Effectiveness Evaluation Report

AMAZON'S WATER SPRINGS PROJECT

December, 2016.

December, 2016.

Effectiveness Evaluation Report

AMAZON'S WATER SPRINGS PROJECT

This report presents the effectiveness evaluation results of the project supported by the Amazon Fund, called "AMAZON'S WATER SPRINGS PROJECT", which was concluded in 2013. This evaluation was carried out by a team of independent consultants, under the coordination of technical cooperation between BNDES and German Cooperation for Sustainable Development through GIZ. All opinions expressed herein are the sole responsibility of the authors, not necessarily reflecting the position of GIZ and BNDES. This document has not been subject to editorial review.

EVALUATION TEAM:
Bernardo Anache . Fabiano Toni . Heliandro Torres Maia . Julia Queiroz

Design: Marcus Vinícios de Oliveira

Table of contents

1. Executive summary

This document brings the results of an ex-post independent evaluation of the Amazon Water Springs project in the Amazon region, carried out by the Environmental Secretariat of the Municipality of Alta Floresta / MT (SECMA) between 2011 and 2013, with the financial support of the Amazonia Fund (FA) in the total amount of R$ 2,781,340.40.

The evaluation, carried out as part of technical cooperation between the Brazilian Development Bank (BNDES) and the German Cooperation for Sustainable Development through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, was carried out by a team of two technicians from GIZ and two independent consultants. The study sought to respond to multiple questions involving project stakeholders, to understand how much the activities in a single municipality had relevance, impact, sustainability, efficiency and effectiveness to the region and to Amazon Fund objectives .

Relevance

The Amazon Water Springs project was of great relevance because it dealt with an important theme for the Brazilian environmental policy. Furthermore, it allowed Alta Floresta to emerge from a situation of environmental illegality through local governance initiatives coordinated by municipal public authorities. This was done through a joint effort to make the local organized society aware and mobilize it on the importance of restoring degraded Permanent Preservation Areas (APPs).

Thus, the project became a relevant case because it was able to accomplish results linked to greenhouse gas emissions (GHG) reduction. And also because, from the point of view of local, state and federal governments, the public policies of deforestation monitoring and control, linked to those of environmental adequacy, had effects on Alta Floresta farms.

The project work of Secma and local partners contributed to a decrease of 72.7% in the deforestation rates of the municipality, starting from the accumulated 87.4km² in the period 2007-2010, to 23.8km² in the period 2011-2014 (Prodes/INPE, s.d.). It should be noted that in the same period there was a decrease of 48% in deforestation in Mato Grosso.

High levels of adherence and commitment have been achieved among project beneficiaries. The farmers, resigned to the criminalization of their form of land occupation, gradually realized that the project brought them an alternative of environmental regularization linked to the sustainable management of their farms.

Considering the tangible and intangible benefits of environmental services in the recovery of degraded areas, the project is also relevant for enhancing APP value, since the farmers directly perceive improved: i) thermal comfort around these restored areas; ii) water quality and quantity; and iii) availability of fruits and other family foods.

Impact

The main direct impact of the Amazon Water Springs project came from the completion of the Rural Environmental Registry (Cadastro Ambiental Rural - CAR) and the low deforestation rates, which led the municipality to reach the target required by Federal Decree No. 6,321 / 2007 and to leave the list of priority municipalities to combat deforestation.

1. Executive summary

The project achieved high social adherence in all its objectives and components. The farmers had contact with pasture management technologies to increase productivity, productive use of APPs and techniques for the development of Agroforestry Systems (SAFs).

The perception of being legalized had an unexpected impact on the farmer beneficiaries, going beyond mere law enforcement. With the new Forest Code of 2012, the legal requirement for environmental recovery of APPs, fell from a band of 30 to 5 meters around water bodies. Still, the small farmers kept it in bands between 20 and 30 meters.

Other important impacts of enhancing Secma's structure were the new Municipal Environmental Policy and the approval of the Environmental Code and the Urban Arborization Code. The Municipal Environment Fund was also set up, funded by fines and conduct change agreements prepared by Mato Grosso prosecutors.

As indirect impacts identified, the following stand out:

- **Secma was recognized and gained the confidence of Alta Floresta's farmers, strengthening a partnership with the farmer association, representing farm employers and family farmers.**
- **The environmental regularization of the municipality enabled an unprecedented agreement with the McDonald fast food chain to purchase meat from two Alta Floresta suppliers. Despite its low business impact, the news had great impact on the media and was hailed in the municipality, because Alta Floresta was associated with "sustainable meat" production.**
- **The Amazon Water Springs project influenced the Mato Grosso municipalities of Carlinda, Cotriguaçu and Marcelândia. They also received FA support for similar environmental regularization activities. In addition, other municipalities in the Portal also started similar preliminary work.**

An important challenge: The project generated limited carry over of benefits from farmers who received municipal support to other farmers. Those benefitted farmers were almost exclusively the ones to carry out recovery activities, indicating a dependence on public resources.

Sustainability

The project promoted activities on its Demonstration Units (DUs). Even at an early stage, honey has generated income for some farmers. Locally developed reputation and technical expertise have also been factors which opened the way for funding from other sources, such as the Moore Foundation, the Vale Fund and the Althelia Climate Fund.

On the other hand, in order to strengthen sustainable production activities, so that the farmer does not depend again on deforestation for his basic sustenance, some activities need to be improved. The absolute majority of the farmers involved are engaged in continuous activities, but do not obtain direct economic results.

