RESEX RIO PRETO-JACUNDÁ REDD+ PROJECT MONITORING REPORT GHG EMISSION REDUCTIONS FROM AVOIDING UNPLANNED DEFORESTATION IN 2013, 2014 AND 2015

Document Prepared By:

Biofílica Investimentos Ambientais.

Project Title	Resex Rio Preto-Jacundá REDD+ Project
Version	2.3
Report ID	
Date of Issue	June 15th, 2016
Project ID	
Monitoring Period	01-October-2012 to 30-September-2015.
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1 PROJECT DETAILS

1.1 Summary Description of Project

Resex Rio Preto-Jacundá REDD+ Project is a partnership between Biofílica and the residents of Resex Rio Preto-Jacundá, represented by the Neighborhood Association of the Extractive Reserve Rio Preto-Jacundá and Ribeirinhos do Rio Machado (ASMOREX), having the Center of Studies Rioterra (CES Rioterra) and the Executive Board of the Extractive Reserves of Valley of Anari (CDREX) as partners in the planning and implementation of the Project activities.

Located in the extractive reserve of the same name in the municipalities of Machadinho D'Oeste and Cujubim, northeastern of the State of Rondônia, Resex Rio Preto-Jacundá (RRPJ) has a territory of 95 thousand hectares. It was created in 1996 by State Decree 7,336 and has a history of struggle for rubber tappers rights, which started with the occupation of the area and the installation of two rubber plantations (Jatuarana and Vera Cruz) over 70 years ago. Thereafter, the rubber cycle in the Amazon declined and deepened the vulnerability of traditional communities. Faced with these difficulties, the residents of Resex Rio Preto-Jacundá seek livelihoods in a highly biodiverse territory but scarce in basic public services.

In this problematic scenario, it is highlighted the pioneering of the community, since the initiative of income generation and forest valorization from the sale of environmental services came from the rubber tappers. The agreement for the realization of the project emerged from an extensive and wide-ranging dialogue between the parties involved, which culminated in several meetings mediated by CES Rioterra, both in Resex as in the office of the Environmental Development Secretariat of the state of Rondônia (SEDAM) in the municipality of Machadinho D'Oeste. In these meetings, it was sought the Prior, Free and Informed Consent (FPIC) of the community residing in Resex from the exhibition of concepts, benefits and conditions for carrying out such project.

In these early meetings, the main goal of the Project was defined as setting the extractive community sustainability by reducing forest degradation and unplanned and illegal deforestation and consequent emission of greenhouse gases (GHG). The project main goal for climate is to avoid deforestation of 35,398 hectares, corresponding to a total of 12,428,713 tons of CO2e that will have their emission to the atmosphere avoided, to be achieved by the following activities: political engagement with environmental State bodies, monitoring deforestation through satellite images, on-the-ground patrolling, strategic physical occupation of territory, improvement of forest management practices and multiple and sustainable use of forest products.

In Resex Rio Preto-Jacundá live 29 families, approximately 130 residents, composed mostly of a very young population also poor in prospects regarding the stay in the land and the continuity of extractive traditions. Still, the potential of extractive production and an almost extinct way of life leads to believe that a project of forest conservation has a lot to offer to the people who live there, due to the synergies present in the economic, social and environmental spheres. Thus, the main objective in the category community is

raising the local empowerment to a population that sought the reward for being as they call themselves, “forest guardians”.

Biodiversity in line with the presence of extractive population deserves attention due to the presence of threatened and endemic species in the region, such as *Rhegmatorhina hoffmannsi* (the white-breasted antbird), and for being in the “Endemism Center Rondônia", considered one of the most important areas of bird endemism in South America, and the whole complexity brought by River Madeira. The project will seek, in this sense, the monitoring of species in situations of vulnerability and the monitoring of project interventions, creating arrangements for state research and educational institutions to access the area and have an ongoing process of understanding and monitoring of local biodiversity.

Community involvement will be covered in the activities related to biodiversity, since from forest resources are extracted almost the entire income of the families, as well as the fauna (hunting and fishing) is important for food security.

In analysis from Araújo et al. (2015) on conservation and deforestation units, Resex Rio Preto-Jacundá appears among those in critical situation of deforestation, supporting the thesis that the area needs priority conservation actions associated with the generation of income for the population that characterizes is as Extractive Reserve.

Relevant Implementation Dates

- Started in May 2012 continuously throughout the Project: political and stakeholder articulation;
- Started in 2012 and to continue throughout the Project lifetime: project’s budget follows up;
- 20 November 2012: Survey and identification of local partners such as consultants, researchers and institutions to develop the project;
- 30 September 2013: end of study for carbon stock estimate;
- 15 December 2013: determination of the baseline and the potential carbon credits;
- Started in October, 2013 and finished in July, 2014: six workshops with RRPJ community in order to build the REDD+ Project;
- 20 January 2014: end of Socioeconomic and Environmental Assessment (DSEA);
- 15 October 2015: Preparation of the Project description document;
- Annually since October 2012: Monitoring of deforestation and carbon emissions.

Total GHG emission reductions

The total GHG emissions reductions generated in this monitoring period (01-October-2012 to 30-September-2015) are 1,346,827 tCO_2e.

1.2 Sectorial Scope and Project Type

Project Scope 14: Agriculture, Forest and other Land Use (AFOLU)

Project Category: Reduction Emission from Deforestation and Degradation

Type of Activity: Avoided Unplanned Deforestation (AUD)

Grouped Project: No

1.3 Project Proponents

Biofílica Investimentos Ambientais: general coordination of the socioeconomic and environmental assessment and baseline studies and carbon stock; PDD (Project design document) development and financing; credits validation/checking and trading; project co-management throughout the project lifetime.

Contact information: Plínio Ribeiro. E-mail: plinio@biofilica.com.br Phone: +55 11 3073-0430 Website: www.biofilica.com.br.

Associação dos Moradores da Rerserva Extrativista Rio Preto-Jacundá e Ribeirinhos do Rio Machado–ASMOREX (local association of communities): ASMOREX is responsible for developing and implementing, in a participatory manner, the REDD+ Project and ensure the implementation of the project and maintain all documentation needed for the project to happen; monitoring and co-management of the REDD+ project.

Contact information: José Pinheiro Borges. Phone: +55 69 3581-2084. E-mail: jpinheiroborges@gmail.com.

1.4 Other Entities Involved in the Project

Entity	**Centro de Estudos da Cultura e do Meio Ambiente da Amazônia - CES Rioterra**
Role	Coordination of socio-economic and environmental studies; planning of conservation activities; support the validation / verification of the project; implementation and monitoring of REDD+ project activities.
Responsible	Alexis Bastos
Contact	Phone: +55 (69) 3223-6191 E-mail: alexis@rioterra.org.br Website: www.rioterra.org.br

Entity	**CDREX – Conselho Deliberativo das Reservas Estaduais Extrativistas de Machadinho D'Oeste e Vale do Anari**
Role	Manager of the area

Responsible	Ataíde de Jesus Santos
Contact	Telefone: (69) 3581-2786 E-mail: sedammachadinho@gmail.com

Entity	**Instituto de Pesquisas Ecológicas - IPÊ**
Role	Development of the deforestation baseline scenario.
Responsible	Alexandre Uezu
Contact	Phone: +55 (11) 3590-0041 E-mail: aleuezu@ipe.org.br Website: www.ipe.org.br

Entity	**Hdom - Engenharia e Projetos Ambientais**
Role	Development of forest carbon estimative for the Resex área.
Responsible	Francisco Higuchi
Contact	Phone: +55 92 3302 7249 E-mail: fghiguchi@hdom.com.br Website: www.hdom.com.br

1.5 Project Start Date

The Resex Rio Preto-Jacundá REDD+ Project starting date is October 1st, 2012, date set for signing the partnership agreement between Biofílica and Asmorex.

1.6 Project Crediting Period

The Project accreditation period is 1 October 2012. The end of the Project will be 30 September 2042 upon completing 30 years.

1.7 Project Location

The project is located in the Extractive Reserve Rio Preto-Jacundá located in the municipalities of Machadinho d'Oeste and Cujubim (Figure 1) approximately 350km from Porto Velho, capital of the state of Rondônia. Limits:

- North – state of Amazonas,
- South – Valley of Anari,
- East – state of Mato Grosso;
- West - River Crespo and Ariquemes,
- Between the coordinates 62°16'5,63"W 8°58'15,71"S

The Resex can be accessed either by land, using the route from Porto Velho, BR-364 (to Cuiabá), RO 257 and RO 133 (Ariquemes to Machadinho d'Oeste and river Machado) and other vicinal roads in the municipality of Machadinho d'Oeste, and by boat across the River Rio Machado, one of the main tributaries of the river basin of the Madeira river.

The total area of RRPJ has some controversy. The State Decree creating property has a limit of 95.300 hectares. However, the official shape provided by the state has an area of 102,808 hectares. The state of Rondônia is seeking to demarcate more precisely based on the official area of the decree, not having yet a set date to occur. Justified, thus, the use of the official shape of the state in socioeconomic and environmental diagnostics, in carbon studies and modeling of deforestation and in the planning and development of conservation activities in the area.

