

# JARI/ AMAPÁ REDD+ PROJECT MONITORING REPORT GHG EMISSION REDUCTIONS FROM AVOIDING UNPLANNED DEFORESTATION IN 2011



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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

The Jari/Amapá REDD+ Project is a partnership between Biofilica Investimentos Ambientais S.A. Jari Florestal and Jari Celulose, both belonging to Grupo Jari, for the promotion of forest conservation and reduction of potential GHG emissions based on a local economic development model that value the standing forest through a mosaic of activities

The Project is located in the Valley of Jari, in the municipalities of Laranjal do Jari and Vitória do Jari in the state of Amapá. The Valley of Jari enacts a very important role as home for over two thousand rural families, and as an ecological corridor connecting several Conservation Units. With a very rich biodiversity, its vegetation includes eight forest and non-forest formations, and species of extreme importance ecologically (54 species of flora are considered threatened) and socially (extractivists' communities have the diverse flora as a source of income and food). In the Project region three important rivers flow (Jari, Cajari and Maracá), and it is also home for over two thousand species of fauna, from which over a hundred are considered endangered.

Despite the social and environmental importance of the Valley of Jari, this region is threatened by agricultural and cattle activities and human settlements as well as large infrastructure work.

Thus, the main project components are:

- Forest protection and monitoring: implementation of conservation activities which will reduce deforestation risks;
- Scientific researches in the area: promotion of studies focused on the efficient use of natural resources and scientific research applied to biodiversity; and
- Social inclusion of the communities in the areas where the Project operates: activities developed by the Fundação Jari focusing on favoring sustainable business chains to generate additional income to the communities.

Such activities will be economically feasible with the combination of the FSC-certified Management (FSC certified low impact forest management) and the commercialization of carbon credits generated through the REDD+ mechanism.

### 1.2 Sectoral 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 Proponent

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

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Website: [www.biofilica.com.br](http://www.biofilica.com.br)

**Jari Florestal:** responsible for the co-management of the Project, for operating the forest sustainable management, as well as all related activities such as the environmental and social management of the Project to reduce negative impacts and generate positive ones.

Contact information: João Antônio Prestes. E-mail: [jprestes@gruppoorsa.com.br](mailto:jprestes@gruppoorsa.com.br) Phone: +55 11 4689-8700  
Website: [www.grupoorsa.com.br](http://www.grupoorsa.com.br)

**Jari Celulose:** title and land tenure regularization; land ownership monitoring and maintenance.

Contact information: Vinícius M. Garcia. E-mail: [vmgarcia@gruppoorsa.com.br](mailto:vmgarcia@gruppoorsa.com.br) Phone: +55 11 4689-8700  
Website: [www.grupoorsa.com.br](http://www.grupoorsa.com.br)

**1.4 Other Entities Involved in the Project**

Entity	Fundação Jari
Role	Development of social activities and Project social management.
Responsible	Jorge Rafael Almeida
Contact	Phone: +55 93 3735-1140 e-mail: <a href="mailto:jralmeida@fundacaoorsa.com.br">jralmeida@fundacaoorsa.com.br</a> Website: <a href="http://www.fundacaoorsa.org.br">www.fundacaoorsa.org.br</a>

Entity	Instituto do Homem e Meio Ambiente da Amazônia - IMAZON
Role	Development of baseline studies and carbon stock.
Responsible	Carlos Souza Jr.
Contact	Phone: +55 91 3182-4000 e-mail: <a href="mailto:souzajr@amazon.org.br">souzajr@amazon.org.br</a> Website: <a href="http://www.amazon.org.br">www.amazon.org.br</a>

Entity	Instituto de Pesquisas Ecológicas - IPÊ and Arvorar
Role	Technical coordination of the socioeconomic and environmental assessment and socioeconomic module
Responsible	Angela Pelin
Contact	Phone: +55 11 4597-1327 e-mail: <a href="mailto:angela@arvorar.com">angela@arvorar.com</a> Website: <a href="http://www.arvorar.com">www.arvorar.com</a>

Entity	Center for International Forestry Research – CIFOR
Role	Carrying out Global Comparative Study on REDD+
Responsible	Amy Duchelle
Contact	Phone: +55 21 2285-3341 e-mail: <a href="mailto:a.duchelle@cgiar.org">a.duchelle@cgiar.org</a> Website: <a href="http://www.cifor.org/">www.cifor.org/</a>

### 1.5 Project Start Date

The Jari/Amapá REDD+ Project starting date is February 14th, 2011, which is the date when the first socioeconomic and environmental assessment planning meeting was held.

### 1.6 Project Crediting Period

The Project accreditation period is February 14th, 2011. The end of the Project will be February 14th, 2041 upon completing 30 years.

### 1.7 Project Location

The Project is located in the Valley of Jari, in the municipalities of Laranjal do Jari and Vitória do Jari, south of the state of Amapá, on the left margin of the Jari River on the border of the state of Pará north of Brazil.

The physical boundaries of the Project area are show in the Figure 1 and Table 1below:

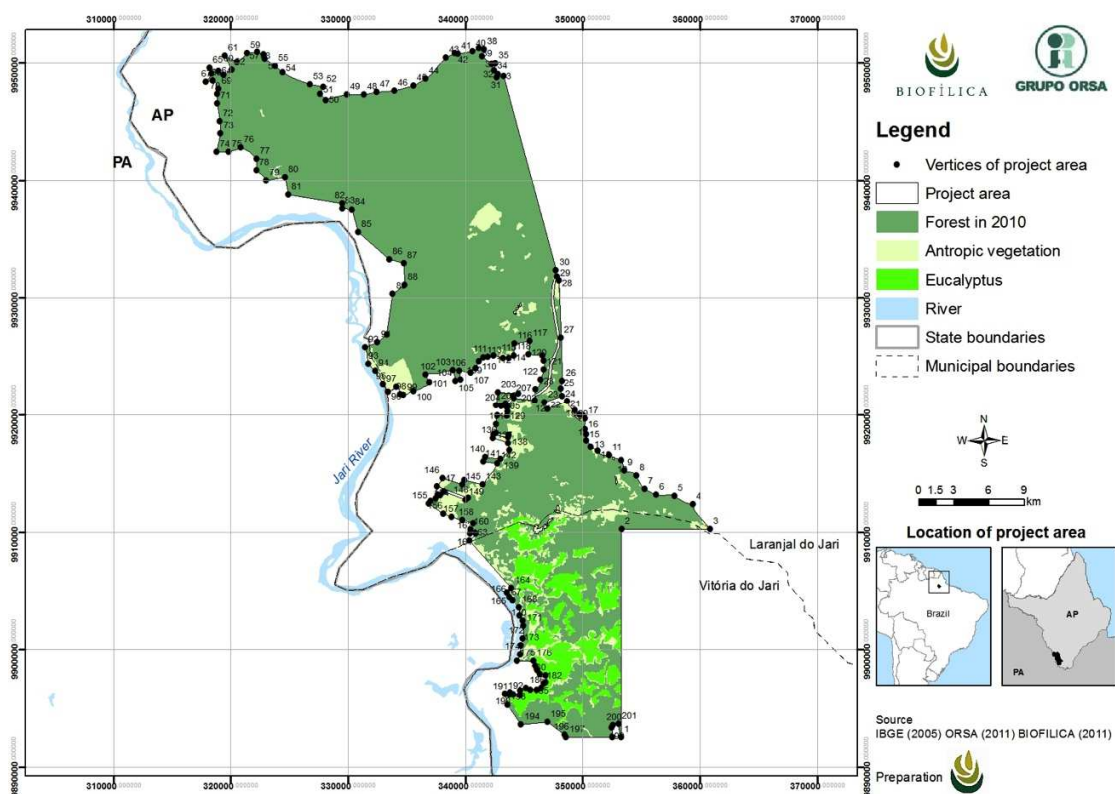


Figure 1. Jari/ Amapá REDD+ project area location

**Table 1.** Vertices and coordinates of the Project area polygons

Coordinates System: UTM – Zone 22S, Datum SIRGAS 2000.

Vertex	X	Y	Vertex	X	Y
1	353318.346	9892531.538	38	341596.032	9951182.111
2	353336.113	9910260.460	39	341149.380	9951271.442
3	360870.617	9910259.451	40	340613.398	9951003.451
4	359417.669	9912349.040	41	339347.653	9950792.464
5	357852.884	9913054.482	42	339078.933	9950839.198
6	356294.972	9913169.482	43	338335.474	9950467.469
7	355299.062	9913689.483	44	336593.532	9948680.862
8	354586.717	9914819.488	45	335566.233	9948100.214
9	353570.587	9915231.489	46	333958.287	9947653.563
10	353296.461	9916088.491	47	332439.671	9947519.567
11	352283.676	9916545.493	48	331367.707	9947296.241
12	351308.111	9916912.495	49	329904.017	9947332.892
13	350719.453	9917246.496	50	328119.910	9946817.686
14	350341.671	9917793.698	51	327615.832	9947385.572
15	350329.890	9918350.699	52	327857.107	9947944.930
16	350203.014	9918780.701	53	326722.528	9948189.545
17	350224.576	9919679.704	54	324399.939	9949216.844
18	350066.670	9919961.705	55	323774.627	9949752.826
19	349744.698	9920030.706	56	322881.323	9950333.473
20	349337.604	9920413.707	57	322768.026	9950758.337
21	348669.650	9921222.085	58	322227.195	9950963.108
22	347014.250	9920519.281	59	321362.707	9950824.790
23	346766.749	9921072.021	60	320514.069	9950110.147
24	348258.152	9921652.266	61	319486.770	9950601.464
25	348144.379	9922295.714	62	320067.417	9949440.170
26	348282.589	9922931.135	63	319397.440	9948993.518
27	348146.958	9926621.449	64	318950.788	9949350.839
28	347967.687	9931499.155	65	318191.480	9949574.165
29	347840.497	9931818.174	66	318325.475	9949082.848
30	347740.949	9932340.758	67	317867.095	9948400.067
31	343283.238	9948867.336	68	318459.471	9948502.201
32	342667.996	9948770.192	69	318950.788	9947787.558
33	342801.992	9949038.183	70	318816.792	9947385.572
34	342444.670	9949395.504	71	318816.792	9946581.598
35	342578.666	9949976.152	72	319068.165	9945031.464
36	342266.010	9949931.487	73	319084.783	9943991.018
37	341417.371	9950556.799	74	318772.127	9942427.737

Vertex	X	Y
75	319799.426	9942427.737
76	320853.240	9942826.725
77	322211.346	9941847.090
78	322211.346	9940864.456
79	322984.920	9939987.285
80	324640.727	9940279.249
81	324898.723	9938816.081
82	329492.914	9938050.226
83	329524.612	9937608.832
84	330320.777	9937519.605
85	330883.536	9935625.399
86	333506.600	9933301.314
87	334751.755	9932988.134
88	334811.662	9931119.822
89	333816.452	9930342.615
90	333289.669	9926902.878
91	332514.829	9926238.314
92	331440.601	9925815.477
93	331755.752	9924409.195
94	332312.196	9923792.870
95	332969.036	9922655.581
96	333397.250	9922007.437
97	334096.984	9922453.755
98	334439.882	9921810.482
99	334735.647	9921733.236
100	335581.970	9922059.710
101	336938.741	9922802.367
102	336624.371	9923460.015
103	338926.382	9923861.224
104	339153.314	9922955.272
105	339596.602	9923065.960
106	339475.564	9923799.740
107	340462.795	9923665.194
108	340870.336	9924033.825
109	341143.524	9924600.506
110	341525.351	9924920.826
111	341930.177	9924991.188
112	342419.515	9925097.153
113	343244.124	9924897.886
114	343687.614	9924883.407

Vertex	X	Y
115	344145.175	9925107.274
116	344194.189	9926158.253
117	345502.883	9926348.572
118	345368.237	9925218.406
119	346552.360	9925110.689
120	346702.000	9924676.794
121	346703.198	9923923.271
122	346393.931	9923039.196
123	345964.310	9922212.547
124	345938.249	9921271.239
125	344153.339	9921455.849
126	343481.655	9920713.422
127	343617.986	9920686.579
128	343602.285	9920254.515
129	343520.614	9919908.443
130	342720.838	9919958.040
131	342606.773	9919214.392
132	342620.515	9918450.870
133	343697.367	9918256.384
134	343647.591	9918054.243
135	342432.822	9918315.459
136	342348.095	9918027.466
137	343674.215	9917589.276
138	343754.312	9916972.600
139	343008.062	9916218.237
140	341689.300	9916366.909
141	341554.617	9915983.724
142	342755.406	9915843.328
143	341460.097	9914071.522
144	339913.558	9914404.581
145	339737.131	9914070.387
146	338089.335	9914565.082
147	337559.221	9913911.048
148	340225.155	9912907.132
149	340033.254	9912756.827
150	338171.279	9913453.671
151	337846.052	9913150.365
152	337635.576	9913162.625
153	337485.731	9912859.531
154	337025.073	9912643.677



Vertex	X	Y
155	336901.834	9912410.233
156	338104.836	9911551.538
157	338811.103	9911294.017
158	339735.239	9911001.178
159	340651.015	9910720.361
160	340470.683	9910192.328
161	340419.345	9909881.556
162	340873.095	9909849.248
163	340359.377	9909271.239
164	343945.347	9905214.935
165	343531.941	9904836.025
166	343752.726	9904456.897
167	344012.343	9904175.930
168	344549.594	9903587.730
169	344644.891	9902903.254
170	344898.951	9902452.764
171	344975.178	9902012.209
172	344923.228	9900941.451
173	344751.916	9900329.278
174	344668.743	9899594.837
175	344414.048	9899023.057
176	345801.282	9899019.432
177	345999.783	9898625.431
178	346136.190	9898224.429
179	346338.909	9897882.428
180	346847.976	9897774.646
181	346834.692	9897221.426
182	346660.285	9897074.425
183	346476.597	9896725.424
184	346110.908	9896568.424
185	345547.500	9896532.423
186	345189.686	9896685.424
187	344702.622	9896468.423
188	344701.082	9896111.424
189	344082.681	9896156.279
190	343836.526	9896354.423
191	343743.916	9896180.851
192	343390.963	9896206.158
193	343612.527	9895309.802
194	344756.541	9893615.066