1. Executive summary

Effectiveness

The general and specific objectives achieved significant deliverables, some above targets and others partially:

- **27 workshops and 4,757 farm visits provided knowledge to 1,720 farmers, of which 30% were women. This number is equivalent to approximately 69% of the farms of Alta Floresta.**
- **1,738 ha have undergone recovery activities. In October 2016, this recovery was observed on 794 ha, through orbital analysis.**
- **Secma's institutional strengthening was achieved through temporary hiring and training of 22 technicians, 4 of whom remain on the permanent staff.**
- **Technological support equipment for environmental management, monitoring and control activities were acquired, used and maintained in good condition.**
- **18% of the municipal territory, composed of 2,801 farms were regularized in the CAR and obtained the Unified Environmental License (LAU).**
- **It is important to note that the registered areas do not guarantee the implementation of the degraded areas recovery policy. In spite of the success of the advancing recovery of 1,738 ha of APPs, a significant deficit of deforested APPs persists In addition, a significant number of farmers that have large unregistered areas resist and have not complied with the recovery set by law.**

Efficiency

The project intended to recover 1,200 ha. It spent R$ 965,000 to recover and protect 1,738 ha of APPs, for an averagge cost of R$ 555 / ha. The cost to the farmer of only the materials at local market prices would be R$ 2,420 / ha, for a total of R$ 2.9 million for the 1,738 ha. Considering the 794.89 ha in recovery, it is seen that this is a time-consuming process and although orbital surveys cannot detect vegetation in very early stages of recovery, even so the result detected so far shows that the area in process of recovery is significant, with at least 47.41% of orbital confirmation rate. This means an increase of 27% in forest coverage in the project areas There was also a decrease of 10% in the areas of exposed soil, which can be considered significant in the cost-benefit correlation, given the time of the project until the present.

The project allowed Secma to create and maintain considerable infrastructure to act on environmental and land use management of the municipality. Even after the end of the project, the evaluation team found that this infrastructure was very well maintained and, most importantly, in use, expressing the efficiency of investments in institutional strengthening.

The project team registered 2,040 CAR projects, serving 2,801 farms that cover 159,028.15 ha and reducing the expense to only 11% of the market cost to obtain CAR and LAU. The number of orientation sessions and workshops, especially of the 1,720 farmers participating in any of the project events, exceeded almost 23% of the initial target. Despite this, there remains a challenge to be overcome: to develop project results on the application of technologies and knowledge, as well as directly measure economic benefits obtained by the direct beneficiaries.

1. Executive summary

Recommendations

The main recommendations include:

- To the project executors:

• Structure value chains with sustainable products and systematically measure their impacts;
• Expand local and regional partnerships in order to diversify technical support capacities to farmers;
• Strengthen the institution of the other mechanisms of the Environmental Regularization Program (PRA) and of local deforestation control;
• Go beyond regularization and environmental recovery, taking advantage of the reputation of "green municipality" with market innovations.

- To other public entities:

• Improve direct incentives for sustainable production activities, integrating more with the policies of strengthening family agriculture.

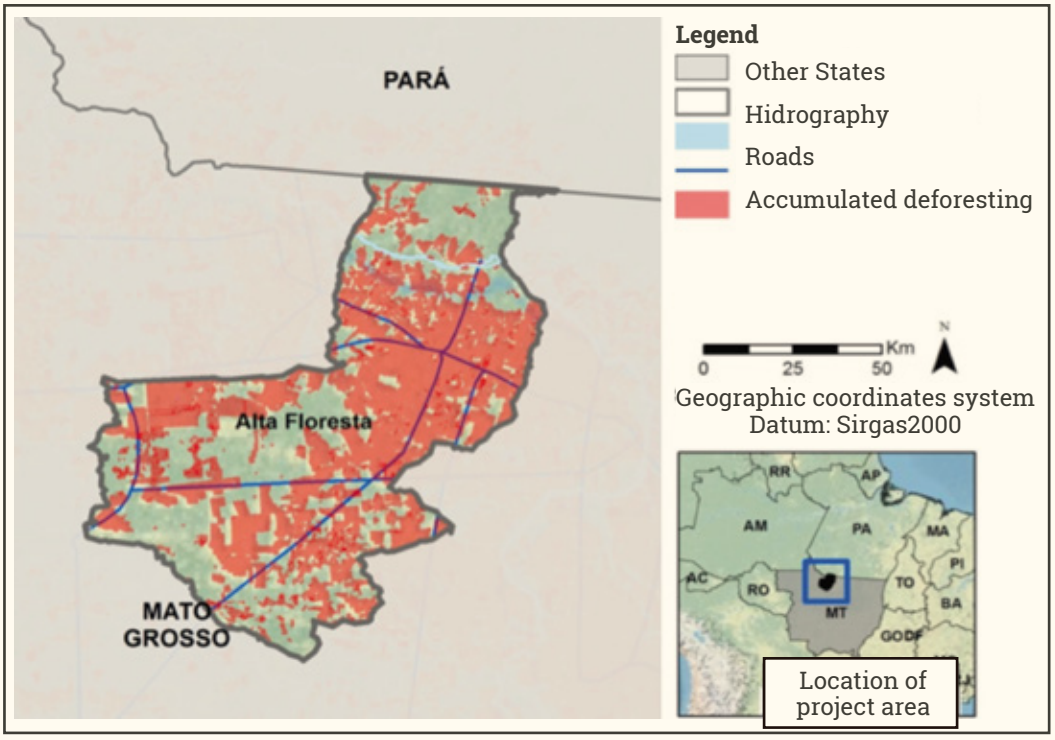
- To AF donors and managers:

• Persevere in the development of financial instruments and support to project management in order to increase local capacities for sustainability.

2. Background

The municipality of Alta Floresta, located to the north of Mato Grosso, has cattle ranching and dairy farming as its main rural economic activities (about 716 thousand head in 2015), annual crops (soybean and corn), forestry and wood extraction (Source: IBGE, @cidades and Sidra). Alta Floresta was occupied by a developmental policy that encouraged deforestation, because it was located far from large urban centers, had a large amount of natural resources, vacant lands and an ample road network. As a result, 41.6% remain in forest (Figure 1).

Figure 1. Alta Floresta/MT



Sources: IBGE, Prodes/Inpe (S.d.)

In 2008, due to high deforestation rates, the Ministry of the Environment (MMA), according to Ordinance No. 28, dated 01/24/2008, included the municipality in the list of those which the monitoring and control of deforestation was a priority. Livestock and logging activities were the main vectors of deforestation. Of the estimated 8,000 existing springs, only 4,000 were preserved in 2010, and in 2012, 54% of Alta Floresta's total area was deforested . Among these areas, according to Secma data, those of permanent preservation were the most endangered.