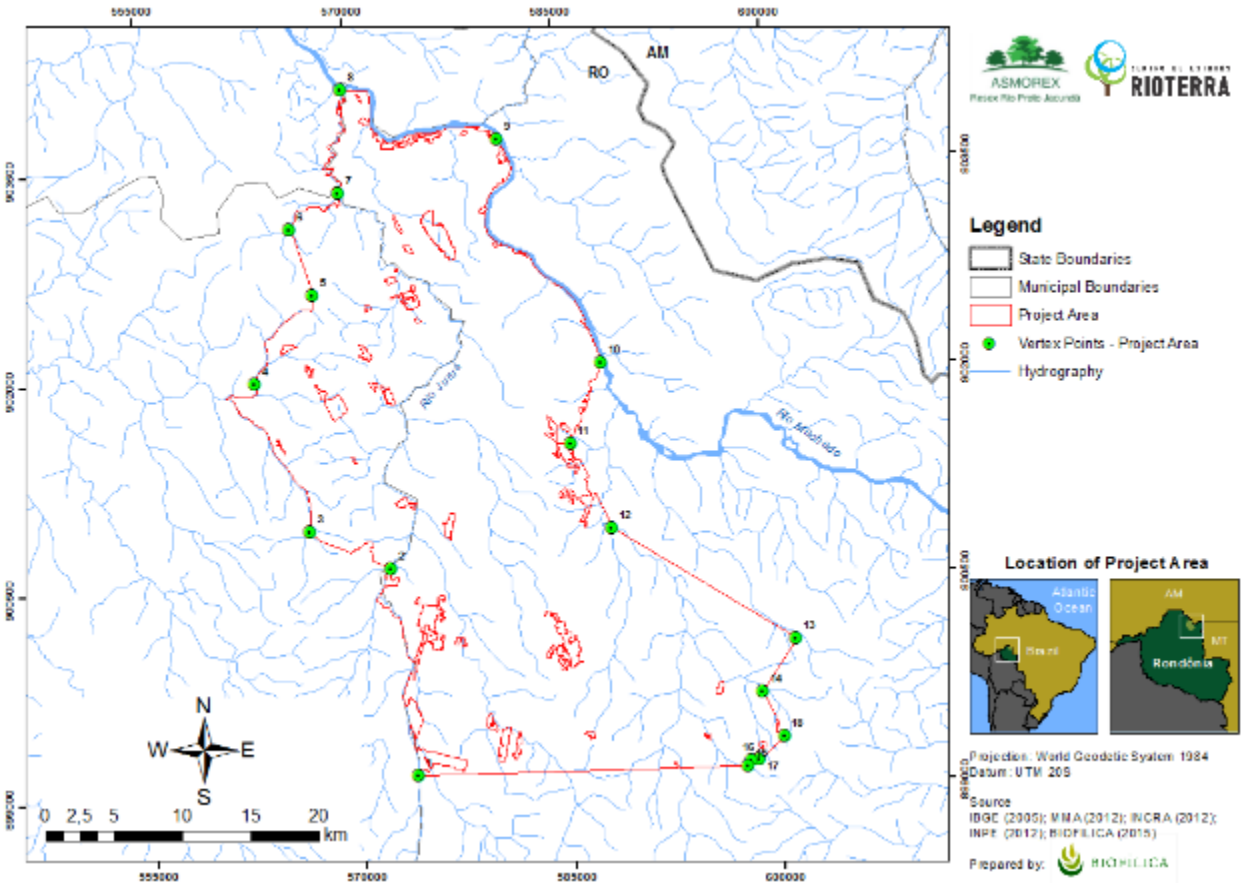

Figure 1. Resex Rio Preto-Jacundá REDD+ project area location

Table 1. Vertices and coordinates of the Project area polygons

Coordinates System: UTM – Zone 20S, Datum WGS 1984.

Vértices	X	Y
1	573935,5	8991425
2	572415,2	9006347
3	566723,6	9009158
4	563071,8	9019840
5	567419,5	9026129
6	565914,5	9030841
7	569478,5	9033404
8	569860,8	9040776
9	581004,1	9036959
10	587997,2	9020661
11	585611,6	9014878
12	588375,6	9008740
13	601342,8	9000416
14	598869,1	8996643
15	597637,3	8991372
16	597913,5	8991709
17	598466	8991777
18	600300,3	8993383

1.8 Title and Reference of Methodology

Approved VCS Methodology VM0015 for Avoided Unplanned Deforestation, version 1.1.

1.9 Other Programs

The Resex Rio Preto Jacundá REDD+ Project has not been registered under any other GHG program. However, the Project proponents intend on submitting this project to validation/verification under the CCB Standard (Climate, Community and Biodiversity Standard). It is important to mention that the CCB Standard does not issue or register any type of carbon certificates.

Also, currently there is no national or international REDD+ regulatory regime applicable to the RRPJ REDD+ Project. However, the Resex Rio Preto Jacundá REDD+ Project is being developed in order to integrate and comply with possible future regulatory regimes.

The Project neither has no intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program. Neither it has been submitted to validation/verification under any other GHG Program. Therefore, it has not been rejected by any other GHG Program.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The REDD+ activities are related to the greenhouse gas emission reduction by containing unplanned and illegal deforestation and social inclusion and local socioeconomic development (REDD+).

Below are described the activities that were performed during the Project's first period of verification (01 October 2012 – 30 September 2015).

REDD+ activities are under responsibility of Biofílica Investimentos Ambientais, Associação dos Moradores da Rerserva Extrativista Rio Preto-Jacundá e Ribeirinhos do Rio Machado–ASMOREX (local association of communities), and started in October 1st 2012, date set for signing the partnership agreement between Biofílica and Asmorex. The activities have been developed simultaneously, since the process of conception of the Project until the credit verification, and will be continued for all the Project's duration, through studies planning and execution, and prospection of buyers for Project's credits, ensuring the continuation of the Project. The activities of the REDD+ component implemented during the first monitoring period are shown in **Table 2**.

Table 2. Summary of the Resex Rio Preto Jacundá REDD+ Project main activities in the REDD+ activities component in this monitoring period.

Activity	Description	Status, applicable procedure and additional information regarding recording format
Planning Activities		
Survey of institutions and identification of partnerships	Survey and identification of local partners such as consultants, researchers and institutions to develop the project.	Concluded in 2013. See document Workshop I, II and III *Projeto REDD+ Resex Rio Preto Jacundá – Período de Monitoramento Oct.2012-Oct.2015*.
Technical studies		
Socioeconomic and Environmental Assessment (DSEA)	Study developed together with the Centro de Estudos da Cultura e do Meio Ambiente da Amazônia - CES Rioterra. The objective of the DSEA was to characterize the project and surrounding areas in 4 modules (social-economy, flora, fauna, and physical environment) and to conduct a preliminary assessment of possible impacts of the project on local social-economic and environmental context, as well as suggest monitoring measures based on scientific reports and articles already developed in the area.	Concluded in 2014. See document: *Diagnóstico Socioeconomico e Ambiental da Região do Projeto REDD+ Resex Rio Preto Jacundá Relatório Final – Período de Monitoramento Oct.2012-Oct.2015*.
Carbon stock estimate	Study developed in partnership with Hdom aiming at estimating the forest carbon stock and producing a map of the carbon stock for the project area based on data of forest inventories.	Concluded in 2013. See document: *Relatório Técnico Final v.4.0 para o Projeto REDD+ Resex Rio Preto Jacundá* and *Relatório de Despesas Projeto REDD+ Resex Rio Preto Jacundá – Período de Monitoramento Oct. 2012-Oct.2015.*
Determination of the baseline and the carbon credits generation potential	It was also developed in partnership with IPÊ – Instituto de Pesquisas Ecológicas aiming to determine the project baseline and estimate the amount of REDD credits to be potentially generated by the project.	Concluded in 2014. See document: *Relatório de Projeção de Linha de Base - RESEX RPJ* and *Relatório de Despesas Projeto REDD+ Resex Rio Preto Jacundá – Período de Monitoramento Oct. 2012-Oct.2015.*
Management and conception design activities		

Activity	Description	Status, applicable procedure and additional information regarding recording format
Preparation of the Project description document	Detailed project description, with used methodology, proposed activities and impacts, and estimates avoided GHG emissions.	Concluded in October, 2015. See VCS Project Description: Resex Rio Preto Jacundá REDD+ Project
Political and stakeholder articulation	Several meetings between project proponents and Sedam, CDREX and Ministério Público and Rondonia's Governor, discussing project and Resex issues.	Continuously throughout the Project lifetime. See documents "Atas", "Apresentacao reuniao Cdrex 2013 e 2015", "Anuencia Governador", "Carta_MP_RO"
Carrying out six workshops with RRPJ community in order to build the REDD+ Project.	Participatory building of project activities, management models, Resex zoning and design concepts	Started in October, 2013 and finished in July, 2014. See documents "*Relatórios das Oficinas".*
Project's Financial Management		
Prospection of potential buyers of the Project's VCUs	In order to ensure the Project's longevity, Biofílica Investimentos Ambientais continuously searches for potential buyers of the VCUs to be generated by the Project. Such activities consist in participating in related events, relationship with potential buyers and sales representative.	Started in 2013 and to be continued throughout the Project duration. See document *Ata de Reunião de Conselho and Biofilica's folder*
Project's budget follow up	Income and expenses spreadsheet	Started in 2012 and to be continued throughout the Project lifetime. See document *Relatorio de Despesas Projeto REDD+ Resex Rio Preto Jacundá – Período de Monitoramento Oct. 2012-Oct.2015.*
Monitoring Activities		
Monitoring of deforestation and emissions	Monitoring of deforestation ex post dynamics was monitored through satellite images, GIS analysis and annual deforestation reports.	Completed for 2013, 2014 and 2015. Continuously throughout the Project. See: *Boletim de desmatamento Jacundá 13-14-15.*

Analysis of land-use and land cover change during the monitoring period

The analysis of land-use and land cover change during the monitoring period was carried out following the procedures described on the item 2.4 of the Project Description, though PRODES data. The main activities carried out by the PRODES Project to monitor the Brazilian Amazon forest cover are presented hereafter.