Vertex	X	Y
195	347028.553	9893815.130
196	348461.901	9892776.789
197	348607.373	9892538.285
198	352549.856	9892532.633
199	352502.984	9893355.653
200	352584.239	9893551.415
201	353064.858	9893684.107
202	344506.672	9921877.821
203	342797.827	9921958.351
204	342619.200	9920849.127
205	343082.969	9920773.651
206	343454.408	9920958.316
207	344069.488	9921651.212

## 1.8 Title and Reference of Methodology

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

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

Jari/Amapá REDD+ Project brings together activities from two components: the certified forest management (FSC-certified Management) and 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 (February 2011 – February 2012).

#### Implemented activities under the FSC-certified Management component

Jari Florestal started conducting studies for the FSC-certified Management in the region where the Project is located in 2006. The implemented activities during the first monitoring period are shown in Table 2.

**Table 2.** Summary of Jari/Amapá REDD+ Project main activities in FSC-certified Management component executed during the first monitoring period (Feb. 2011 - Feb. 2012).

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
<b>Activities of sizing of exploitation</b>		
Pre-harvest inventory	100% Pre-harvest inventory conducted in sample plots on the 200 thousand hectares of forest management area in order to support forest management planning by quantifying and qualifying forest resources determining the wood potential of the area through statistical sampling techniques.	Concluded in 2011. See applicable procedure document <i>PA-MFS 002 - Inventário Florestal 100%</i> . The original data sheets are archived in Jari Florestal Office.
Property zoning	Macro and micro zoning of the forest management area for Forest Management Units (UPA) delimitation, identification, classification and delimitation of the different classes of soil use, hydrography, landscaping, operational and non-operational areas, vines and other environmental aspects, and definition of the areas for the 100% Pre-harvest Inventory.	Concluded in 2011. UPA 01 macro zoning and micro zoning concluded in 2011; micro zoning of other UPA to be carried out throughout the operation cycle. See document <i>Elaboração e</i>

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
<b>Activities of sizing of exploitation</b>		
		<i>revisão de plano de manejo florestal.</i>
Definition of Forestry System and Production Regulation	Definition of forest management operational planning (cutting cycle, number of UPA, volume of wood to be extracted, protected species to be managed and other operational aspects).	Concluded in 2011. <i>See document Elaboração e revisão de plano de manejo florestal</i>

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
<b>Pre-management activities</b>		
Implementation and mapping of the plots	Delimitation of permanent preservation, operation and non-operational areas. Determining the location of the plot for the 100% pre-harvest inventory.	Concluded in 2011 for UPA 01; for other UPAs it will be carried out throughout the operation cycle. <i>See document PA-MFS 001 - Implantação e Mapeamento de Parcelas.</i>
100% Pre-harvest inventory or forest census	Field measurement, identification, classification and location of the trees in the UPA for later processing of such information and definition of the species and volume to be cut. It is the main instrument for the preparation of the Annual Operation Plans (POA, in Portuguese).	Concluded in 2011 for UPA 01; for other UPAs it will be carried out throughout the operation cycle. <i>See document applicable procedure PA-MFS 002 - Inventário Florestal 100%.</i>
Implementation and measurement of permanent sample plots	Implementation and collection of data regarding the permanent plots taking into consideration the relationship of the existing species, number of trees per species and the quality of the species in order to assess the impact on the forest by monitoring its regeneration.	Concluded in 2011 for UPA 01; for other UPAs it will be carried out throughout the operation cycle. <i>See document applicable procedure PA-MFS 003 - Permanent Sample Plots.</i>

**Implemented activities under the REDD+ component**

REDD+ component activities are under responsibility of Biofíllica Investimentos Ambientais, Jari Celulose, Jari Florestal and Fundação Jari, and started in February 14th 2011, when the first planning meeting for the Socioeconomic and Environmental Diagnosis was held in Monte Dourado – PA. The activities under this component 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, meetings with stakeholders – such as local and state government institutions and local communities and population –, security and land surveillance 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 3**.

**Table 3.** Summary of the Jari/Amapá REDD+ Project main activities in the REDD+ activities component in this monitoring period.

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
<b>Planning Activities</b>		
Activities Planning Meeting	Proponents meet to plan the activities from project conception to validation and first verification.	Concluded in 2011. See document <i>Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012</i> .
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 2011. See document <i>Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012</i> .
<b>Development Activities</b>		
Conducting Socioeconomic and Environmental Assessment (DSEA)	Study developed together with the Arvorar Soluções Florestais and Instituto de Pesquisas Ecológicas (IPÊ) and 10 specialized researchers. 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 2012. See document: <i>Diagnóstico Ambiental da Região do Projeto Jari/Amapá Relatório Final e Volume Anexo</i> and <i>Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012</i> .
Carbon stock estimate	Study developed in partnership with IMAZON aiming at estimating the forest carbon stock and	Concluded in 2012. See document: <i>Estimativa do Estoque de Carbono</i>

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
	producing a map of the carbon stock for the project area based on data of forest inventories carried out in the FSC-certified Management component.	<i>Florestal Para o Projeto REDD+ Jari/Amapá and Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012.</i>
Determination of the baseline and the carbon credits generation potential	It was also developed in partnership with IMAZON aiming to determine the project baseline and estimate the amount of REDD credits to be potentially generated by the project.	Concluded in 2012. See document: <i>Determinação da Linha de Base e Dinâmica de Desmatamento Para o Projeto REDD+ Jari/Amapá and Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012.</i>
<b>Management and conception design activities</b>		
Carrying out a workshop to plan and design the project.	Proponents and partners of the project meet to present the results of previous studies, identification of potential social and environmental activities to be developed throughout the project as well as definition of the project monitoring actions.	Concluded in 2012. See document <i>Relatório de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012.</i>
Preparation of the Project description document	From the management plan the Project description document (Project Description) was prepared according to the criteria established by the VCS.	Concluded in 2012. See VCS Project Description: Jari/Amapá REDD+ Project
Selection and contracting of validation agency and registration platform	Survey of validation/verification institutions accredited by the VCS and definition of the project validation/verification bodies (VVB).	Concluded in 2012 with selection of SCS – Scientific Certification Systems. See document SCS Assessment Services Agreement
<b>Project's Financial Management</b>		
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	Started in 2011 and to be continued throughout the Project duration. See document <i>Ata de Reunião de Conselho Realizada em 09</i>

ACTIVITY	DESCRIPTION	STATUS, APPLICABLE PROCEDURE AND ADDITIONAL INFORMATION REGARDING RECORDING FORMAT
	potential buyers and sales representative.	<i>de Agosto de 2011</i>
Project's budget follow up	Income and expenses spreadsheet	Started in 2011 and to be continued throughout the Project duration. See document <i>Relatorio de Despesas Projeto REDD+ Jari/Amapá – Período de Monitoramento Fev.2011-Fev.2012.</i>
<b>Social activities</b>		
Fundação Jari's activities in the communities Valdomiro/Barbudo and Tira Couro		Concluded in 2011. See document <i>Fundação Jari Relatório de Atividades 2011.</i>

### 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.

As a result of the monitoring of deforestation in the leakage belt through satellite images, it was possible to verify that no leakage has occurred.