Therefore, the Amazon Fund supported, in the municipality, the Amazon Water Springs Project from the first quarter of 2011 to the fourth quarter of 2013. The municipality, through Secma, was responsible for its execution. Throughout its implementation, the project received a total value of R$ 2,781,340.40 and its target audience were rural cattle farmers and farm families.

The project's rationale for intervention was conceived based on two components of the Amazon Fund, namely:

i) economically attractive activities that keep the forest standing ;
ii) monitoring and control, with economic activities conforming to environmental legislation.

For the Amazon Water Springs project, these components are the general objectives. Under the first general objective, the specific objectives were:

• **Objective 1.** Expanded management and technical capacities of Alta Floresta farmers to carry out agroforestry systems, forest management activities and agro-extractive production;

• **Objective 2**. Deforested and degraded areas recovered and used for economic and conservation purposes on the farms included in the municipality's CAR;

The second objective, of monitoring and control, had the following specific objectives:

• **Objective 3.** Easier access of Alta Floresta farmers to environmental and land regularization of their farms.

• **Objective 4.** Easier access of Alta Floresta farmers to environmental and land regularization of their farms.

Thus, the Amazon Water Springs project aimed to contribute to reduce deforestation and adapt the municipality to the environmental legalization process in search of a more sustainable development.

3. Introduction

Evaluations are carried out to provide information to help understand the results and impacts achieved in a given project, whether predicted or unexpected, and, thus, to support institutional learning and decision making. However, the challenges to evaluate a project over a medium and long-term are significant. With many factors, it is difficult to determine to what extent its impacts and results are due to its activities or to external variables.

The present evaluation was carried out within the framework of technical cooperation between BNDES and the German Cooperation for Sustainable Development through GIZ GmbH. Its objective is to support the Fund by: (i) reporting to its donors; (ii) enabling institutional learning and contributing to improving project quality, investment priorities and decision-making; (iii) verifying the compliance of supported projects according to Cancun safeguards agreements concerning the UNFCCC for REDD+ activities; and (iv) verifying the project alignment with PPCDAm and state plans to prevent and control deforestation.

In this context, this report presents the effectiveness evaluation of the Amazon Water Springs Project, supported by Fundo Amazônia / BNDES. It took place in the municipality of Alta Floresta / MT, carried out by municipal government, through Secma.

The project aimed to support the strengthening of municipal environmental management, carry out the CAR mainly for small farms, as well as to implement the recovery of degraded areas near springs. In this way, the project contributed to reducing deforestation and enabled the municipality to adapt to the environmental legalization process in search of sustainable development.

This study will then evaluate the project's relevance, effectiveness, efficiency, impacts and sustainability. To this end, given the project's main objectives this study notes the achieved results, the positive points and the remaining challenges facing implementation.

Finally, the report, presents lessons learned and recommendations for stakeholders with specific interests, such as executors, direct and indirect beneficiaries, the MMA and the Amazon Fund.

4. Methodology

The methodology used to evaluate the effectiveness of the Amazon Water Springs project in the Amazon Region sought to analyze the degree to which the project's objectives and goals were fulfilled, as well as the impacts and sustainability of the achieved results. For such purpose, the evaluation team first performed a systematic collection of secondary data. This data collection comprised the initial memorandum that served as reference source for all of the information related to the evaluated project. Since the beginning of the proposal until completion of the prelimary report, the memorandum was developed with the project's own documentation and public and scientific data available in its area.

Subsequently, the team of evaluators structured a questionnaire / road map (Appendix I) based on the criteria defined in the Conceptual Framework for the Evaluation of Effectiveness of the projects supported by the Amazon Fund. The evaluators used this script in the interviews conducted during the field mission. The questionnaires addressed the OECD criteria, REDD+ safeguards and cross-cutting themes. In addition, depending on the actor interviewed and the topic addressed, other specific questions were inserted into the script.

The field mission aimed to conduct part of the data collection in person, in visits to the region covered by the project, and in an integrated way. In addition to the data related to the Amazon Water Springs project, the team obtained information on the federal and state PPCDAm actions applied in the region; and other socio-environmental and development policies, including investments in infrastructure and agribusiness, which served as a basis for analyzing the regional context.

Field work took place between August 22 and 29, 2016 in the municipality of Alta Floresta - MT. The team carried out 16 interviews, including municipal government, the third sector, farmers, academics and the farmer association, as well as visiting some assisted farms.

During the field mission, a collective approach, in a workshop format, was also applied with project stakeholders. This workshop took place on August 26 at the State Technical School of Mato Grosso Campus, with 24 participants. The SWOT methodology (Strengths, Weaknesses, Opportunities, and Threats) was applied in order to support the analysis from a joint vision of the project (Appendix IV).

There were some methodological difficulties and limitations. A further analysis on specific topics would require more in-depth studies, and would require nformation that is not available. For example, the implementers did not quantify the project's economic benefits. In addition, some results depend on the convergence of activities, initiatives, external factors and the economic, social and political situation. It is often not possible to separate these causes, needing further analysis.

A counterfactual study was also carried out to estimate the effect of the Amazon Water Springs project on the growth of CAR registries and on the reduction of deforestation in Alta Floresta through SCM (Synthetic Control Method). The method is used to evaluate the effect of an intervention implemented in only one municipality, that is, when it is not possible to use a comparative experimental design among several units. In order to go beyond the limitations of case and panel studies, Abadie and Gardeazabal (2003) present SCM, which is a generalization of the difference in differences (DID) estimation method, applied to cases where only one or some units are treated. In this case, instead of a subjective selection of untreated units, SCM analyzes the trajectory of the units of analysis before the beginning of the intervention

4. Metodologia

to find a control group that resembles the behavior of the treated unit as if it had not been treated (see Box 3, page 20).

The results of the evaluation were presented and improved upon in a workshop held in November 2016 in Brasília, with the participation of the Evaluation Reference Group, MMA representatives, the former Coordinator of the Amazon Water Springs project and Alta Floresta's Secretary of the Environment.

