPRETATION

The deforestation and the source of land use change analysis should be conducted through the use of satellite images and in-field verifications. The procedures that will be considered are the following:

1. Selection of satellite images:

The image was obtained from the image server: Instituto Nacional de Pesquisas Espaciales - (INPE-Brasil) <http://www.dgi.inpe.br/catalogo/>

The satellite image used was Landsat- 8, path 003 and row 068. The dates correspond to June 22th 2015, the sensor was the OLI. The image has only 1% of cloud cover, in the evaluated area.

The monitoring reports must detail the relationship between the acquired images and the use of an "Images Acquisition Form" that includes the following information: Path, Row, Date, Year, Source and Code.

Images with a cloud cover surpassing 10% of the entire area of the image must not be used, this to ensure the proper analysis of them.

2. Satellite images processing:

For the processing of the selected satellite images, the software used are Erdas Imagine 2011 2® and ArcGis v10.1®. This activity should include the following steps:

a) Band composition

As the image is acquired in TIFF format (raw format), it has to be decompressed and exported to Erdas Imagine matrix (*.img). Then, all bands are grouped in a 543-RGB combination, which is the most optimal combination for visual interpretation of deforestation and land use change.

b) Geometric Correction

This process is applied to transform images by eliminating geometrical distortions from the sensor, which means that they must be georeferenced. It is a very important step because it assures that the image is located in the same geographical space as the historic images.

c) Radiometric Improvement

This is done to get a better visual appearance of the image.

d) Visual classification

IIAP methodology was used to classify the satellite images. The working scale was 1:80 000. The classes identified were:

- Forest
- Non forest land, which was divided into sub categories:
 - Pastures
 - Agriculture
 - Farming
 - Infrastructure
 - Secondary forest, included here to avoid accounting for positive changes in forest (natural regeneration).

For this period no deforestation has occurred in the Project Area. The Leakage Belt has 87,28 ha of new deforestation since the last period.

More details of the whole procedure can be seen in the technical report “Memoria SIG monitoreo M&M jun16” file

INTERNAL AUDITING

The main purpose of the management system of the project’s information quality is to minimize the risks of error, obtaining reliable data on which to base the monitoring results. It includes the following steps:

1. Training

It includes the training of general staff in the different roles to play within the framework of the Madre de Dios Amazon REDD Project, however, aiming at always having quality information, the training on those critical points of the information management will be prioritized, which are field collection and its processing (Evaluation and Monitoring Chief, field staff and GIS Specialist). All staff must go through an induction process before executing any activity related to the monitoring.

2. In-field verification

It basically consists of monitoring in the field, and that the field staff is following the procedures set out in the methodological guidelines given in the previous process of induction. This work is in charge of the Evaluation and Monitoring Chief.

An error in following the procedures should be corrected in the field during the execution of samplings or assessments.

3. Review of the collected data pre and post digitalization

The collected data should be reviewed before (field forms) and after (electronic spreadsheet) its digitalization, so that a second eye can detect inconsistent information. This work is in charge of the Evaluation and Monitoring Chief.

If any information inconsistency is identified at the level of field forms, this information must be verified in the field. If the inconsistency is found in the digitalized information, it must be corroborated in the field forms and whether the inconsistency persists, it must be corroborated in the field.

4. Review of the monitoring reports prior to publication

The monitoring reports must be reviewed prior to publication, in order to confirm the calculations, analysis and the conclusions are accurate and measured. This work is in charge of the Project Chief or Coordinator.

If non-conformities exist during the internal or external auditing processes, the data should be reviewed and the non-conformities addressed.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

In order to be able to reproduce the calculations, please read the following files:

- Cp Estimations in MDD 2015 (octubre)
- Leakage Estimations in MDD 2015 (octubre)

- Uncertainty Analysis MDD 2015 (octubre)
- VCUs Estimations in MDD 2015 (octubre)
- VCS NonPermRisk v1 (octubre)
- Guia M&E-REDD
- Memoria SIG Monitoreo_M&M_jun_2016_v1

4.1. Baseline Emissions

As showed in the Project PD, the net GHG emissions under the baseline scenario in the 2015 period was (pg. 164 in PD):

T	Year	$\Delta C_{BSL,unplanned}$ (t CO ₂ -e)
1	2015	1,046,807.0

T	Year	$\Delta C_{BSL,unplanned}$	ΔCP	$\Delta CLK-AS, unplanned$	CREDD,t	Buffer UNPLANNED	VCUt
7	2015	1046.807	0	81,361	966.446	104.681	861.765

4.2. Project Emissions

The net change in carbon stock, inside the project area, by deforestation was “0”. The change in carbon stock in CO₂ equivalent, by CLG,CLR and CWP , as per ecuation N° 1 was **535,911.65**

During the monitoring, all the steps in M-MON module were followed to obtain the Net greenhouse gas emissions under the project scenario.