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

- When illegal activities were identified in the Project region, Grupo Jari took the necessary measures, such as registering the occurrence at the competent government institution. Related documents are filed by Biofílica Investimentos Ambientais and were made available to the VVB.
- As part of the communication plan with the stakeholder, the first meeting of the Thematic Chamber of REDD+ took place in August 2012 with the participation of local and state government institutions and community representatives, as described on Section 7 of the Project Description. A consultation with the involved communities was also carried by the Project proponents. Presence list of such meetings are filed by Biofílica Investimentos Ambientais and were made available to the VVB.
- Grupo Jari has registered in the competent governmental institution the wiliness to protect the Project by legally binding commitment, that is, to register its property's Legal Reserve (Document IMAP 11/2011 DIPRE/IMAP). Grupo Jari keeps a constant communication with such governmental institution in order to keep track of the status of process.

**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:	0,269% ha/year on average (2000-2010).
Purpose of the data:	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 28 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.
Any comment:	See documents: <ul style="list-style-type: none"> <li>• <i>Câmara et al. 2006. Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal</i></li> <li>• <i>Determinação da Linha de Base e Dinâmica de Desmatamento para o Projeto REDD+ Jari/Amapá.</i></li> </ul>

<b>Data Unit / Parameter:</b>	<b>Ctot</b>
Data unit:	tCO <sub>2</sub> e ha <sup>-1</sup>
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 Jari Florestal field measured data.
Value applied:	566 tCO <sub>2</sub> e ha <sup>-1</sup>
Purpose of the data:	Above-ground biomass estimate was carried out using forest inventory data, allometric equations developed in areas similar to the project area (HIGUCHI, 1998). And expansion factors developed by Nogueira et al. (2008) in sites of the Brazilian Amazon to estimate biomass of trees with DBH lower than 10 cm, palm trees, vines, non-tree components and dead above-ground biomass . Below-ground biomass was obtained using root-shoot ratio of 25.8% biomass of trees DBH> 10cm. Total biomass spatial estimate was obtained applying geostatistics techniques developed by Sales et al. (2007).
Any comment:	See documents: <ul style="list-style-type: none"> <li>• <i>Estimativa do Estoque de Carbono Florestal para o Projeto REDD+ Jari/Amapá.</i></li> <li>• <i>PMFS – Amapá.</i></li> <li>• Section 3.1 of the Project Description</li> <li>• Tabela_Estoque_TDR4_2013.xlsx</li> </ul>



<b>Data Unit / Parameter:</b>	<b>DBH</b>
Data unit:	cm
Description:	Diameter at Breast Height (130 cm) for each tree with DBH equal or higher than 15 cm in each plot of the forest inventory.
Source of data:	Measured in the field by Jari Florestal.
Value applied:	See field measurements spreadsheet.
Purpose of the data:	VCS Methodology VM0015 requirement. Data from forest inventory collected less than 10 years ago from multiple plots at wide spatial distribution.
Any comment:	Jari/Amapá REDD+ Project's main variable for carbon stock estimate.

<b>Data Unit / Parameter:</b>	<b><math>\ln(\text{Pi}) = -1.497 + 2.548 \times \ln(\text{DBH})</math></b>
Data unit:	Ln kg (fresh weight)
Description:	Equation to convert DBH into biomass for trees with DBH equal to or higher than 5 cm.
Source of data:	Higuchi et al (1998) Biomassa da parte aérea da vegetação da floresta tropical úmida de terra-firme da Amazônia brasileira. Acta Amazonica 28(2): 153-166. 1998.
Value applied:	$\ln(\text{Pi}) = -1.497 + 2.548 \times \ln(\text{DBH})$
Purpose of the data:	Equation developed for forest with characteristics similar to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b><math>R_j</math></b>
Data unit:	Dimensionless
Description:	Above-ground to below-ground biomass conversion factor using shoot-root ratio.
Source of data:	VCS VM0015 methodology
Value applied:	25.8%
Purpose of the data:	Value suggested by VCS VM0015 methodology.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to convert fresh weight biomass into dry weight biomass</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert fresh weight biomass into dry weight biomass
Source of data:	The value was obtained by the average of dry/fresh ratio for the crown and bole weighted by the percentage contribution of bole and crown weight to total biomass. HIGUCHI, N., DOS SANTOS, J., RIBEIRO, R. J., MINETTE, L., BIOT, Y. Biomassa da parte aérea da vegetação da floresta tropical úmida de terra-firme da Amazônia brasileira. Acta Amazonica 28(2): 153-166. 1998.
Value applied:	0.5997
Purpose of the data:	Values calculated in forests with similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate palm trees biomass for dense forest</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10cm into biomass of palm trees for dense forest.
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:	0.019
Purpose of the data:	Value suggested by VCS VM0015 methodology.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate palm trees biomass for non-dense forest</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10cm into biomass of palm trees for non-dense forest
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:	0.086
Purpose of the data:	Values calculated in forests with similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate biomass of trees with DBH&lt;10 cm for dense forest</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10cm into biomass of trees <10 cm in DBH for dense forest
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:	0.065
Purpose of the data:	Values calculated in forests with similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate biomass of trees with DBH&lt;10 cm for non-dense forest</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10cm into biomass of trees <10 cm in DBH for non-dense forest
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:	0.040
Purpose of the data:	Values calculated in forests with similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate biomass of vines</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10 cm into biomass of palm trees into vine.
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:	0.031
Purpose of the data:	Values calculated in forests of similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate dead wood biomass</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10 cm into biomass of dead wood
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:	0.137
Purpose of the data:	Values calculated in forests of similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>Expansion factor to estimate non-tree components biomass</b>
Data unit:	Dimensionless
Description:	Expansion factor to convert biomass of trees DBH > 10 cm into biomass of non-tree components
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:	0.002
Purpose of the data:	Values calculated in forests with similar characteristics to the forests in the reference region.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>IC</b>
Data unit:	m <sup>3</sup>
Description:	FSC-certified forest management forecast harvest intensity.
Source of data:	<i>Plano de Manejo Florestal Sustentável-Amapá</i>
Value applied:	20m <sup>3</sup>
Purpose of the data:	Average intensity of the harvest for timber Expected in each UPA of the <i>Plano de Manejo Florestal Sustentável-Amapá</i> .
Any comment:	