5. Results

1.Activities that maintain the forest standing with economic attractiveness and;

2. Monitoring and control adequated to environmental legislation

1.1.
Producers' managing and technical abilities expanded for the implementation of SAFs, forest management activities and agricultural production

1.2.
Deforested and degraded areas recovered and used for economic and conservation purposes in the properties inserted in the CAR

2.1.
Structured and modernized Secma for monitoring, control and environmental responsibility

2.2.
Facilitated access of Alta Floresta rural producers to environmental and land regulation of their properties

5.1. General objective 1: activities that keep the forest standing have economic attractiveness in the municipality of Alta Floresta

This objective represents, at the same time, the unique advantages and the significant limitations of the Amazon Water Springs project in the Amazon. The advantages, in relation to other municipal environmental regularization projects, is precisely in the recovery of degraded areas, not only for its innovative character, but also for the results and effects achieved - presented in section 5.4 - such as the change of Alta Floresta farmer mentality coming to value the conservation of APPs.

5. Results

On the other hand, the Amazon Water Springs project faces a problem that is common to many conservation and rural development projects, which is the difficulty in consolidating new production chains for alternative products of low environmental impact: the economic use of the reclaimed areas was incipient. However, there is no doubt that farmers clearly perceive the environmental services provided by the recovery of these APPs.. During the interviews, the majority reported the benefits of carrying out this recovery: improved thermal comfort around the recovered APP, improved water quality and quantity and the availability of fruits and other foods.

Positive Points

The activities consolidated the importance among the farmers of the recovery of degraded areas, mainly of the springs and riparian forests. The activities helped maintain low rates of deforestation in the municipality. Environmental gains and the prospect of legalizing farms were the main incentive for farmers to change their practices.

The proposal to discuss an environmental agenda in the municipality strengthened environmental awareness, demonstrating the possibility of conserving the forests in association with production activities. Even with the changes in the Forest Code in 2012 (Law 12.651), which reduced the dimensions of APPs, the farmers showed no interest in reducing already fenced APPs. This demonstrates a commitment to the recovery of degraded areas that goes beyond mere law enforcement.

Challenges

The economic impacts of the project have not been measured. There are isolated impacts but not relevant enough to change the structure of the local economy or even incentives for farmers to modify their decisions on land use. Cattle ranching was, on average, stable in the 2004-2015 period of, in contrast with the more intensive use of soil for temporary crops, especially soybeans, which expanded cultivated areas considerably(Tables 1 and 2).

Table 1: Cattle herd increase in the target municipalities of the project 2004-2013

Cattle herd		Herd increase between 2004 and 2015
2004	2015	
723.871	**716.438**	**-1,02%**

Source: Municipal Cattle Research. SIDRA/IBGE.

Table 2: Increase in the planted corn and soy area in the target municipalities of the project, 2004-2013

Product	Planted area		Increase in area (ha) between 2004 and 2015
	2004	2015	
Corn	**800**	**4018**	**402,25%**
Soy	**117**	**9920**	**8.378,63%**

Source: Municipal Agricultural Production. SIDRA/IBGE.

5. Results

The project did not seek to diversify farmer activities. This leads one to fear an even greater predominance of thelivestock, corn and soybean agriculture. The development paradigm has not been changed. One challenge is how to rethink to take the ground against these risks.

5.1.1. Specific Objective 1: Management and technical capacities of the Alta Floresta producers expanded for the implementation of agroforestry systems, forest management activies and agroextractivist production

The first specific objective was to carry out workshops to train farmers on SAFs, pasture management and seed collection, processing and storage.

The indicator used was the number of farmers trained to implement agroforestry systems, forest management activities and agro-extractivist production, effectively using the knowledge acquired. The project aimed to train 1,400 farmers. Through workshops and informal meetings, the team was able to train 1,720 farmers. This represents 69% of the farms in the municipality and, most importantly, 84% of the owners who carried out the CAR through the project (see objective 4). Another interesting aspect was the participation of women in these activities. About 30% of the target population, mainly because the participation of women has traditionally been low or absent.

Positive Points

The workshops covered themes relevant to environmental sustainability, notably recovery of degraded areas, agroforestry systems and pasture management. They gathered farmers and contributed to their awareness on issues such as protection of springs and environmental regulation.

The commitment of the project's technical team made the difference in this process of training and raising awareness among farmers. The team always sought to involve them in the interventions made in these areas, and the initial resistance to discuss environmental issues was overcome due to the intense mobilization of this team, which made numerous visits and meetings with farmers.

Although this activity had not been originally planned in the project, technicians introduced bee keeping as a component of the SAFs and held a mini-course on the subject at a demonstration unit (DU)[1]. This exercise was important to attract farmers involved in the project, because in addition to the beneficial effects of pollination by bees, it generated a rich additional product for nourishment, the honey of native bees.

1) Avina Foundation support was important for the later success of the activity. It helped to select the first bee matrices and defining the ideal format of bee boxes for both reproduction and honey. In addition, it indicated the structuring of the municipal bee center for the second phase of the project.

5. Results

Challenges

Some workshops focused on the farmers around the DUs. However, there was not a precise record of the origin of working group participants. Without more detailed management of the public and their applied learning, one can increase the risk of giving priory to these units and neglecting the ability to overflow learning to farmers in other areas.

5.1.2. Specific objetive 2: Deforested and degrated areas recovered and used for economic and conservation purposes in the properties inserted in the municipal CAR.

Objective 2 had four activities: 1) Install 20 Demonstration Units of SAFs and pasture management; 2) supply inputs and technical support to small farmers to implement SAFs, manage pastures, and isolate altered APPs for environmental recovery; 3) develop a communication plan to attract farmers to activities of environmental recovery and spring protection; 4) pepare degraded area recovery projects and survey the remaining flora species on the farms with CAR.