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

Stratum	$CpDef,PA,i,t$	$Cpdeg,PA,i,t$	$CpDist,PA,i,t$	$GHGp-e,i,t$	Cp,Enh,i,t	TOTAL
Hilly Forest	-	530,345.64	-	-	-	530,345.64
Terrace forest	-	5,566.01	-	-	-	5,566.01
Bamboo	-	-	-	-	-	-
Others	-	-	-	-	-	-
Tree Swamps	-	-	-	-	-	-
TOTAL	-	535,911.65	-	-	-	535,911.65

$$\Delta C_{P,Deg,i,t} = \Delta C_{P,DegW,i,t} + \Delta C_{P,SelLog,i,t} \quad (7)$$

$$\Delta C_{P,DegW,i,t} = A_{DegW,i} * \frac{C_{DegW,i,t}}{AP_i} \quad (8)$$

Where the PRA or the limited sampling indicate no degradation occurring:

$$\Delta C_{P,DegW,i,t} = 0$$

$$\Delta C_{P,SelLog,i,t} = \sum_{t=1}^t (C_{LG,i,t} + C_{LR,i,t} - C_{WP,i,t}) \quad (9)$$

We can see in the following chart the different change in carbon stock by:

Cp,SelLog,i,t (2015)				
Stratum	CLG	CLR	CWP	Total per stratum
Hilly Forest	250,140.10	289,206.12	9,000.58	530,345.64
Terrace Forest	1,850.71	3,782.42	67.13	5,566.01
Bamboo	-	-	-	-
Others	-	-	-	-
Tree swamps	-	-	-	-
Total	251,990.81	292,988.54	9,067.71	535,911.65

CLG. Annual net project emissions arising from the logging gap

CLR Annual net project emissions arising from logging infrastructure

CWP Carbon stock in wood products pool

$$C_{LG,i,t} = \sum_{z=1}^Z (C_{EXT,z,i,t} + (LDF_{z,i} * V_{EXT,z,i,t} * \frac{44}{12}))$$

Cext:

	Maderacre		Maderyja		Total	
Stratum	$V_{EXT,z,i,t}$ (m3)	$C_{EXT,z,i,t}$ (t CO ₂ -e)	$V_{EXT,z,i,t}$ (m3)	$C_{EXT,z,i,t}$ (t CO ₂ -e)	$V_{EXT,z,i,t}$ (m3)	$C_{EXT,z,i,t}$ (t CO ₂ -e)
Hilly forest	46,772.01	68,317.20			46,772.01	68,317.20
Terrza forest	472.44	690.07	17,387.16	24,205.19	17,859.61	24,895.26
Bamboo	-	-	-	-	-	-
Others	-	-	-	-	-	-
TOTAL	47,244.46	69,007.27	17,387.16	24,205.19	64,631.62	93,212.46

CLG.

MADERACRE 2015				
$\begin{matrix} t \\ i \end{matrix}$	$C_{EXT,z,i,t}$ (t CO ₂ -e)	$LDF_{z,i}$ (t C/m3)	$V_{EXT,z,i,t}$ (m3)	$CLG_{i,t}$ (t CO ₂ -e)
Hilly Forest	68,317.20	0.67	46,772.01	183,220.44
Terrace Forest	690.07	0.67	472.44	1,850.71
Bamboo	-	-	-	-
Others	-	-	-	-
Tree swamps	-	-	-	-
MADERYJA 2015				
$\begin{matrix} t \\ i \end{matrix}$	$C_{EXT,z,i,t}$ (t CO ₂ -e)	$LDF_{z,i}$ (t C/m3)	$V_{EXT,z,i,t}$ (m3)	$CLG_{i,t}$ (t CO ₂ -e)
Hilly Forest	24,205.19	0.67	17,387.16	66,919.66
Terrace Forest				
Bamboo				
Others				
Tree swamps				

Stratum	TOTAL CLG _{i,t} (t CO ₂ -e)
Hilly Forest	250,140.10
Terrace Forest	1,850.71
Bamboo	-
Others	-
Tree swamps	-
Total	251,990.81