<b>Data Unit / Parameter:</b>	<b>CF</b>
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. <i>Forest Ecology and Management</i> , 256 (11), pp.1853-1867
Value applied:	0.485
Purpose of the data:	Value found in scientific literature.
Any comment:	

<b>Data Unit / Parameter:</b>	<b>44/12</b>
Data unit:	tCO <sub>2</sub> e
Description:	Carbon mass to CO <sub>2</sub> e 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:	IPCC standard value
Any comment:	

3.2 Data and Parameters Monitored

<b>Data Unit / Parameter:</b>	<b>Deforestation in the Project area and leakage belt</b>
Data unit:	Hectare (ha)
Description:	Forest coverage areas converted into non-forest areas inside the Jari/Amapá REDD+ Project area and leakage belt.
Source of data:	Calculated through Landsat TM5 images acquired in 12/08/2011, processed by the PRODES Digital project and additional Cosmo SkyMed ScanSar images acquired in 21/04/2012 and 23/05/2012.
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 SAR data.
Frequency of monitoring/recording:	Annual
Value monitored:	32 ha in project area 71 ha in leakage belt
Monitoring equipment:	Geographic information systems, digital processing program, and navigation GPS.
QA/QC procedures to be applied:	The minimum mapping unit is 1 ha. The assessment of the mapping was carried out through data collected in the field using navigation GPS. Cloud areas were analyzed with images collected by orbital Synthetic Aperture Radar (SAR) of satellite Cosmo SkyMed, ScanSAR mode and dual polarization (HH-HV).
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: <a href="http://www.dpi.inpe.br/prodesdigital/prodes.php">http://www.dpi.inpe.br/prodesdigital/prodes.php</a> Further information on QA/QC available in: • <i>Câmara et al. 2006. Metodologia para o cálculo da taxa anual de desmatamento na Amazônia Legal</i>

<b>Data Unit / Parameter:</b>	<b>Ctot</b>
Data unit:	tCO <sub>2</sub> e ha <sup>-1</sup>
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 Jari Florestal.
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 (HIGUCHI, 1998). And expansion factors developed by Nogueira et al. (2008) in sites of the Brazilian Amazon to estimate biomass of trees with DBH lower than 10 cm, palm trees, vines, non-tree components and dead above-ground biomass. Below-ground biomass was obtained using root-shoot ratio of 25.8% biomass of trees DBH > 10cm. Total biomass spatial estimate was obtained applying geostatistics techniques developed by Sales et al. (2007).
Frequency of monitoring/recording:	One year before harvest. At one, three and five-year intervals after the UPA harvesting.
Value monitored:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Further information on QA/QC available in: <ul style="list-style-type: none"> <li>• <i>Plano de Manejo Florestal Sustentável-Amapá;</i></li> <li>• <i>PA - MFS 001 - Gestão e Certificação Florestal - Distribuição e Seleção das Parcelas Monitoradas;</i></li> <li>• <i>PA - MFS 001 - Gestão e Certificação Florestal - Implantação e Mapeamento de Parcelas;</i></li> <li>• <i>PA - MFS 002 - Inventário Florestal 100%;</i></li> <li>• <i>PA - MFS 003 - Gestão e Certificação Florestal - Parcelas Permanentes;</i></li> <li>• <i>PA - MFS 015 - Gestão e Certificação Florestal - Monitoramento do inventário florestal 100%.</i></li> </ul>
Calculation method:	Comparison between total carbon stock average value contained in forest class used in the baseline scenario, according to <i>Estimativa do Estoque de Carbono Florestal para o Projeto REDD+ Jari/Amapá</i> and measures analyzed after



	the UPA harvesting.
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.

<b>Data Unit / Parameter:</b>	<b>DBH</b>
Data unit:	cm
Description:	Diameter at Breast Height (130 cm) for each tree with DBH equal or higher than 15cm in each plot of the forest inventory.
Source of data:	Calculated from the circumference at breast height measured in the field by Jari Florestal.
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:	One year before harvest. In intervals of one, three and five years after the UPA harvest.
Value monitored:	N/A
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. Further information on QA/QC available in: <ul style="list-style-type: none"> <li>• <i>Plano de Manejo Florestal Sustentável-Amapá;</i></li> <li>• <i>PA - MFS 001 - Gestão e Certificação Florestal - Implantação e Mapeamento de Parcelas;</i></li> <li>• <i>PA - MFS 001 - Gestão e Certificação Florestal - Distribuição e Seleção das Parcelas Monitoradas;</i></li> <li>• <i>PA - MFS 003 - Gestão e Certificação Florestal - Parcelas Permanentes;</i></li> <li>• <i>PA - MFS 015 - Gestão e Certificação Florestal - Monitoramento do inventário florestal 100%.</i></li> </ul>
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 Jari/Amapá REDD+ Project. In this

	monitoring period not had carbon stock change due to planned logging activities in the project area.
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<b>Data Unit / Parameter:</b>	<b>Planned deforestation to build the FSC-certified Forest Management infrastructure</b>
Data unit:	Hectare (ha)
Description:	Map of forest cover areas converted into non-forest areas due to the construction of FSC-certified forest management roads, trails and forest patios.
Source of data:	Remote sensing images, technical maps, and specific field cards to monitor the construction of FSC-certified forest management roads, trails and forest patios.
Description of measurement methods and procedures to be applied:	The monitoring of forest cover areas in the FSC-certified forest management area 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:	Further information on QA/QC available in: <ul style="list-style-type: none"> <li>• <i>Plano de Manejo Florestal Sustentável-Amapá;</i></li> <li>• <i>PA - MFS 006 - Planejamento Trilhas de Arraste;</i></li> <li>• <i>PA - MFS 012 - Redução da Formação de Grandes Clareiras;</i></li> <li>• <i>PA - Planejamento, Abertura e Manutenção de Estradas Florestais;</i></li> <li>• <i>PA - MFS 021 - Monitoramento da Abertura de Estradas.</i></li> </ul>
Calculation method:	In case planned deforestation areas are detected the Forest Cover Benchmark Map will be updated by map algebra.