The project team installed 20 DUs as part of a municipal government unit divided into four sectors. This prevented the units from being concentrated in areas near the town, and made them more easily accessible to farmers living in more distant areas. The location of the DUs was carefully planned in each of the four sectors. The team sought to identify farmers who were enthusiastic about the new techniques and displayed ability to attract other farmers. The DUs were chosen at strategic points in areas that would bring other farmers and, thus, replicate the new techniques used. As an example, farmers worked together sowing seeds.
The technical team prepared evaluations of the areas to design forest restoration, SAF and pasture management projects. Orbital image mapping of the degraded areas detected about 14 thousand hectares of deforested APPs in Alta Floresta. Based on this assessment, the project proposed to start the recovery process on 1,200 ha in the 20 DUs and in areas of other farmers interested in carrying out this recovery by way of CAR on their farms.

A partnership with the State University of Mato Grosso (UNEMAT) was a particularly important in these evaluations, carrying out a floristic survey that helped choose the species used in forest recovery. Another important partner was the Brazilian Agricultural Research Corporation (EMBRAPA), which trained the project technicians on SAFs and pasture management. The recovery of degraded took place by a process of learning-by-doing and learning-by-interacting. There is not a single recipe for recovery. It was a process of constant learning about how to deal with local specificities.

5. Results

With project funds, in addition to technical assistance, the municipality distributed seeds and fencing material to isolate the areas in recovery. The efficiency in project execution can be measured by comparing avoided costs for recovery. The project spent R$ 965,000 to recover 1,738 ha of APPs, or R$ 555 / ha. The cost of the material alone at local market prices would be R$ 2,420 / ha, which would generate a total expenditure of R$ 2.9 million for the 1,738 ha[2]. This indicates the efficiency of this activity, as, without the project's contribution, several farmers would not be able to afford these costs. The same scenario occurred with the DU activities, which cost R$ 340,000, while market values would have been R$ 540,000.

Positive Points

The total area that underwent reforestation intervention for recovery of APPs, 1,738 ha, was higher than the project's target (1,200 hectares). It is estimated, based on the orbital surveys carried out, that at least 794,89 ha are in the process of recovery at a stage which can be captured by satellite images. Considering that recovery is a long process and that orbital surveys cannot detect vegetation in very early stages of recovery, the result is quite significant (Box 1).

Box 1: Preservation areas permanently recovered by the project

The contribution of the Amazon Water Springs project to the recovery of degraded APPs in supported farms is one of the project's great successes. In order to verify this contribution, an analysis of the recovery of areas was made comparing the first year of the project (2011) with the year 2015.

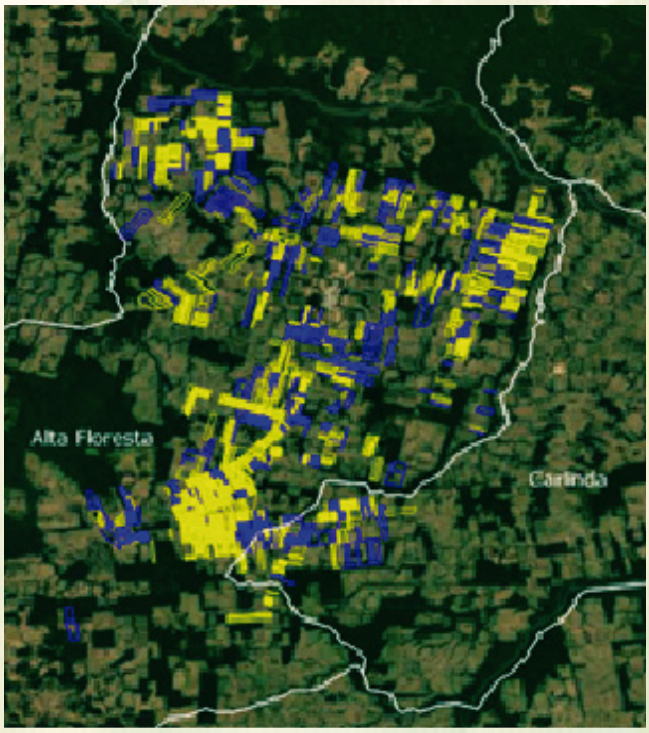
For this, geographic data provided by Secma was used (Figure 2), indicating the limits of the mapped farms and the rivers of the municipality, as well as images of the RapidEye sensor. This data was processed based on the Normalized Difference Vegetation Index (NDVI).

The study considered APP margin areas of 30m, therefore, according to the NDVI methodology, areas that correspond to exposed fields where there are no tree species (Soil))/ vegetation 1 (Veg-1), with characteristics of recomposition resulting from the introduction of plant species or in a natural way from its fencing; and vegetation 2 (Veg-2), related to the older types of vegetation, which already existed in the APP area in 2011 and have undergone a forest enrichment planting process.

2) Data supplied by SECMA

5. Results

Figure 2: Amazon Water Springs Project properties limits database (Phase I in yellow and Phase II in blue)



Nº of farms/areas	2011 (ha)	2015 (ha)	Difference between 2015 e 2011 (ha)	Variation % between 2015 e 2011
PHASE I: 1157 properties				
Soil	1.175,42	1.049,58	125,84	10,71%
Veg 1	716,84	933,04	216,2	30,16%
Veg 2	1.985,94	2.501,28	515,34	25,95%
Veg1+Veg2	2.702,78	3.434,32	731,54	27,07%
PHASE I: 620 properties				
Soil	928,12	877,23	50,89	5,48%
Veg 1	641,46	690,29	48,83	7,61%
Veg 2	1.797,69	1.812,21	14,52	0,81%
Veg1+Veg2	2.439,15	2.502,5	63,35	2,60%
TOTAIS Veg1+Veg2(em 2011 e 2015)	5.141,93	5.936,82	794,89	

Table 3. Evolution of the areas of exposed soil and vegetation in the period of 2011 and 2015. For further details, see Appendix II. .

In fact, this result does not mean that only these values represent the actual increase. Several factors intervene in this type of orbital sensor analysis, among which: the short time between the intervention and the geographical analysis; the buffer distance of 30m used to measure the recovery areas which does not always cover the total area in recovery; and the small farm areas analyzed relative to the spatial resolution of the RapidEye sensor images. This hindered a more in-depth visual interpretation of the changes that occurred during the period (Altieri, 2016).