Pre-processing

Images pre-processing procedures carried out by PRODES consist of the following steps (Câmara et al, 2006):

- Selection of images with less cloud coverage, shooting date closer to Amazon dry season and adequate radiometric quality;
- Georeferencing of the images with spatial resolution of 30 meters with topographic charts in a 1:100,000 scale and NASA images in MrSID orthorectified format.

Interpretation and classification

The satellite images classification method used by PRODES follows four main steps. The first is the generation of a spectral mixture model in which vegetation, soil and shadow components are identified; this technique is known as spectral linear mixture model and aims to estimate the percentage of vegetation, soil and shadow component for each pixel of the image. The second step is the application of the segmentation technique which identifies in the satellite image the spatially adjacent regions (segments) with similar spectral characteristics; after segmentation there is the individual classification of the segments to identify forest classes, non-forest vegetation and deforestation (anthropic vegetation). Finally, the classified segmentation result is submitted to an editing process, or classification audit, carried out by a specialist and finalizing with the creation of state mosaics.

Map accuracy assessment

PRODES mapping evaluation was carried out by comparison of each of the classes of the land-use and land-cover map (2012, 2014 and 2015) with a set of 120 points randomly distributed over the monitored area (Project Area and Leakage Belt). Reference data used come from the point obtained by visual interpretation of images from Landsat 8 with 15 meters of spatial resolution (panchromatic image fusion) and with support from the Google Earth images.

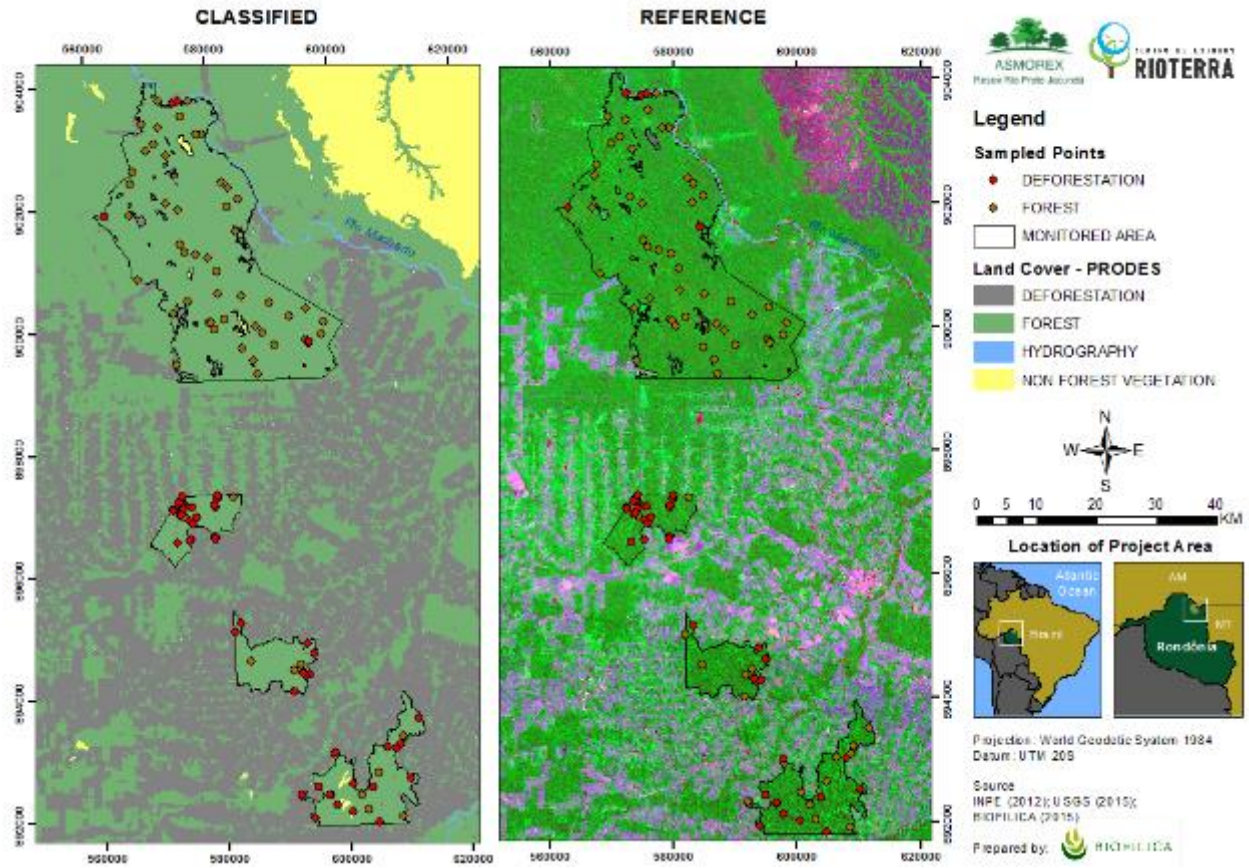

Figure 2 Map accuracy assessment

Having the reference points and the land-use and land-cover map of the monitoring period, it was possible to evaluate the performance of the monitoring process by analyzing the confusion matrix (*Table 3*) as per Congalton (1999). The overall accuracy of the monitoring process for the land-use classes at the monitored area presented values above 80%.

Table 3 Confusion matrix of the monitoring period

		REFERENCE			
CLASSIFIED		Forest	Deforestation	Total	User accuracy %
	Forest	58	2	60	97
	Deforestation	10	50	60	83
	Total	68	52	120	
	Producer accuracy %	85	96		

The confusion matrix was made based on a stratified random allocation of points with the aim to sample all the land use land change classes. A total of 120 points were used in the accuracy assessment, which is more the suggested in the Project Description, being 60 points randomly distributed in classes Deforestation and Forest.

Monitoring of leakage and management of non-permanence risk factors

The monitoring of leakage was realized through satellite images, allowing the mapping of the forest cover in the leakage belt, as described in section 4.3 of the monitoring report.

Regarding the non-permanence risk factors, the main risks are related to the External Risks, and they have been monitored as follows:

- When illegal activities were identified inside the Project Area or within the boundaries of Resex Rio Preto Jacunda, the local association community (ASMOREX) took the necessary measures, such as registering the occurrence at Sedam (local competent government institution).

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable.

2.2.2 Project Description Deviations

Not applicable.

2.3 Grouped Project

Not applicable.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	**Deforestation**
Data unit:	Hectare (ha)
Description:	Maps of forest coverage areas converted into non-forest areas.
Source of data:	Measured though data from PRODES/INPE project.
Value applied:	2,2%/year on average (2000-2012).
Justificativa da escolha do dado ou descrição dos meios de medição e procedimentos aplicados:	For deforestation mapping and production of the Forest Cover Benchmark Map data from PRODES Digital (official Brazilian Amazon Forest deforestation satellite mapping) program were used. A total of 38 Landsat images were used during the analyzed period. The ISOSEG non-supervised classification method was used in the classification of the images to map forest classes, non-forest vegetation, hydrography and deforestation.
Purpose of the data:	• Determination of baseline scenario • Calculation of leakage
Any comment:	See documents: • *Câmara et al. 2006. Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal* • *Relatório de Projeção de Linha de Base – RESEX RPJ.*

Data Unit / Parameter:	**Ctot**
Data unit:	$tCO_2e\ ha^{-1}$
Description:	Average carbon stock per hectare in all carbon pools in the forest class used in the baseline scenario.
Source of data:	Calculated by allometric equations, expansion factors from literature and field measured data.
Value applied:	$476,8tCO_2e\ ha^{-1}$
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions

Any comment:	• Above-ground biomass estimate was carried out using forest inventory data, allometric equations developed in areas similar to the project area (Silva, 2007).

Data Unit / Parameter:	**DBH**
Data unit:	cm
Description:	Diameter at Breast Height (130 cm) for each tree with DBH equal or higher than 10 cm in each plot of the forest inventory.
Source of data:	Measured in the field by Hdom Engenharia e Projetos Ambientais Ltda.
Value applied:	See field measurements spreadsheet.
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions
Any comment:	Resex Rio Preto Jacundá REDD+ Project's main variable for carbon stock estimate. VCS Methodology VM0015 requirement. Data from forest inventory collected less than 10 years ago from multiple plots at wide spatial distribution.

Data Unit / Parameter:	$BGB_{fw} = 0{,}0469 \times DAP^{2{,}4754} \times fc_1$ $AGB_{fw} = 2{,}2737 \times DAP^{1{,}9156} \times fc_1$
Data unit:	kg (biomass fresh weight)
Description:	Equation to convert DBH into biomass for trees with DBH equal to or higher than 10 cm.
Source of data:	Silva, 2007.
Value applied:	$BGB_{fw} = 0{,}0469 \times DAP^{2{,}4754} \times fc_1$ $AGB_{fw} = 2{,}2737 \times DAP^{1{,}9156} \times fc_1$
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions
Any comment:	Equation developed for forest with characteristics similar to the forests in the reference region.

Data Unit / Parameter:	**CF**
Data unit:	t

Description:	Carbon content in dry biomass
Source of data:	Nogueira, E.; Fearnside, P.; Nelson, B., et al., 2008. Estimates of forest biomass in the Brazilian Amazon: New allometric equations and adjustments to biomass from wood-volume inventories. Forest Ecology and Management, 256 (11), pp.1853-1867
Value applied:	0.485
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions
Any comment:	Value found in scientific literature.