Any comment:	In this monitoring period not had carbon stock decrease due to planned deforestation in the project area.
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<b>Data Unit / Parameter:</b>	<b>ΔCabBSLLKt</b>
Data unit:	tCO <sub>2</sub> -e
Description:	Total carbon stock changes in the leakage belt area
Source of data:	Calculated.
Description of measurement methods and procedures to be applied:	<ul style="list-style-type: none"> <li>• leakage prevention activities will be listed;</li> <li>• a map showing areas of intervention and type of intervention will be prepared;</li> <li>• areas where leakage prevention activities impact carbon stock will be identified;</li> <li>• non-forest classes existing within these areas in the baseline case will be identified;</li> <li>• carbon stocks will be measured on the identified classes or conservative literature estimates will be used;</li> <li>• carbon stock changes in the leakage management areas under the project scenario will be reported using table 30b of the VM0015;</li> <li>• net carbon stock changes that the leakage prevention measures cause during the fixed baseline period and, optionally, the project crediting period will be calculated;</li> <li>• results of the calculations will be reported in table 30.c of the VM0015.</li> </ul>
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:	To be determined depending on the activity
Calculation method:	To be determined depending on the activity
Any comment:	N/A

<b>Data Unit / Parameter:</b>	<b>Methane (CH4) and nitrous oxidate (N2O) emissions from livestock</b>
Data unit:	tCO <sub>2</sub> -e yr <sup>-1</sup>
Description:	Emissions from grazing animals in leakage management areas at year t
Source of data:	Reports from Fundação Jari and geographic information system
Description of measurement methods and procedures to be applied:	<ul style="list-style-type: none"> <li>• Annual areas that have grazing activities in the leakage management areas will be specified;</li> <li>• Types of animal forage and manure management will be briefly described. Table 31 of VM0015 will be used to report the key parameters required to perform the calculation of GHG emissions;</li> <li>• The number of animals in the baseline case and under the project scenario will be determined based on available areas and forage. The difference will be considered for the calculation of the increase in GHG emissions;</li> </ul> <p>Methods described in appendix 4 of the VM0015 will be used to estimate emissions from enteric fermentation and manure management; final calculations will be done using equation 18 of the VM0015 and results will be reported in table 32 of the VM0015.</p>
Frequency of monitoring/recording:	Annually
Value monitored:	0
Monitoring equipment:	Field spreadsheets
QA/QC procedures to be applied:	N/A
Calculation method:	Equation 18 of the VM0015 will be used.
Any comment:	N/A

### 3.3 Description of the Monitoring Plan

#### Technical description of the monitoring tasks

The Project encompasses two components two components of activities that will be monitored:

- i) the continuous monitoring of FSC-certified forest management activities prior to, during and after the FSC-certified forest management operations will be done by Jari Florestal specialized team, assessing the activities regarding operational, environmental and occupational safety aspects.
- ii) the monitoring of the REDD+ activities aimed at avoiding unplanned deforestation through the intensification of premises, security and surveillance 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 Jari/Amapá REDD+ Project area of influence.

**Table 4.** Data to be collected to the monitoring plan.

Component	Data/Parameter	Description	Unit	Source	Frequency
FSC-certified Management	Training and qualification of workers	Training courses to qualify workers on the operational and environmental procedures related to their area of work, as well as other subjects such as Sustainable Management, Certification and Safety at Work.	Number of trained staff	Jari Florestal	Annual
	Permanent plots	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
	100% pre-harvest inventory or forest census	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
	DBH	Diameter at Breast Height (130 cm) for each tree with DBH equal or higher than 15cm in each of the forest inventory plot.	cm	Calculated from the circumference at breast height measured in the field by Jari Florestal.	One year before harvest. In intervals of one, three and five years after the UPA harvest.

Component	Data/Parameter	Description	Unit	Source	Frequency
	Storage patios and forest roads opening	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
	Felling of trees	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
	Logging, measurement and marking of the logs.	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
	Log skidding to storage yards	Register of the implementation of the activity.	Status of implementation	Jari Florestal	Annual
REDD+ activities	Income and expenses spreadsheet	Project's budget follow up	R\$	Biofilica Investimentos Ambientais	Annual
	Social activities	Social activities developed together with the communities in the Jari/Amapá REDD+ Project area of influence.	Number of benefited families	Fundação Jari	Annual
	$AUDPA_{ic,t}$	Areas of unplanned deforestation in forest class <i>ic</i> / at year <i>t</i> in the project area	ha	Calculated through remote sensing images.	Annual
	$APDPA_{ic,t}$	Areas of planned deforestation in forest class <i>ic</i> / at year <i>t</i> 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	tCO <sub>2</sub> -e	Calculated	Annual

Component	Data/Parameter	Description	Unit	Source	Frequency
		to planned logging activities at year $t$ in the Project Area			
	$ACPA_{icl,t}$	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 <sub>2</sub> -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 $t$ .	t CO <sub>2</sub> -e	Calculated	Annual

### Overview of data collection procedures

#### 3.3.1 Monitoring of project implementation

The monitoring of the implementation and execution of the FSC-certified forest management activities will be done according to Jari Florestal's procedures throughout all its phases and in all the aspects – operational, environmental and social – so as to meet FSC principles and criteria. The implementation of REDD+ activities will be 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 will be done through project area forest cover mapping using 30-meter or higher spatial resolution satellite images. The monitoring of the deforestation for implementation of FSC-certified forest management infrastructure will be 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 of SAR images using field data and cartographic quality standards may be used.

Data on deforestation events will be compared to baseline scenario. Emission reduction values for the monitored period will be based on the comparison between forecasted and real deforestation.

The main activities carried out by the project to collection and process data are:

- 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;
- 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.

### **Quality control and quality assurance procedures:**

In order to validate the information obtained from satellite images, the mapped data on deforestation occurrences will be carried out through data collected in the field using GPS navigation. The minimum accuracy of the classification for the land use and land cover map is 80%. For cloud-covered areas, images from SAR sensors, such as RADARSAT-2, Cosmo SkyMed or TerraSAR-X will be used.

The original (raster) and processed (vector) digital data from satellite images, coordinates, technical maps, field photos and cards will be stored by Biofílica Investimentos Ambientais throughout the project. Maps of infrastructure installation, satellite images and annual deforested areas reports will be made available to the verification body at each verification event.

### **3.3.3 Monitoring changes in carbon stocks**

#### Within leakage management areas:

No areas will be 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:

$$\Delta\text{CUDdPA}_t = \sum_{y=1}^t \left( \sum_{icl=1}^{icl} \text{AUDPA}_{icl,y} * \Delta\text{Ctot}_{icl,t-y} - \sum_{fcl=1}^{fcl} \text{AUDPA}_{fcl,y} * \Delta\text{Ctot}_{fcl,t-y} \right)$$

Where:

$\Delta\text{CUDdPA}_t$  Total carbon stock change due to unavoided unplanned deforestation within the project area at year t.

$\text{AUDPA}_{icl,y}$  Area of unplanned deforestation in the initial forest class icl at year t within the project area in the project scenario.

$\Delta\text{Ctot}_{icl,Ac}$  Carbon stock loss in the initial forest class icl at age of change Ac (# of years after LU/LC change).

$\text{AUDPA}_{fcl,y}$  Area of non-forest class fcl at time t within the project area post-unplanned deforestation in the project scenario.

$\Delta\text{Ctot}_{fcl,Ac}$  Carbon stock gain in the final non-forest class fcl at Age of change Ac (# of years after LU/LC change).

In case there is significant reduction in carbon stock due to FSC-certified forest management activities, such reduction will be reported in the verification processes using Tables 29 of the VCS approved methodology VM0015 version 1.1.