5. Results

Technical assistance and monitoring were intense - 4,757 field visits by technicians. The constant presence of the technical team and their commitment to the project allowed the recovery of degraded areas to be a process of constant learning about how to deal with local specifics. The recovery methodology generally opted to plant seed mix, which proved to be effective, easy to apply and inexpensive. However, specific recovery solutions were also adopted, taking into account topography and soils, as well as farmers' preferences and abilities.

Demonstration Units and recoveries through SAFs were carried out by joint efforts that, along with workshops and meetings, strengthened a social farmer network that helped disseminate knowledge.

Pasture management techniques have been particularly attractive to the farmers because they require relatively low investment and bring rapid returns. The main benefit is the reduction of feed and grass costs in managed areas. According to farmers, during the dry season these pastures can remain nutritious for livestock for at least three days longer than unmanaged pastures.

Box 2. Pasture management good practices adoption

The evidence shows that management techniques are quite advantageous both in terms of the environment and economic returns.

For example, the Pecuária Verde (Green Livestock) project introduced intensification techniques in cattle ranching on pilot farms in Paragominas/PA, which generated a 27% increase in pasture stocking rate in one year (3.3 cattle per hectare in 2013) and greater daily weight gain. As a result of the project, there was also an increase in productivity of 25% in one year and an increase of 55% in the profit margin.

Now in the Novo Campo project, developed by Instituto Centro de Vida (ICV) in Alta Floresta, activities such as pasture reform, cattle feed supplementation, herd withdrawal from permanent protection areas (APPs) and water channeling were introduced. In one year of the project, productivity doubled from 75 kg of meat per hectare per year to an average 150 kg/ha/year, with productivity increasing to 300 kg/ha/year in the intensified areas.

Queiroz et al. (2014), in turn, estimated the feasibility of implementing good agricultural practices on 914 thousand hectares of pasture in São Félix do Xingu/PA. The authors calculated two scenarios, in which (i) only pasture reform and maintenance are evaluated and (ii) with a forest-pasture system and crop-livestock integration.

5. Results

Costs of implementing good pasture practices	R$/ha
Reform	**2.500,00**
Maintenance	**1.000,00**
Implementation of forest-pasture system	**5.000,00**
Cattle and agricultural farming integration	**2.100,00**

Source: Manual de Boas Práticas, Agrssuisse (2011).

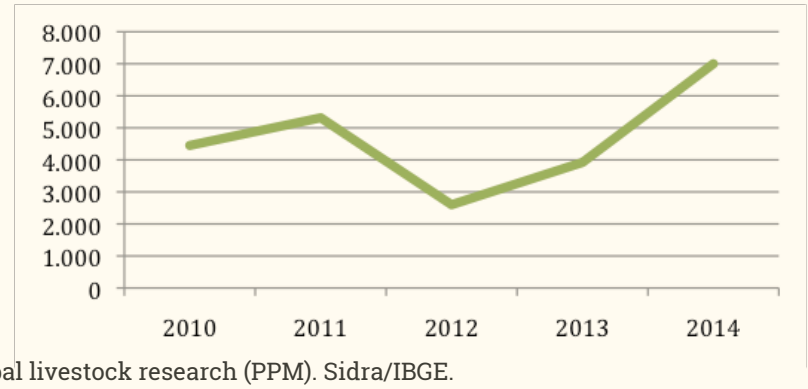
Return	R$/ha
Degraded pasture	**0,00**
Traditional cattle farming	**121,00**
Technified cattle farming / intensive and silvopastoral system	**610,00**
Livestock-crop integration	**1.312,00**

Taking into account the implementation costs and the performance of these practices, the authors calculated the feasibility of implementing them in São Félix do Xingu. Based on a hypothesis of a 10-year adaptation period and another 10 years of pasture maintenance, the authors showed that the balance of investment costs relative to yields is positive, showing the feasibility of applying these techniques. At the end of 20 years, the implementation of good practices would generate a balance of R$ 692 (first 10 years) and R$ 932 million (following 10 years) for the 914 thousand hectares of pasture. However, the authors point out that ranchers are locked in to existing technology which hinders this transition to more sustainable techniques. Therefore, economic instruments and incentives are necessary for this transition to take place.t

Some farmers have been attracted to beekeeping, as its implementation and multiplication requires little investment of capital and labor. From the beginning of the restoration work until the moment of the field work (that is, after the end of the the project's second phase), the municipal government maintains a bee center and donates queens to interested farmers. Each farmer receives 6 boxes when they set up the SAF and can acquire others from the Secma bee center. If the farmer wants to increase the amount of boxes, he will only pay their initial cost. Some are already selling honey, mainly in the municipal fair. The price of a litre in town reaches R$ 70.00. It is, therefore, a good additional source of income. According to data from IBGE (s.d.), the production (in kg) of bee honey in Alta Floresta showed an increase of 57% between 2010 and 2014. One can consider that part of this increase is the result of the project, although more accurate analysis is needed to assess honey production derived from the project.

5. Results

Image 1: Honey production (kg) in Alta Floresta.



Source: Municipal livestock research (PPM). Sidra/IBGE.

Recovery work began before the last change in the Forest Code. This means that farms of less than 400 ha should maintain a buffer of vegetation of at least 30 m along streams. This was observed in the recovery work of the Amazon Water Springs project. Even with the reduction of this legal requirement to 5m in 2012, the interviewed farmers stated that they had no interest in reducing the area recovered. Moreover, many of those who started work after 2012 have recovered a strip of about 20 to 30m along the banks. Farmers have shown satisfaction not only because they are complying with the legislation, but also because they perceive additional recovery benefits such as increased flow of the streams and an improved microclimate around the recovered areas.

Regarding the Communication Plan, it had a significant impact on the dissemination of the project, which is widely known in the city and in the Amazonia Portal municipalities , and has been important to attract farmers.

Challenges

Despite advances in the recovery process of 1,738 ha of APPs, there is still a significant number of deforested areas in Alta Floresta around springs and streams (there were 14 thousand ha at the beginning of the project).