Data Unit / Parameter:	**44/12**
Data unit:	tCO_2e
Description:	Carbon mass to CO2e mass conversion factor.
Source of data:	From scientific literature: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 AFOLU.
Value applied:	44/12
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions
Any comment:	IPCC standard value

Data Unit / Parameter:	**Open area for management infrastructure**
Data unit:	Percent
Description:	Open area necessary for the forest management, like patios and roads.
Source of data:	Post exploratory report
Value applied:	8%
Purpose of the data:	• Calculation of project emissions
Any comment:	

3.2 Data and Parameters Monitored

Data Unit / Parameter:	**Deforestation in the Project area and leakage belt**
Data unit:	Hectare (ha)
Description:	Forest coverage areas converted into non-forest areas inside the Resex Rio Preto Jacundá REDD+ Project area and leakage belt.
Source of data:	Calculated through Landsat images acquired in 23/08/2014 and 25/07/2015, processed by the PRODES Digital project and additional Landsat 8 (USGS - EarthExplorer) acquired in 10/10/2014.
Description of measurement methods and procedures to be applied:	The monitoring of the forest coverage in the project area and leakage belt was conducted through satellite image analysis and Geographic Information System. Images of spatial resolution of 30 m were used in the mapping carried out by automatic classification from optical image and visual interpretation of images from Landsat8 data.
Frequency of monitoring/recording:	Annual
Value monitored:	Deforestation area identified within the Project Area (PA) and Leakage Belt (LK) for: 2013: 14 ha (PA) and 160 ha (LK); 2014: 1,1 ha (PA) and 33,2 ha (LK); 2015: 24,8 ha (PA) and 301,3 ha (LK);
Monitoring equipment:	Geographic information systems, digital processing program, and navigation GPS.
QA/QC procedures to be applied:	The minimum mapping unit is 1 ha. Cloud areas were analyzed with images collected by USGS (EarthExplorer) of satellite Landsat 8, with spatial resolution of 15 m (panchromatic image fusion). The accuracy of the LU/LC classification was higher than 80%.
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method:	Shapefile of areas detected as unplanned deforestation was used for updating the Shapefile

	of Forest Cover Benchmark Map by map algebra operations.
Any comment:	PRODES Digital project: http://www.dpi.inpe.br/prodesdigital/prodes.php Further information on QA/QC available in: • *Câmara et al. 2006. Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal*

Data Unit / Parameter:	**Ctot**
Data unit:	$tCO_2e\ ha^{-1}$
Description:	Average carbon stock per hectare in all carbon pools in the Forest class used at baseline scenario.
Source of data:	Calculated by allometric equations, expansion factors from scientific literature, and data measured in the field by Hdom Engenharia e Projetos Ambientais Ltda.
Description of measurement methods and procedures to be applied:	Above-ground biomass estimate was carried out using forest inventory data, allometric equations developed in areas similar to the project area (Silva, 2007). The dead wood pool was estimate as Feldpausch et al (2005).
Frequency of monitoring/recording:	Data collected in the forest inventory periods of up to 10 years in multiple installments.
Value monitored:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Further information on QA/QC available in: "Hdom#12_Relatório Tecnico Final_PT_v4.0", section 5.3 of the document.
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions • Calculation of leakage
Calculation method:	Comparison between total carbon stock average value contained in forest class used in the baseline scenario, according to *Estimativa do Estoque de Carbono Florestal para o Projeto REDD+ Resex Rio Preto Jacundá*

Any comment:	Methodology VM0015 mandatory requirement for areas with logging. In this monitoring period not had carbon stock change due to planned logging activities in the project area.

Data Unit / Parameter:	**DBH**
Data unit:	cm
Description:	Diameter at Breast Height (130 cm) for each tree with DBH equal or higher than 10cm in each plot of the forest inventory.
Source of data:	Calculated from the circumference at breast height measured in the field by Hdom Engenharia e Projetos Ambientais.
Description of measurement methods and procedures to be applied:	DBH is calculated from the circumference at breast height (CBH) data of each monitored tree measured in the field.
Frequency of monitoring/recording:	Data collected in the forest inventory periods of up to 10 years in multiple installments.
Value monitored:	See field measurements spreadsheet.
Monitoring equipment:	Calculated from the circumference at breast height data measured in the field using a measuring tape.
QA/QC procedures to be applied:	Mandatory monitoring according to Methodology VM0015. Data coming from forest inventory collected in periods of up to 10 years from multiple plots.
Purpose of the data:	• Calculation of baseline emissions • Calculation of project emissions
Calculation method:	DBH is calculated from the circumference at breast height (CBH) data of each tree monitored measured in the field.
Any comment:	Main variable used to estimate changes in carbon stock on the Resex Rio Preto Jacundá REDD+ Project. In this monitoring period not had carbon stock change due to planned logging activities in the project area.

Data Unit / Parameter:	**Planned deforestation to Forest Management infrastructure**

Data unit:	Hectare (ha)
Description:	Map of forest cover areas converted into non-forest areas due to the construction of roads, trails and forest patios.
Source of data:	Remote sensing images, technical maps, and specific field cards to monitor the construction of forest management roads, trails and forest patios.
Description of measurement methods and procedures to be applied:	The monitoring of forest cover areas will be done by satellite images analysis, road, trails and forest patio construction maps, and field verification. In case planned deforestation occurs, the Forest Cover Benchmark Map will be updated by map algebra. The reduction in carbon stock in the Project area will be reported in the verification processes.
Frequency of monitoring/recording:	During the year of management of each UPA.
Value monitored:	N/A
Monitoring equipment:	Field card and geographic information system.
QA/QC procedures to be applied:	Analysis of planned deforestation areas due to Forest Management Infrastructure performed by high resolution images from Google Earth and Landsat 8 images without cloud interference.
Purpose of the data:	• Calculation of project emissions
Calculation method:	In case planned deforestation areas are detected the Forest Cover Benchmark Map will be updated by map algebra.
Any comment:	

Data Unit / Parameter:	**ΔCabBSLLKt**
Data unit:	tCO_2-e
Description:	Total carbon stock changes in the leakage belt area
Source of data:	Calculated.
Description of measurement methods and procedures to be applied:	• leakage prevention activities will be listed; • a map showing areas of intervention and type of intervention will be prepared; • areas where leakage prevention activities impact carbon stock will be identified;

	• non-forest classes existing within these areas in the baseline case will be identified; • carbon stocks will be measured on the identified classes or conservative literature estimates will be used; • carbon stock changes in the leakage management areas under the project scenario will be reported using table 30b of the VM0015; • net carbon stock changes that the leakage prevention measures cause during the fixed baseline period and, optionally, the project crediting period will be calculated; • results of the calculations will be reported in table 30.c of the VM0015.
Frequency of monitoring/recording:	To be determined depending on the activity
Value monitored:	0
Monitoring equipment:	To be determined depending on the activity
QA/QC procedures to be applied:	Not applied because during the monitoring period there wasn't carbon stock change in the leakage belt area (table 35 of VCS VM0015).
Purpose of the data:	• Calculation of leakage
Calculation method:	To be determined depending on the activity
Any comment:	N/A

3.3 Description of the Monitoring Plan

Organizational structure, responsibilities and competencies

The REDD+ Project Monitoring Plan will cover three components: climate, community and biodiversity. At this first verification period, deforestation in the project area and leakage belt was monitored. As a proponent and partner implementer of the project, Biofílica coordinated the monitoring process during the first monitoring period. The climate aspects were monitored directly by the Biofílica team.

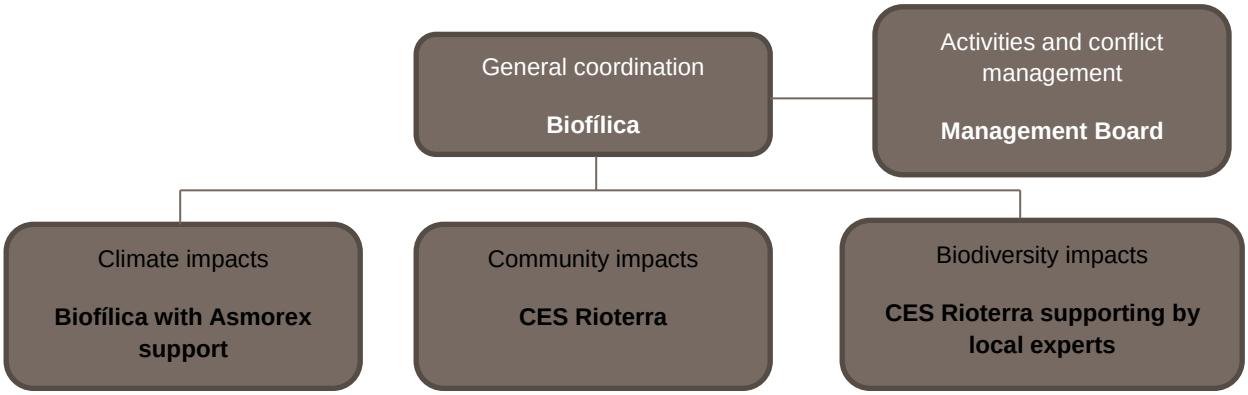

Figure 3. Organizational Structure of Monitoring Plan

- Biofílica:

a) Responsibilities: general coordination of the socioeconomic and environmental assessment (DSEA) and baseline studies and carbon stock; PD (Project document) development and financing; credits validation/checking and trading; Project co-management throughout the Project lifetime; implementation of conservation activities; general coordination of monitoring activities and climate impacts monitoring.

b) Competencies: It has technical skills for monitoring activities with experts trained in GIS tools with full dedication to REDD+ projects.