CLR

$$C_{LR,i,t} = \Delta C_{SKID,i,t} + \Delta C_{ROAD,i,t} + \Delta C_{DECKS,i,t}$$

CLR _{i,t} (2015) Maderacre y Maderyja				
$\begin{matrix} t \\ i \end{matrix}$	Croad	Cdecks	Cskid	Total
Hilly Forest	148,862.38	8,051.48	132,292.27	289,206.12
Terrace Forest	1,024.60	418.86	2,338.97	3,782.42
Bamboo	-	-	-	-
Others	-	-	-	-
Tree swamps	-	-	-	-
TOTALES	149,886.97	8,470.33	134,631.24	292,988.54

Cwp.

$$C_{WP,i} = \sum_{ty=s,w,oir,p,o} C_{XB,ty,i} * (1 - WW_{ty}) * (1 - SLF_{ty}) * (1 - OF_{ty})$$

Where:

$$C_{XB,ty,i} = \frac{1}{A_i} * \sum_{j=1}^S (V_{ex,ty,j,i} * D_j * CF_j * \frac{44}{12})$$

But we have the same products in all stratum

MADERACRE 2015				
Stratum	Plot	$\Sigma(V_{ex,ty,j,i} * D_j)$	ΣC_{XB} (t CO ₂ -e)	C _{WP} Sawnwood (t CO ₂ -e)
Hilly Forest	13 y 12	38,024.41	68,317.20	6,645.90
Terrace Forest	13 y 12	384.08	690.07	67.13

MADERYJA 2015				
Stratum	Plot	$\Sigma(V_{ex,ty,j,i} * D_j)$	ΣC_{XB} (t CO ₂ -e)	C _{WP} Sawnwood (t CO ₂ -e)
Hilly Forest	13, 3 y 4	13,472.28	24,205.19	2,354.68
Terrace Forest		-	-	-
Bamboo		-	-	-

In Hilly Forest plot 13 y 12 Vex= 46,772.01 m3 with Dj= 0.81 t/m3

In terrace Forest plot 13 y 12 Vex= 47,244.46 m3 with Dj= 0.81 t/m3

In Hilly Foresta plot 13,3,y 4 Vex= 13,472.28 m3 with Dj= 0.77 t/m3

CF=0.49

Cwp = 38,024.41*0.49*0.28*44/12 = 68,317.20 (1-0.24)*(1-0.2)*(1-0.84)= 6,645.90

Cwp = 384.08 *0.49*44/12= 690.07 (1-0.24)*(1-0.2)*(1-0.84)= 67.13

Cwp = 13,472.28 *0.49*44/12= 24,205.19 (1-0.24)*(1-0.2)*(1-0.84)= 2,354.68

Please, see Cp Estimations in MDD 2015 file

4.3. Leakage

During the monitoring of period 2015 and following the steps presented in LK-ASU module, the Net greenhouse gas emissions due to leakage are equal to:

$$\Delta C_{LK-AS,unplanned} = \Delta C_{LK-ASU-LB} + \Delta C_{LK-ASU-OLB} + GHG_{LK,E} \quad \dots \text{Equation n}^\circ 13 \text{ LK-ASU}$$

$\Delta C_{LK-ASU-LB}$	$\Delta C_{LK-ASU-OLB}$	$GHG_{LK,E}$	$\Delta C_{LK-AS,unplanned}$
-	325.994	-	325.99

$\Delta C_{LK-ASU-LB}$

Where:

$$\Delta C_{LK-ASU-LB} = \Delta C_{P,LB} - \Delta C_{BSL,LK,unplanned} \quad \text{here:}$$

$\Delta C_{LK-ASU-LB}$	Net CO ₂ emissions due to unplanned deforestation displaced from the project area to the Leakage Belt; 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
$\Delta C_{P,LB}$	Net greenhouse gas emissions within the leakage belt in the project case t CO ₂ -e

$\Delta C_{P,LB}$	$\Delta C_{BSL,LK-unplanned}$	$\Delta C_{LK-ASU-LB}$
41,318.45	732,451.00	-

$\Delta C_{P, LB}$ = Deforestation area in Leakebelt for this period was 68.37 ha due to farming and 18.92 due to agriculture (a total of 87.29 ha). This means a total of 41, 318.45 t CO₂.