Thus, the challenge is to scale up this activity, ensure its continuity and, especially, have constant monitoring. By monitoring, the project team can follow changes in recovered APPs and, if necessary, make new interventions.

Given the experimental nature of the recovery, it is not yet known what is the best proportion of native to exotic species to be used to ensure environmental and economic benefits.

It is debatable to what extent the floristic survey has really become a tool for educating and persuading farmers to engage in conservation and the economic use of their areas. During project implementation, practical criteria, such as the availability and difficulty of managing native species and the need to use exotic species for production, overlapped the survey.

In general, no practical emphasis on the economic use of reclaimed areas was perceived. The results of these activities practically did not generate economic return. A few products planted in the SAF system were used for subsistence.

A relevant challenge is how to structure other production chains besides dairy cattle for smallholders. There are limits of logistics and scale regarding the development of other products, such as produce and even fish farming.

5. Results

Despite farmer enthusiasm for pasture management, there are still no data on these farmers' reduction of costs and increases in productivity and income, nor has the adoption of these management techniques outside the DUs been mapped.

There is a lack of dairy market response to environmental incentives or sanctions, which already occurs with beef cattle. That is, there are still no difference in prices for those who adopt lower impact practices, nor limits on the purchase from those who cause environmental damage and/or do not comply with the legislation.

In general, the project failed to generate a significant increase in production by activities developed in the DUs. In addition, few farmers isolated river sources and ciliary forest without project support. This scenario suggests that farmers rely on the support of other actors to introduce more sustainable techniques.

5.2. General objective 2: Activities by the Alta Floresta municipality ensure the compliance of anthropic activities to environmental legislation.

The inclusion of Alta Floresta in the list of priority municipalities in the Amazon induced the local government to act and begin the process of municipal environmental regulation. In order for Alta Floresta to leave the list, it has to meet the minimum requirements set out in Decree No. 6,321 / 2007: (i) reduce deforestation to less than 40 Km2; (ii) include 80% of its territory in the CAR; and (iii) maintain the average deforestation of the years 2007 - 2008 at or below 60% of the average for the 2004-2006 period.

The inclusion of the municipality in the list had great impact on the population of Alta Floresta. The sanctions resulting from this inclusion were of great influence. The blocking of municipal farmer access to rural credit stands out. The city was occupied by the Brazilian Institute of Environment and Renewable Resources (IBAMA) inspectors and federal police, which caused a very negative initial reaction in the community.

The municipal government quickly mobilized to start the necessary work for Alta Floresta to leave the list. At that time, the only municipal environmental agency was an environmental board, under the Municipal Department of Agriculture. The great challenge was, then, to include 80% of the municipal territory in the CAR, which would require a larger and more qualified technical team, as well as a source of funds to cover the expensive work to carry out this cadastre. Team formation and CAR execution are explained in more detail below.

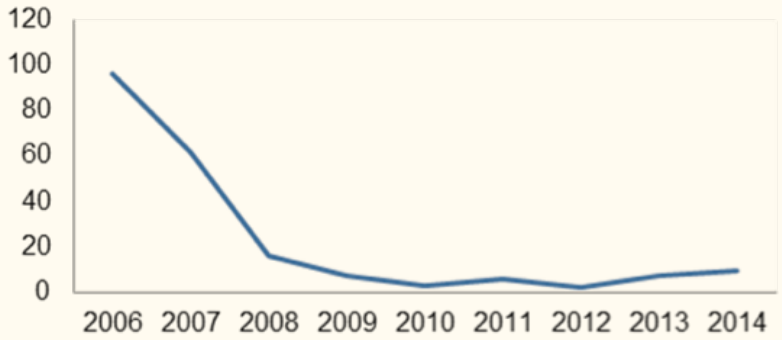
Positive Points

The project's performance may have contributed to the 72.7% fall in deforestation in the municipality from an accumulated 87.4 km2 in the 2007-2010 period to 23.8 km2 in the 2011-2014 period (Graph 2). In comparison, between 2010 and 2015, Mato Grosso state deforestation increased by 43%.

5. Results

Undoubtedly, preparing CAR had an initial beneficial effect. (See Box 3). However, the process of environmental regularization must continue, since registration is only the starting point. As foreseen in the Environmental Regularization Program (PRA), it is still necessary to validate the cadastre, the environmental licensing, monitoring and recovery of all of the muncipal environmental deficit.

Image 2: Annual deforesting in Alta Floresta 2006 - 2013



Source: Prodes/Inpe

The Amazon Water Springs project has influenced other municipalities in the area to adhere to environmental regularization actions. This influence enabled the municipalities of Carlinda, Cotriguaçu and Marcelândia, all in the state of Mato Grosso, also to receive support from the Amazon Fund for similar actions. In addition, other municipalities of the Portal have also initiated, as far as possible, preliminary work on environmental regularization.

Box 3: Synthetic control of the effect of the Amazon Water Springs Project on the CAR and deforestation in Alta Floresta: a counterfactual study

The synthetic control method (SCM) was applied for a counterfactual comparison of CAR results in the Amazon Water Springs project and Alta Floresta deforestation. This technique separated the effects of entering the list of priority municipalities (commonly known as the blacklist) to combat deforestation in the Amazon, from the effects of the Amazon Water Springs project. First, Alta Floresta was compared with the other municipalities included in this list.

As at the time of the intervention, only the states of Mato Grosso and Pará had the CAR in operation. in addition, the sample was restricted to the municipalities belonging to these two states totaling 31 participating municipalities.