- CES Rioterra:

a) Responsibilities: coordination of socio-economic and environmental studies; planning of conservation activities; support in the validation/verification; implementation and monitoring of social and biodiversity REDD+ Project activities.

b) Competencies: It has experience in implementation and monitoring indicators of social and environmental projects with traditional communities in the Amazon. It has an agreement with researchers from the Federal University of Rondônia to hire expert researchers in regional biodiversity.

- Amorex:

a) Responsibilities: responsible for developing and implementing, in a participatory manner, REDD+ Project, and to ensure execution of the project and maintain all documentation needed for the project; monitoring and co-management of the REDD+ Project activities.

b) Competencies: official representative of Resex residents. As project developer, it will manage financial resources and ensure its proper use and the impact generated by the projects activities.

- Management Board:

a) Responsibilities: Monitor the targets, outcomes and impacts of project activities; Manage the resources of RESEX Rio Preto-Jacundá Fund in accordance with the principles, with the planning and priorities established collectively; Making public data, information, reports, deliberations and rendering of accounts in accessible language; Mediate unresolved conflicts with the first instance among the community.

b) Competencies: project forum for discussion and follow-up activities, as well as being space presentation and disclosure of the results of monitoring.

Internal auditing performed

Internal Audit procedures were examinations and investigations, including compliance tests which allowed the internal auditor to obtain enough information to substantiate its findings and recommendations to the project management.

In its application, the following was considered:

a) inspection - verification of records and documents;

b) observation - monitoring process or procedure;

The evidences were sufficient, reliable, relevant and useful to provide solid basis for the conclusions and recommendations to the project coordination.

Internal audit staff with sufficient knowledge of techniques that require the use of information processing technology resources were hired in order to implement their own procedures or, if necessary, guide, supervise and review the work of experts.

Table 4. Internal audit Plan

Data/Parameter	Procedure	Unit	Source	Frequency	Responsible	Conformity
Income and expenses spreadsheet	Project's budget follow up	R$	Biofilica Investimentos Ambientais	Monthly	Project Coordinator	Yes
$AUDPA_{icl,t}$	Areas of unplanned deforestation in forest class in the project area	ha	Calculated through remote sensing images.	Quarterly	GIS Analyst	Yes
$APDPA_{icl,t}$	Areas of planned deforestation in forest class in the project area	ha	Calculated through remote sensing images, technical maps, and specific field cards.	Quarterly	GIS Analyst	Yes

Data/Parameter	Procedure	Unit	Source	Frequency	Responsible	Conformity
$\Delta CPLdPA_t$	Total decrease in carbon stock due to planned logging activities in the Project Area	tCO_2-e	Calculated	Quarterly	GIS Analyst and Project Coordinator	Yes
$\Delta CUDdPA_t$	Total carbon stock decrease due to unavoided unplanned deforestation within the project area	tCO2-e	Calculated	Quarterly	GIS Analyst and Project Coordinator	Yes

Technical description of the monitoring tasks

The monitoring of the REDD+ activities aimed at avoiding unplanned deforestation through the social and conservation activities (increase in the frequency and comprehensiveness), the monitoring of the forest cover with satellite images and field survey, and social inclusion of the communities in the Resex Rio Preto Jacundá REDD+ Project area.

Table 5. Data collected to monitoring plan.

Data/Parameter	Description	Unit	Source	Frequency
Income and expenses spreadsheet	Project's budget follow up	R$	Biofilica Investimentos Ambientais	Annual
$AUDPA_{icl,t}$	Areas of unplanned deforestation in forest class *icl* at year *t* in the project area	ha	Calculated through remote sensing images.	Annual

Data/Parameter	Description	Unit	Source	Frequency
$APDPA_{icl,t}$	Areas of planned deforestation in forest class *icl* at year *t* in the project area	ha	Calculated through remote sensing images, technical maps, and specific field cards.	Annual
$\Delta CPLdPA_t$	Total decrease in carbon stock due to planned logging activities at year *t* in the Project Area	tCO_2-e	Calculated	Annual

Table 6. Data collected to leakage monitoring.

Data/Parameter	Description	Unit	Source	Frequency
$ACPA_{icl,t}$	Annual area within the Project Area affected by catastrophic events in class *icl* at year *t*	ha	Calculated through remote sensing images.	Each time a catastrophic event occurs
$\Delta CUCdPA_t$	Total decrease in carbon stock due to catastrophic events at year *t* in the Project Area	tCO_2-e	Calculated	Each time a catastrophic event occurs
$\Delta CUDdPA_t$	Total carbon stock decrease due to unavoided unplanned deforestation within the project area at year t.	tCO2-e	Calculated	Annual

Overview of data collection procedures

3.3.1 Monitoring of project implementation

The monitoring of the implementation was made by Biofílica, Asmorex and CES Rioterra, procedure throughout all its phases and in all the aspects (operational, environmental and social). The implementation of REDD+ activities was monitored through physical-financial schedules, follow-up of performance and quality reports, social management reports, maps of forest cover, meeting reports, land invasion police reports and other actions to control illegal deforestation, and other relevant documents.

3.3.2 Monitoring of land-use and land-cover changes

The monitoring of planned and unplanned deforestation was made through project area forest cover mapping using 30-meter or higher spatial resolution satellite images. The monitoring of the deforestation for implementation of forest management infrastructure was carried out through specific field cards for the construction of roads, trails and forest patios inside the project area, and the maps and satellite images containing information on forest cover areas converted into non-forest areas. In order to have more flexibility in the deforestation mapping process, different techniques of automatic classification and visual interpretation using field data and cartographic quality standards may be used. Data on deforestation events was compared to baseline scenario. Emission reduction values for the monitored period was based on the comparison between forecasted and real deforestation.

Data acquisition:

For the mapping of forest cover and land use was used images from the satellite Landsat. The Landsat images used was with spatial resolution equal to 30 meters and spectral resolution between 0,45 to 2,35 *μm,* within the period of lower incidence of clouds and rain in the region. For the monitoring of forest cover in the monitored area all the satellite images covered the area between the following coordinates: 61°44'23"W 8°34'39"S and 62°32'25"W 9°52'40"S. All the data used to perform the monitoring, including maps in Shapefile and Geotiff format was provided by PRODES Digital of the National Institute for Space Research (INPE), the information provided by PRODES Digital can be accessed at www.obt.inpe.br/prodes. Support data from USGS and Google Earth was used just to validate the PRODES mapping.

Pre-processing:

The main activities regarding pre-processing were carried out by PRODES. The procedures were the following:

- Selection of optical satellite images with less cloud coverage, shooting date closer to Amazon dry season and adequate radiometric quality;
- Georeferencing of the satellite images with topographic charts in a 1:100,000 scale or NASA images in MrSID orthorectified format;
- All data was in Datum WGS84 20S;
- Generation of a spectral mixture model to estimate the percentage of vegetation, soil and shadow component for each pixel of the image;
- Application of the segmentation technique which identifies in the satellite image the spatially adjacent regions (segments) with similar spectral characteristics;
- Classification the segments to identify forest classes, non-forest vegetation and deforestation.

Classification:

The methodology of classification adopted by PRODES Digital is made by using the multispectral images to transform values from digital numbers to scene component (vegetation, soil and shadow) through spectral mixture algorithm. The classification is performed, for every year since 2000, using the algorithm unsupervised ISOSEG with the acceptance threshold of 90% for the classes: forest, deforestation, non-forest vegetation, hydrography and cloud. These segmentation and classification algorithms can be applied using the programs Spring and TerraView. In the case of this monitoring period was used de classification made for the years 2012, 2013 and 2015 (Câmara et al., 2006). For more information, access: obt.inpe.br/prodes/metodologia.

Post-processing:

The methodology of classification is programmed to avoid the cloud coverage by selection of optical satellite images with less cloud coverage and by estimating the areas deforested under cloud coverage. The areas remained within the cloud cover were validated by visual interpretation of additional images such as Radar or other satellites.

Classification accuracy assessment:

PRODES mapping evaluation was carried out by comparison of each of the classes of the land-use and land-cover map (2013, 2014 and 2015) with a set of 120 points randomly distributed over the monitored area (Project Area and Leakage Belt). Reference data used come from the point obtained by

visual interpretation of Landsat images with technique of panchromatic image fusion and support from Google Earth.

Having the reference points and the land-use and land-cover map of the monitoring period, it was possible to evaluate the performance of the monitoring process by analyzing the confusion matrix (Table 3) as per Congalton (1999). The overall accuracy of the monitoring process for the land-use classes at the monitored area presented values above 80%.

Additional Procedure Implemented

Additionally to the predicted procedure explained in the Project Description Section 2.4 and 2.5, all the identified deforestation Polygons will be checked in the field according with the following procedure, developed after Project Validation and first verification. The deforestation polygons were not checked in the field at this first verification period because the lack of security in the area, however these activity is foreseen for the next project years.

For this monitoring period Biofílica Investimentos Ambientais generated an Annual Deforestation Bulletin (for 2013, 2014 and 2015). This Bulletin contained all the data, methodology applied and the results of Biofílica's analyses of PRODES data, for the corresponding year, within the Project Area and the Leakage Belt. Maps were generated with all the deforestation polygons of interest (those inside the perimeter of Project Area and Leakage Belt) and the polygons coordinates were set in a table. For the next monitored years Biofílica Investimentos Ambientais will generate these Bulletins annually with the PRODES data.