Monitoring changes (reduction) in carbon stock will be done through forest inventory, measurement of Diameter at Breast Height (130 cm), for each tree with DBH equal or higher than 15 cm in each plot of the forest inventory. DBH is the main variable used to estimate carbon stock and changes in carbon stock on the Jari/Amapá REDD+ Project. The monitoring of carbon stock for FSC-certified forest management areas will be carried out through the installation and measurement of pre-harvest forest inventory permanent plots in each UPA. Each monitored plot will be measured after harvest at one, three and five-year intervals.

### Quality control and quality assurance procedures:

Information about QA/QC is available in the following documents:

- PMFS – Amapá;
- PA – Gestão e Certificação Florestal - Implantação e Mapeamento de Parcelas;
- PA – Gestão e Certificação Florestal – Seleção e distribuição das parcelas;
- PA – Gestão e Certificação Florestal – Parcelas Permanentes;
- PA – Gestão e Certificação Florestal – Monitoramento do inventário florestal 100%.

The original reports and field cards will be stored by Jari Florestal. Biofílica Investimentos Ambientais will keep a copy of these documents filed in digital format throughout the project. Spreadsheets, forest inventory and monitoring reports of the plots will be made available to the verification body at each verification event.

### 3.3.4 Monitoring of non-CO<sub>2</sub> 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 will be done through monitoring of forest cover by satellite using the same methods applied to monitoring forest cover in the project area (section 1.1.2).

The main activities carried out to collection and process data are:

- 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;
- Mapping the affected forest cover areas.

Emissions due to natural disturbance or catastrophic events will be estimated by multiplying area of forest loss mapped by average forest carbon stock. In case there is significant reduction in carbon stock due to natural disturbance or catastrophic events, such reduction will be reported in the verification processes using Tables 25e, 25f and 25g of the VCS approved methodology VM0015 version 1.1.

### **Data archiving**

All data and reports of the Jari/Amapá REDD+ Project will be stored by Biofílica Investimentos Ambientais in digital files throughout the project.

The original reports and field cards collected for the FSC-certified forest management activities will be stored by Jari Florestal. Biofílica Investimentos Ambientais will keep a copy of these documents filed in digital format throughout the project.

The compilation and announcement of the results of social activities will be done through Fundação Jari Activities Report and Impacts Report periodically prepared and made available in digital format.

All documents related to the monitoring of Jari/Amapá REDD+ Project will be 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, Jari Florestal, Jari Celulose and Fundação Jari.

#### **3.3.6 Monitoring of Leakage:**

#### **Technical description of the monitoring tasks**

The Jari/Amapá REDD+ Project will involve two monitoring activities of sources of leakage:

- i) 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 will be estimated by Fundação Jari and Biofílica Investimentos Ambientais technical staff.
- ii) Monitoring of forest cover in leakage belt through satellite images to be performed by Biofílica Investimentos Ambientais and Jari Celulose technical staff.

**Table 5.** Data to be collected to leakage monitoring.

Data	Description	Unit	Source	Frequency
$\Delta\text{CLPMLK}_t$	Carbon stock decrease due to leakage prevention measures	tCO <sub>2</sub> -e	Calculated	Annual
$\text{EgLK}_t$	Emissions from grazing animals in leakage management area at year <i>t</i>	tCO <sub>2</sub> -e	Calculated	Annual
$\text{ELPMLK}_t$	Annual total increase in GHG emissions due to leakage prevention measures at year <i>t</i>	tCO <sub>2</sub> -e	Calculated	Annual
$\Delta\text{CBSLLK}_t$	Total ex post carbon stock change at year <i>t</i> .	tCO <sub>2</sub> -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

A reduction in carbon stocks due to activities carried out in leakage management areas is not expected as no activities of agricultural improvement or management of grazing areas able to alter carbon stocks and increase GHG emissions as compared with baseline scenario in leakage management areas is planned to be implemented. However, if it is decided that such activities are necessary, then the ex ante carbon stock changes and GHG emissions associated to such activities will be estimated as per step 8 of the methodology VM0015, and if significant they will be monitored and data will be made available to the verification body at each verification event using Tables 30b, 30c, 31, 32 and 33 of methodology VM0015 version 1.1.

The following activities in leakage management areas could occasion a decrease in carbon stocks or an increase in GHG emissions:

- Carbon stock changes due to activities implemented in leakage management areas;
- Methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) emissions from livestock intensification (involving a change in the animal diet and/or animal numbers).

According to the most recent version of the VCS Standard nitrous oxide (N<sub>2</sub>O) emissions from nitrogen fertilization are considered always insignificant. Consumption of fossil fuels is considered always insignificant in AUD project activities and must not be considered.

The main activities carried out to collection and process data for monitoring of Carbon stock changes due to activities implemented in leakage management areas are:

- 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.

The main activities carried out to collection and process data for monitoring of Methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) emissions from livestock are:

- annual areas that have grazing activities in the leakage management areas will be specified;
- types of animal, forage and manure management will be briefly described. Table 31 of VM0015 will be used to report the key parameters required to perform the calculation of GHG emissions;
- the number of animals in the baseline case and under the project scenario will be determined based on available areas and forage. The difference will be considered for the calculation of the increase in GHG emissions;
- methods described in appendix 4 of the VM0015 will be used to estimate emissions from enteric fermentation and manure management; final calculations will be done using equation 18 of the VM0015 and results will be reported in table 32 of the VM0015.

### **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 will be 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. Monitoring of carbon stock changes:

Procedures for collection data will be done using the same methods applied to monitoring deforestation in the project area (section 3.3.3).

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.

Monitoring of carbon stock decrease and increases in GHG emissions due to activity displacement leakage:

Procedures for quality control and quality assurance will be done using the same methods applied to monitoring deforestation in the project area (section 1.2).

Activity data for the leakage belt area will be 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 unavoided unplanned deforestation within the leakage belt area is calculates the following way:

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

Where:

$\Delta CBSLLK_t$  Total carbon stock change due to unavoided unplanned deforestation within the leakage belt area at year t.

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

$\Delta Ctot_{icl,Ac}$  Carbon stock loss in the initial forest class icl at age of change Ac (# of years after LU/LC change).

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

$\Delta Ctot_{fcl,Ac}$  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 will be stored by Fundação Jari. Biofílica Investimentos Ambientais will keep 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 will be stored by Biofílica Investimentos Ambientais throughout the project. Maps of annual deforested areas, satellite images and reports will be made 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, Jari Celulose and Fundação Jari

**4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS**

**4.1 Baseline Emissions**

Total emissions in the baseline scenario for year 2011 are 257,054.8 tCO<sub>2</sub>e as presented in Table 6.