$$\Delta C_{LK-ASU-LB} = IF < 0, \text{ then it must be set } = 0$$

$$\Delta C_{BSL, LK-unplanned} = 732,451.00 \text{ TCO}_2$$

$\Delta C_{LK-ASU-OLB}$

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

$A_{LK-OLB, t}$ Area deforested by immigrants outside the Leakage Belt and project area under the project scenario at time t; ha

$A_{LK-IMM, t}$ Total area deforested by immigrant agents in the baseline and project scenario at time t; ha

$A_{LK-ACT-IMM, t}$ Area deforested by immigrants in the project area and Leakage Belt under the project scenario at time t; ha

$A_{LK-IMM, t}$		
$PROP_{IMM}$	$A_{BSL, PA-unplanned, t}$	Total 1
from Step 2 LK-ASU	PDD pg 150 (2015)	Eq 7 LK-ASU
0.18	2,013.40	362.41

$A_{LK-ACT-IMM, t}$			
$PROP_{IMM}$	$A_{Def, PA-i, t}$	$A_{Def, LB-i, t}$	Total 2
from Step 2 LK-ASU	from M-MON	from M-MON	Eq 8 LK-ASU
0.18	-	87.29	15.71

$$\Delta C_{LK-OLB,t} = 362.41 - 15.71 = 346.70 \text{ T CO}_2, \text{ If is } > 0 \text{ leakage outside the leakage has occurred}$$

Where

$$\Delta C_{LK-ASU-OLB} = PROP_{CS} * \Delta C_{LK-OLB,t}$$

PROP _{CS} (Eq 4 LK-ASU)		
C _{OLB}	C _{LB}	Total 3
379.78	403.90	0.94

$$= 0.94 * 346.70$$

$\Delta C_{LK-ASU,OLB}$
Eq 10 or 11 LK-ASU
325.99

GHG LK, E

Greenhouse gas emissions as a result of leakage of avoided deforestation activities; T CO₂. There wasn't in the project

Please, see Leakage Estimations in MDD 2015

4.3 Net GHG Emission Reductions and Removals

- The risk rating was 10%. You can see the Risk Report in the VCS NonPerm Risk 2015 file.

The total net greenhouse gas emissions reductions of the REDD project activity were calculated as follows:

2015	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
Total	1,046,807.00	535,911.65	325.99	510,569.36

Then, this result was adjusted to account for the uncertainty analysis:

$$\text{Adjusted_C}_{\text{REDD}} = \text{C}_{\text{REDD}} * (100\% - \text{C}_{\text{REDD_ERROR}}^{12} + 15\%) \dots \text{Equation in REDD-MF, page 19}$$

$$\text{Adjusted_C}_{\text{REDD}} = 510,569.36 * (100\% - 14.47\% + 15\%) = 510,569.36 \text{ t CO}_2\text{-e}$$

A final discount due to Permanence Risk Buffer was made, so the final result is:

$$\text{Buffer}_{\text{UNPLANNED}} = \Delta \text{C}_{\text{BSLunplanned}} - 0 - (\Delta \text{C}_{\text{Punplanned deforestation area}} - 0) * \text{Buffer} \dots \text{Equation in REDD-MF-17}$$

$$\text{Buffer}_{\text{UNPLANNED}} = \Delta \text{C}_p - \Delta \text{C}_{LK} = ((1,046,807 - 0) - (535,911.65 - 0)) * 10\% = 51,089.54 \text{ t CO}_2\text{-e}.$$

In this way, the total emission reductions due to project activity for the 2015 period were obtained:

$$\text{VCS} = (\text{Adjusted_C}_{\text{REDD}}) - \text{Buffer total}$$

C _{REDD,t}	Adjusted C _{REDD,t}	Buffer _{UNPLANNED}	VCU _t
510,569.36	510,569.36	51,089.54	459,479.82

$$\text{Vcu} = 459,479$$

¹² Uncertainty does not exceed the 15%, is 14.47%

Please, see the Uncertainty Analysis MDD 2015 and VCUs Estimations in MDD 2015 files

All calculations and SIG information, can be reviewed in the following worksheets, which will be available for the auditor:

- Cp Estimations in MDD 2015 (octubre)
- Leakage Estimations in MDD 2015 (Octubre)
- Uncertainty Analysis MDD 2015 (octubre)
- VCUs Estimations in MDD 2015 (octubre)
- VCS NonPermRisk v1 (octubre)
- Guia M&E-REDD
- Memoria SIG Monitoreo_M&M_jun_2016_v1