Quality control and quality assurance procedures:

Data from INPE / PRODES monitoring system are recognized as the official data of deforestation in the Brazilian Amazon, the PRODES system is internationally recognized as the main source of data regarding the change of land use in the Amazon. This system already has more than 25 years and has been constantly improved, since 2000 the system is fully digital and has 1 ha as a minimum mapping unit. PRODES system mainly uses Landsat satellite images in carrying out mapping with a resolution of 30 meters. The methodology of PRODES is specifically developed to map the Amazon rainforest, has image interpretation techniques and reducing the influence of clouds to the specific characteristics of the Amazon rainforest. Thus, in the case of mapping the Amazon rainforest, PRODES is the most accurate system available, details of PRODES monitoring methodology can be found at Camara, et al., 2006.

The original (raster) and processed (vector) digital data from satellite images, coordinates, technical maps, field photos and cards were stored by Biofílica Investimentos Ambientais throughout the project.

Maps of infrastructure installation, satellite images and annual deforested areas reports are available to the verification body.

3.3.3 Monitoring changes in carbon stocks

Within leakage management areas:

No areas were subject to planned carbon stock decrease in the leakage management areas in the project scenario.

Within the project area:

It is expected that ex ante carbon stock estimate for forest class does not change during baseline period. However, VCS Methodology VM0015 requires the monitoring of carbon stock in project area subjected to significant carbon stock decrease in the project scenario according to the ex ante assessment due to controlled deforestation and planned harvest activities, or areas subjected to unplanned and significant carbon stock decrease in the project scenario.

Total carbon stock change due to unavoided unplanned deforestation within the project area is calculates the following way:

$$\Delta \mathrm{CUDdPA}_t = \sum_{y=1}^{t} \left(\sum_{icl=1}^{icl} AUDPA_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDPA_{fcl,y} * \Delta Ctot_{fcl,t-y} \right)$$

Where:

ΔCUDdPAt Total carbon stock change due to unavoided unplanned deforestation within the project area at year t.

AUDPAicl,y Area of unplanned deforestation in the initial forest class icl at year t within the project area in the project scenario.

ΔCtoticl,Ac Carbon stock loss in the initial forest class icl at age of change Ac (# of years after LU/LC change).

AUDPAfcl,y Area of non-forest class fcl at time t within the project area post-unplanned deforestation in the project scenario.

ΔCtotfcl,Ac Carbon stock gain in the final non-forest class fcl at Age of change Ac (# of years after LU/LC change).

All reduction in carbon stock due to sustainable forest management activities was reported in this verification processes using Table 27 of the VCS methodology VM0015 version 1.1, or Table 12 of this document.

Quality control and quality assurance procedures:

3.3.4 Monitoring of non-CO_2 emissions from forest fires

Emissions due to biomass burning are not accounted in this project.

3.3.5 Monitoring impacts from natural disturbances and other catastrophic events

Decreases in carbon stocks and increases in GHG emissions due to natural disturbances or catastrophic events was controlled by monitoring the forest cover through satellite, using the same methods applied in monitoring the forest cover at the project area (section 1.1.2).

The main activities carried out by the project to collect and process data were:

- Selection of optical satellite images with less cloud cover, taken at times near the Amazonian dry season and with adequate radiometric quality;
- Georeferencing of satellite images with topographic charts in a 1:100.000 scale or NASA images in MrSID orthorectified format;
- Mapping the affected forest cover areas.

Emissions due to natural disturbance or catastrophic events will be estimated by multiplying the area of forest loss mapped by the average of forest carbon stock. During this monitoring period no significant reduction in carbon stock due to natural disturbance or catastrophic events were identified during the forest cover monitoring.

Data archiving

All data and reports of the Resex Rio Preto Jacundá REDD+ Project were stored by Biofílica Investimentos Ambientais in digital files throughout the project.

The original reports and field cards collected for the forest management activities were stored by Asmorex. Biofílica Investimentos Ambientais kept a copy of these documents filed in digital format throughout the project.

The compilation and announcement of the results of social activities were made through Biofílica Activities Report and Impacts Report periodically prepared and made available in digital format.

All documents related to the monitoring of Resex Rio Preto Jacundá REDD+ Project were put together in hard and/or virtual files, and made available to the verification body at each verification event.

Organization and responsibilities of the parties involved in all the above

All activities of monitoring are a responsibility of Biofílica Investimentos Ambientais and Asmorex, with support from CES Rioterra.

3.3.6 Monitoring of Leakage:

Technical description of the monitoring tasks

Resex Rio Preto Jacundá REDD+ Project involved two monitoring activities of sources of leakage:

1. Monitoring of decrease in carbon stocks and/or increase in GHG emissions associated with leakage prevention measure if the project proponents implement activities such as tree planting, agricultural intensification, fertilization, fodder production and/or other measures to enhance cropland and grazing land areas. If these activities cause reductions in carbon stocks and/or increase in GHG emissions in leakage management areas, such carbon stock changes and/or GHG emissions would be estimated by Biofílica Investimentos Ambientais technical staff. During this monitoring period project proponents carried none of the interventions mentioned out. Therefore carbon stock changes and GHG emissions associated to leakage prevention activities were not accounted.
2. Biofílica Investimentos Ambientais performed the monitoring of forest cover in the Leakage Belt via satellite images to account for carbon stock decrease and increases in the GHG emissions due to leakage displacement.

Table 7. Data collected to leakage monitoring.

Data	Description	Unit	Source	Frequency
$\Delta CLPMLK_t$	Carbon stock decrease due to leakage prevention measures	tCO_2-e	Calculated	Annual
$ELPMLK_t$	Annual total increase in GHG emissions due to leakage prevention measures at year *t*	tCO_2-e	Calculated	Annual
$\Delta CBSLLK_t$	Total ex post carbon stock change at year t.	tCO2-e	Calculated	Annual

Overview of data collection procedures

3.3.6.1 Monitoring of changes in carbon stocks and GHG emissions associated to leakage prevention activities

The decrease in carbon stocks due to activities developed in Leakage Management areas are not expected, since no activity for improved farming techniques, or management of grazing areas that could alter carbon stocks and increase GHG emissions, as compared to the baseline scenario, has been planned for implementation. And such kinds of activities were not implemented during this monitoring period.

However, if it is decided that such activities are necessary, then, the ex ante carbon stock changes and GHG emissions associated to such activities would be estimated through step 8 of the VM0015 methodology, and, if meaningful, they would be monitored and data would be provided to the verification body at each verification event through tables 30b, 30c, 31, 32 and 33 of VM0015 methodology, version 1.1.

3.3.6.2 Monitoring of carbon stocks reduction and GHG emissions increase due to activity displacement leakage

Activity data for the leakage belt area was determined using the same methods applied to monitoring deforestation in the project area (section 1.2).

It was identified a deforestation even higher than expected for the baseline scenario within the leakage belt in the last year of the monitoring period (01 Oct 2014 to 30 Sep 2015), representing an emission of 6,168 tCO_2e

Monitoring of increases in GHG emissions:

Emissions due to forest fires are not accounted in the baseline.

Quality control and quality assurance procedures

Monitoring of carbon stock changes and GHG emissions associated to leakage prevention activities:

- To be determined depending on the activity, if implemented.

Activity data for the leakage belt area was determined using the same methods applied to monitoring deforestation in the project area (section 1.2). If during the monitoring process a deforestation event higher than the expected for baseline scenario is identified in the leakage belt, and such deforestation

is attributed to deforestation agents from the project area, the losses in carbon stock will be accounted for and reported using Table 22c and 21d of VM0015 approved methodology version 1.1.

Total carbon stock change due to unavoid unplanned deforestation within the leakage belt area is calculates the following way:

$$\Delta \mathrm{CBSLLK}_t = \sum_{y=1}^{t} \left(\sum_{icl=1}^{icl} AUDLK_{icl,y} * \Delta Ctot_{icl,t-y} - \sum_{fcl=1}^{fcl} AUDLK_{fcl,y} * \Delta Ctot_{fcl,t-y} \right)$$

Where:

ΔCBSLLKt Total carbon stock change due to unavoided unplanned deforestation within the leakage belt area at year t.

AUDLKicl,y Area of unplanned deforestation in forest class icl at year t within the leakage belt area in the project scenario.

ΔCtoticl,Ac Carbon stock loss in the initial forest class icl at age of change Ac (# of years after LU/LC change).

AUDLKfcl,y Area of non-forest class fcl at time t within the leakage belt area post-unplanned deforestation in the project scenario.

ΔCtotfcl,Ac Carbon stock gain in the final non-forest class fcl at Age of change Ac (# of years after LU/LC change).

Data archiving

The original reports and field cards were stored by Biofílica Investimentos Ambientais and keeped a copy of these documents filed in digital format throughout the project. The original (raster) and processed (vector) digital data from satellite images, coordinates, technical maps, field photos and cards were stored by Biofílica Investimentos Ambientais throughout the project. Maps of annual deforested areas, satellite images and reports were available to the verification body at each verification event.

Organization and responsibilities of the parties involved in all the above

The all activities of monitoring of leakage are a responsibility of Biofílica Investimentos Ambientais.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Estimation of annual areas of unplanned deforestation in the project area under the without project scenario has been implemented by applying the following four steps:

- Analysis of deforestation during the historic reference period (2000 – 2012).
- Estimation of the annual areas of unplanned baseline deforestation in the Reference Region (RR).
- Estimation of the annual areas of unplanned baseline deforestation in the project area (PA).
- Analysis of the ex-post scenario over the current monitoring period.

The entire process is detailed in the REDD+ Resex Rio Preto Jacundá project description. Results for the 2013 to 2015 monitoring period are presented in tables on the following pages.