**Table 6** 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 <i>icl</i>		Total carbon stock change of initial forest class in the project area		Carbon stock changes per post-deforestation zone <i>z</i>		Total carbon stock change of post-deforestation zones in the project area		Total net carbon stock change of the project area	
ID <sub>icl</sub> >	1	ΔCBSLPA <sub>icl,t</sub>	ΔCBSLPA <sub>icl</sub>	ID <sub>iz</sub> >	1	ΔCBSLPA <sub>z,t</sub>	ΔCBSLPA <sub>z</sub>	ΔCBSLPA <sub>t</sub>	ΔCBSLPA
Name>	Forest	annual	cumulative	Name>	Zone 1	annual	cumulative	annual	cumulative
Project Year <i>t</i>	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	Project Year <i>t</i>	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e
2011-2012	260,731.0	260,731.0	260,731.0	2011-2012	3,676.3	3,676.3	3,676.3	257,054.8	257,054.8

**4.2 Project Emissions**

**Emissions due to planned deforestation**

No emissions associated to planned deforestation were developed in the Project area from 14 February 2011 to 14 February 2012.

**Emissions due to planned logging activities**

No emissions associated to planned logging activities were developed in the Project area from 14 February 2011 to 14 February 2012.

**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.

**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 14 February 2011 to 14 February 2012.

**Emissions due to unavoidable unplanned deforestation**

A total of 32 hectares of unavoidable unplanned deforestation was observed within the Project area in this monitoring period.

Total of emissions related to unavoidable unplanned deforestation is 13,676.7 tCO<sub>2</sub>e.

**Emissions due to forest fires and catastrophic events**

No emissions associated to forest fires and catastrophic events have occurred in the Project area from 14 February 2011 to 14 February 2012.

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

Total ex post estimated carbon stock change in Project area under the Project scenario in this monitoring period is presented in Table 7.



Table 7. 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 unavoids unplanned deforestation		Total ex post net carbon stock change	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta\text{CPAdP}_{A_t}$	$\Delta\text{CPAdP}_A$	$\Delta\text{CPAiP}_{A_t}$	$\Delta\text{CPAiP}_A$	$\Delta\text{CUDdP}_{A_t}$	$\Delta\text{CUDdP}_A$	$\Delta\text{CPSP}_{A_t}$	$\Delta\text{CPSPA}$
	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e
2011-2012	0.0	0.0	0.0	0.0	13,676.7	13,676.7	13,676.7	13,676.7

**Non-CO<sub>2</sub> 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.

**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 8. Leakage was calculated as the difference between the ex post and ex ante the assessment. As the result is <0, total ex post leakage was set to zero.

**Table 8.** Total net ex ante and ex post baseline carbon stock change in the leakage belt (Table 35 of VCS VM0015)

Project year	Total ex ante net baseline carbon stock change in the leakage belt		Total ex post net actual carbon stock change in the leakage belt		Total ex post leakage	
	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta\text{CBSLLKt}$	$\Delta\text{CBSLLK}$	$\Delta\text{CBSLLKt}$	$\Delta\text{CBSLLK}$	$\Delta\text{CBSLLKt}$	$\Delta\text{CBSLLK}$
	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e
2011-2012	330,193.5	330,193.5	30,280.5	30,280.5	0.0	0.0

**4.4 Summary of 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 17%, as calculated in Non-permanence Risk Report. The calculated *ex post* GHG emissions reductions are presented in Table 9.

**Table 9. 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 net anthropogenic GHG emission reductions		Ex post VCUs tradable		Ex post buffer credits	
	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative	annual	cumulative
	$\Delta\text{CBSLPA}_t$	$\Delta\text{CBSLPA}$	$\Delta\text{CPSPA}_t$	$\Delta\text{CPSPA}$	$\Delta\text{REDD}_t$	$\Delta\text{REDD}$	$\text{VCU}_t$	$\text{VCU}$	$\text{VCB}_t$	$\text{VCB}$
	tCO <sub>2</sub> -e	tCO <sub>2</sub> -e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e	tCO <sub>2</sub> e
2011-2012	257,054.8	257,054.8	13,676.7	13,676.7	243,378.1	243,378.1	202,003.8	202,003.8	41,374.3	41,374.3

5 ADDITIONAL INFORMATION

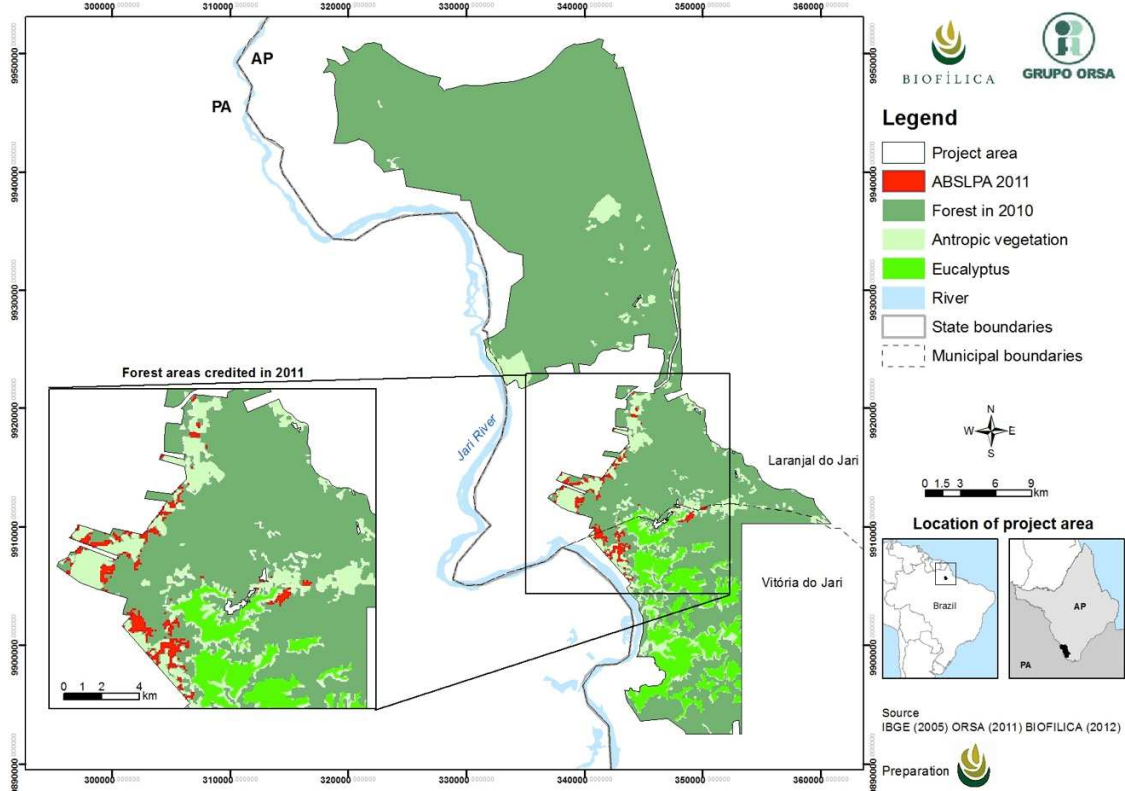


Figure 2. Map showing cumulative areas credited within the Project area.

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.