Table 8 Carbon stocks per hectare of initial forest classes icl existing in the project area and leakage belt

Initial forest class *icl*							
Name:	Forest						
ID_{icl}	1						
Average carbon stock per hectare + 90% CI							
Cab_{icl}		Cbb_{icl}		Cdw_{icl}		$Ctot_{icl}$	
C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$	C stock $tCO_2e\ ha^{-1}$	± 95% CI $tCO_2e\ ha^{-1}$
418,7	21	58,1	4	0,0	0,0	476,8	24,6
tC ha-1	**CI %**	**tC ha-1**	**CI %**	**tC ha-1**	**CI %**	**tC ha-1**	**CI %**
114,19	5%	15,84	7%	-	-	130,03	5%

Cab_{icl} = Carbon stock in aboveground biomass in stratum *i*; tCO_2-e/ha
Cbb_{icl} = Carbon stock in belowground biomass in stratum *i*; tCO_2-e/ha
Cdw_{icl} = Carbon stock in dead wood in stratum *i*; tCO_2-e/ha

Table 9. Annual areas of unplanned baseline deforestation in the Project Area for the 2013-2015 monitoring period

Project year *t*	Stratum i of the reference region in the project area 1 $ABSLPA_{i,t}$ ha	Total	
		annual $ABSLPA_t$ ha	cumulative ABSLPA ha
2013	867	867	867
2014	1,254	1,254	2,121
2015	1,274	1,274	3,395

Table 10. Annual areas of unplanned baseline deforestation in the Leakage Belt for the 2013-2015 monitoring period

Project year *t*	Stratum i of the reference region in leakage belt 1 $ABSLLK_{i,t}$ ha	Total	
		annual $ABSLLK_t$ ha	cumulative ABSLLK ha
2013	350	350	350
2014	367	367	717
2015	287	287	1,004

For the calculations of the carbon stock changes of the baseline scenario was used the Method 1 described in the sections 6.1.2 and 6.1.3 of the Approved VCS Methodology VM0015. *T*otal emissions in the baseline scenario for the years 2013, 2014 and 2015 were 368,053 tCO2e, 537,375 tCO2e and 553,147 tCO2e respectively as presented in Table 11.

Table 11. Total net baseline carbon stock change in baseline scenario in the Project area (table 21b of VCS VM0015)

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the project area		Carbon stock changes per post-deforestation zone z		Total carbon stock change of post-deforestation zones in the project area		Total net carbon stock change of the project area	
ID_{icl}>	1	$\Delta CBSLPA_{i\ cl,t}$	$\Delta CBSLPA_{icl}$	ID_{iz}>	1	$\Delta CBSLPA_{z,t}$	$\Delta CBSLPA_z$	$\Delta CBSLPA_t$	$\Delta CBSLPA$
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2013	368,053.6	368,053.6	368,053.6	2013	5,303.4	5,303.4	5,303.4	362,750.2	362,750.2
2014	537,375.2	537,375.2	905,428.8	2014	12,974.0	12,974.0	18,277.4	524,401.3	887,151.5
2015	553,147.7	553,147.7	1,458,576.5	2015	20,766.9	20,766.9	39,044.3	532,380.7	1,419,532.2

4.2 Project Emissions

Emissions due to planned deforestation

Emissions associated to planned deforestation were developed in the Project area from 1st October 2012 to 30 September 2015. Total emissions related to planned deforestation is 49.851,5 tCO2e. This value was estimated considering 8% of intervention of the Forest Management on each Annual Production Units.

Table 12. Carbon stock decrease due to planned deforestation in the project area

Project Year *t*	Areas of planned deforestation x Carbon stock change (decrease) in the project area		Total carbon stock decrease due to planned deforestation	
	ID_{cl} =	1	annual	cummulative
	$APDPA_{icl,t}$	$Ctot_{icl,t}$	$\Delta CPDdPA_t$	$\Delta CPDdPA$
	ha	$tCO_2e\ ha^{-1}$	tCO_2e	tCO_2e
2013	25	476,8	11.709,2	11.709,2
2014	40	476,8	19.071,1	30.780,3
2015	40	476,8	19.071,1	49.851,5

Emissions due to planned logging activities

There were no emissions associated to planned logging activities were developed in Project Area from 1st October 2012 to 30 September 2015. All logging activities were executed in order to obtain long-lived wood products.

Emissions due to planned fuel-wood and charcoal activities

No emissions associated to planned fuel-wood and charcoal activities were developed in the Project area.

Removals due to carbon stock increase of planned activities

Carbon stock increase due to planned activities in areas that would be deforested in the baseline case was omitted.

Table 13. Total ex post carbon stock decrease due to planned activities

Project Year t	Total carbon stock decrease due to planned deforestation		Total carbon stock decrease due to planned logging activities		Total carbon stock decrease due to planned fuel-wood and charcoal activities		Total carbon stock decrease due to planned activities	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CPDdPA_t$	$\Delta CPDdPA$	$\Delta CPLdPA_t$	$\Delta CPLdPA$	$\Delta CPFdPA_t$	$\Delta CPFdPA$	$\Delta CPAdPA_t$	$\Delta CPAdPA$
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2013	11.709,2	11.709,2	0,0	0,0	0,0	0,0	11.709,2	11.709,2
2014	19.071,1	30.780,3	0,0	0,0	0,0	0,0	19.071,1	30.780,3
2015	19.071,1	49.851,5	0,0	0,0	0,0	0,0	19.071,1	49.851,5

Total ex post carbon stock decrease in the Project area

No carbon stock decrease associated to Project activities has occurred in the Project area from 1October 2012 to 30 September 2015.

Emissions due to unavoidable unplanned deforestation

A total of 40 hectares of unavoidable unplanned deforestation was observed within the Project area in this monitoring period.

Total of emissions related to unavoidable unplanned deforestation is 16,685 tCO2e. (2013/14/15)

Table 14. Observed annual areas of unplanned deforestation under the project scenario in the project area for the 2013-2015 monitoring period.

Area establish after deforestation per zone within the project area		Total monitored deforestation in the project area	
IDz>	1		
Name>	Zone 1	Annual	Cumulative
Project year$_t$	ha	ha	ha
2013	14	14	14
2014	1	1	15
2015	25	25	40

Emissions due to forest fires and catastrophic events

No emissions associated to forest fires and catastrophic events have occurred in the Project area from 1st October 2012 to 30 September 2015.

***Ex post* estimated net carbon stock change in the Project area**

The calculation of the ex-post estimated net carbon stock change in the project area uses the same method described in the sections 6.1.2 and 6.1.3 of the Approved VCS Methodology VM0015, considering at this time the changes observed in the current monitoring period.

Table 15 Ex-post carbon stock change in the project area (Table 21.b2 of VCS VM0015)

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the project area	
ID$_{icl}$>	1	$\Delta CBSLPA_{icl,t}$	$\Delta CBSLPA_{icl}$
Name>	Forest	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2013	5.943,2	5.943,2	5.943,2
2014	548,3	548,3	6.491,5
2015	10.615,6	10.615,6	17.107,1

Carbon stock changes per post-deforestation zone z		Total carbon stock change of post-deforestation zones in the project area	
ID$_{iz}$>	1	$\Delta CBSLPA_{z,t}$	$\Delta CBSLPA_z$
Name>	Zone 1	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2013	85,6	85,6	85,6
2014	92,4	92,4	178,0
2015	244,1	244,1	422,1

Total net carbon stock change of the project area	
$\Delta CBSLPA_t$	$\Delta CBSLPA$
annual	cumulative
tCO_2-e	tCO_2-e
5.857,6	5.857,6
455,9	6.313,5
10.371,6	16.685,0

Total ex post estimated carbon stock change in Project area under the Project scenario in this monitoring period is presented in Table 16.

Table 16. Ex post estimated net carbon stock change in the Project area under the Project scenario (Table 29 of VCS VM0015)

Project Year t	Total ex post carbon stock decrease due to planned activities		Total ex post carbon stock increase due to planned activities		Total ex post carbon stock decrease due to unavoided unplanned deforestation		Total ex post net carbon stock change		Total ex ante estimated actual non-CO2 emissions from forest fires in the project area	
	annual $\Delta CPAdPA_t$ tCO_2e	cumulative $\Delta CPAdPA$ tCO_2e	annual $\Delta CPAiPA_t$ tCO_2e	cumulative $\Delta CPAiPA$ tCO_2e	annual $\Delta CUDdPA_t$ tCO_2e	cumulative $\Delta CUDdPA$ tCO_2e	annual $\Delta CPSPA_t$ tCO_2e	cumulative $\Delta CPSPA$ tCO_2e	annual $EBBBSLPA_t$ tCO_2-e	cumulative $EBBPSPA$ tCO_2-e
2013	11,709.2	11,709.2	0.0	0.0	5,857.6	5,857.6	17,566.8	17,566.8	0.0	0.0
2014	19,071.1	30,780.3	0.0	0.0	455.9	6,313.5	19,527.0	37,093.8	0.0	0.0
2015	19,071.1	49,851.5	0.0	0.0	10,371.6	16,685.0	29,442.7	66,536.5	0.0	0.0

Non-CO_2 emissions from forest fires

Not subject to monitoring and accounting.

4.3 Leakage

One source of leakage was monitored: leakage due to displacement activity.

Leakage due to displacement activity was monitored by mapping forest cover change in the leakage belt. As defined in the VCS Methodology VM0015, deforestation above the baseline in the leakage belt area will be considered activity displacement leakage. Activity data for the leakage belt area was determined using the same methods applied to deforestation mapping in the Project area.

Table 17 Ex-ante Baseline carbon stock change in the leakage belt area (Table 21.c of VCS VM0015)

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the leakage belt area	
ID_{icl}>	1	$\Delta CBSLLK_{i\ cl,t}$	$\Delta CBSLLK_{icl}$
Name >	Forest	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2013	148,579.9	148,579.9	148,579.9

Carbon stock changes per post-deforestation zone z		Total carbon stock change of post-deforestation zones in leakage belt area	
ID_{iz}>	1	$\Delta CBSLLK_{z,t}$	$\Delta CBSLLK_z$
Name >	Zone 1	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e
2013	2,140.9	2,140.9	2,140.9

Total net carbon stock change of the leakage belt area	
$\Delta CBSLLK_t$	$\Delta CBSLLK$
annual	cumulative
tCO_2-e	tCO_2-e
146,439.0	146,439.0

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the leakage belt area		Carbon stock changes per post-deforestation zone z		Total carbon stock change of post-deforestation zones in leakage belt area		Total net carbon stock change of the leakage belt area	
ID_{icl}>	1	$\Delta CBSLLK_{i\ cl,t}$	$\Delta CBSLLK_{icl}$	ID_{iz}>	1	$\Delta CBSLLK_{z,t}$	$\Delta CBSLLK_{z}$	$\Delta CBSLLK_{t}$	$\Delta CBSLLK$
Name >	Forest	annual	cumulative	Name >	Zone 1	annual	cumulative	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2014	157,829.1	157,829.1	306,409.0	2014	4,385.8	4,385.8	6,526.8	153,443.3	299,882.3
2015	125,999.2	125,999.2	432,408.2	2015	6,141.4	6,141.4	12,668.1	119,857.8	419,740.1

Table 18 Ex-post Observed carbon stock change in the leakage belt area

Carbon stock changes per initial forest class *icl*		Total carbon stock change of initial forest class in the leakage belt area		Carbon stock changes per post-deforestation zone z		Total carbon stock change of post-deforestation zones in leakage belt area		Total net carbon stock change of the leakage belt area	
ID_{icl}>	1	$\Delta CBSLLK_{i\ cl,t}$	$\Delta CBSLLK_{icl}$	ID_{iz}>	1	$\Delta CBSLLK_{z,t}$	$\Delta CBSLLK_{z}$	$\Delta CBSLLK_{t}$	$\Delta CBSLLK$
Name >	Forest	annual	cumulative	Name >	Zone 1	annual	cumulative	annual	cumulative
Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	Project Year *t*	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e	tCO_2-e
2013	68,088.7	68,088.7	68,088.7	2013	981.1	981.1	981.1	67,107.6	67,107.6
2014	15,052.4	15,052.4	83,141.1	2014	1,184.6	1,184.6	2,165.7	13,867.8	80,975.4
2015	129,053.5	129,053.5	212,194.6	2015	3,027.9	3,027.9	5,193.6	126,025.6	207,001.0

Total *ex post* estimated leakage

Ex post total net carbon stock changes in the leakage belt due to displacement of activity in this monitoring period are presented in Table 19. The Leakage was calculated as the difference between the *ex post* and *ex ante* assessment. In this case, as result, the value of the carbon stock change within the Fixed Baseline Period in 2013 and 2014 is <0. so the *ex post* leakage was set to zero as recommended by the section 1.2 – Monitoring of Leakage, of VCS VM0015.In 2015, the total *ex post* leakage was 6,167.8.

Table 19. Total net ex ante and ex post baseline carbon stock change in the leakage belt (Table 35 of VCS VM0015**)**

Total net carbon stock change of the leakage belt area			Total net carbon stock change of the leakage belt area		Total ex-post Leakage	
ID_{iz}>	ΔCBSLLKt	ΔCBSLLK	ΔCBSLLKt	ΔCBSLLK	ΔCBSLLKt	ΔCBSLLK
Name>	annual	cumulative	annual	cumulative	annual	cumulative
Project Year *t*	tCO2-e	tCO2-e	tCO2-e	tCO2-e	tCO_2-e	tCO_2-e
2013	146,439.0	146,439.0	67,107.6	67,107.6	0,0	0,0
2014	153,443.3	299,882.3	13,867.8	80,975.4	0,0	0,0
2015	119,857.8	419,740.1	126,025.6	207,001.0	6,167.8	6,167.8

4.4 Net GHG Emission Reductions and Removals

The net anthropogenic GHG emissions reductions were calculated following the equation 19, equation 20 and equation 21 of VCS VM0015 version 1.1. The risk factor used to calculate VCS buffer credits (VBC) is 10%, as calculated in Non-permanence Risk Report. The calculated *ex post* GHG emissions reductions are presented in Table 20.

Table 20. Ex post estimated net anthropogenic GHG emission reductions and Verified Carbon Units (Table 36 of VCS VM0015).

Project Year t	Baseline carbon stock changes		Ex post project carbon stock changes		Ex post leakage carbon stock changes		Ex post net anthropogenic GHG emission reductions		Ex post VCUs tradable		Ex post buffer credits	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta CBSLPA_t$	ΔCBSLPA	$\Delta CPSPA_t$	ΔCPSPA	ΔCLK_t	ΔCLK	$\Delta REDD_t$	ΔREDD	VCU_t	VCU	VCB_t	VCB
	tCO_2-e	tCO_2-e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
01 Oct 2012 to 30 Sep 2013	362,750	362,750	17,567	17,567	0	0	345,183	345,183	310,664	310,664	34,519	34,519
01 Oct 2013 to 30 Sep 2014	524,401	887,151	19,527	37,094	0	0	504,874	850,057	454,386	765,050	50,488	85,007
01 Oct 2014 to 30 Sep 2015	532,380	1,419,531	29,443	66,537	6,168	6,168	496,770	1,346,827	446,476	1,211,526	50,294	135,301

5 APPENDIX

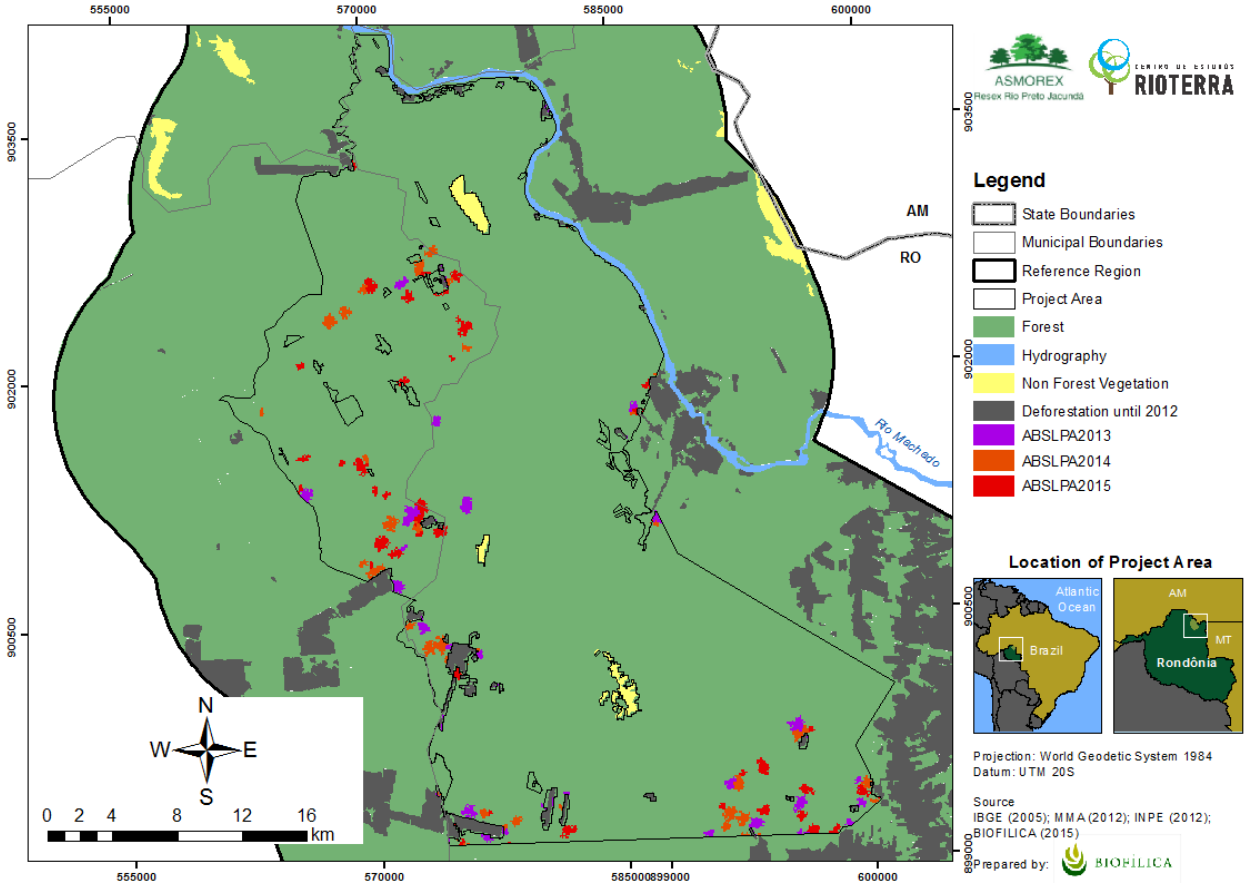

Figure 4. Map showing cumulative areas credited within the Project area**.**

Digital files used for the mapping (satellite images, shapefiles and GPS points) were presented to verification team as evidence of monitoring land-use and land-cover within the project area and leakage belt area.