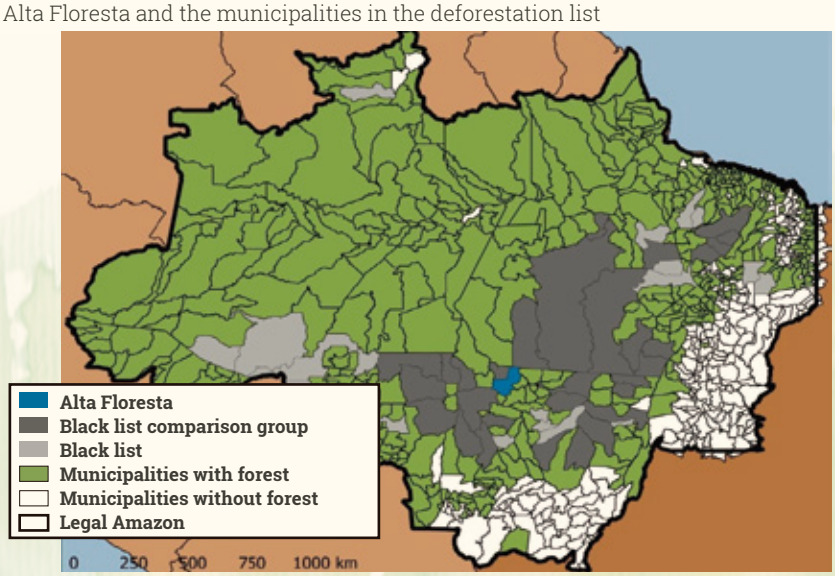
From the data provided, the SCM constructed a synthetic control unit that is the weighted average of the untreated municipalities.

The annual CAR records were nil until 2006, when the previous system, the Rural Property Licensing System (SLAPR) began to receive records that would later be transformed into CAR. With the implementation of the Mato Grosso Legal program and the creation of the state CAR, the number of registrations began to increase in 2008. On average, the number of registrations increased until 2012, the last available year. The farms registered in Alta Floresta during the years of 2008 and 2009 represented, at the time, an annual increase of about 5% of the area registered in CAR.

5. Results

This scenario tripled in 2010 as new registrations in CAR reached 15%, and in 2011 the new registrations already indicated about 25% in the registered area. The registration rate fell during the following year, indicating a possible saturation related to the registration of farms targeted by the project.

Figura 3: Alta Floresta and the municipalities in the deforestation list



The impact analysis for the Amazon Water Springs project (Figure 3) showed a robust and significant effect on the growth of CAR registries. The difference in the annual growth of CAR registries after the beginning of the treatment may be interpreted as a causal effect. It was concluded that 13.9% of the eligible municipal area, or 1,230 Km2, would not have been registered in CAR, in the time it was accomplished, without an intervention project such as the Amazon Fund.

Alta Floresta showed, until 2008, average rates of deforestation equivalent to its peers in the list of priority municipalities. From 2008 on, the municipality presented lower rates than its peers, following the trend of the 5% of the municipalities of this list that had lower rates.

After the start of the project, in 2011, municipal rates were lower than the average of the blacklist municipalities, the control group, and smaller than the synthetic control. However, from the statistical point of view, it cannot be said that the fall of deforestation in Alta Floresta stems directly from the Amazon Water Springs project.

Therefore one can conclude that the Amazon's Water Spring project played an important role in Alta Floresta's effort to have the municipality removed from the black list of deforestation. Strong evidence for this can be seen in the increase, above the general trend observed in the control group, of the number and area recorded in CAR. Many of these areas were registered with funds from the Amazon Fund-supported project. It is possible to assume that this effect includes not only the small farms that entered the system, but also the untreated neighbors, since they were indirectly motivated to register due to project intervention. In addition, assistance from the municipal environment secretariat for monitoring and enforcement and environmental liability measures may also have led to an increase in the voluntary registration of farms without direct intervention.

5. Results

Challenges

Environmental monitoring and control activities are necessary in the fight against deforestation, but they still face great difficulties in consolidating themselves at the local level. This is due to several factors, the most relevant being: lack of trained and stable personnel, low political influence on the necessary interventions for legality and limited access to expensive technologies.

Despite building a consensus on the importance of preserving and recovering water sources and riparian forests in Alta Floresta, the Legal Reserve idea, a large liability, is still taboo in the municipality. However, environmental regulation requires that this be addressed at some point.

5.2.1. Specific objective 3: Structuring and modernization of the Municipal Department of the Environment of Alta Floresta for environmental monitoring, control and accountability

The main activity of Objective 3 is the implementation of a deforestation and fires environmental monitoring system with training in geoprocessing techniques for Secma employees.

The first step towards getting off the list was the creation of Secma. In order to achieve its objectives, this secretariat sought the ICV, a regional NGO with long experience in rural environmental regularization and an office in Alta Floresta.

At first, the prefecture wanted to carry out a limted intervention, to get the municipality off the list. That being accomplished, Secma could be demobilized. In the municipal government's point of view, there was no justification to have three bodies (Ibama, State Secretariat of Environment of Mato Grosso / SEMA and Secma) inspecting farms in the municipality. Instead, the ICV and the municipal government decided that the partnership should be long-term. They also defined that the city would have to develop continuous monitoring work so that Alta Floresta would leave the list without danger of returning or suffering further sanctions due to a possible increase in deforestation. An immediate result of this partnership was the elaboration, by the ICV, of a vectorized map of all the springs in the municipality. This map served as a basis for one of the activities with the greatest impact of the Amazon Water Springs project, which was the recovery of 1,738 ha of forests around springs.

The secretariat was created with a staff of four employees, in addition to the secretary. With the approval of the Amazon Water Springs project, the Secretariat temporarily hired 22 technicians and partnered with the National Institute of Colonization and Agrarian Reform (INCRA) and with the Alta Floresta Farmer Association to train the team. The association provided the infrastructure needed for training, while INCRA provided a technician to teach the team the steps needed to georeference farms and build the municipality's cartographic base.

In parallel, work began to mobilize farmers to understand the importance of CAR. It was crucial at this point to break farmer resistance to the system based on fear that CAR could be used to sanction them. The alliance between the municipal government and the Farmer association helped to change the belief that environmental legislation punished the farmer and prevents agricultural development.

5. Results

The project's technician team acquired the skills and abilities necessary to carry out CAR. In addition, and in line with specific objectives 1 and 2, two technicians were trained in forest restoration, agroforestry systems and pasture management, to implement the demonstration areas and provide technical assistance to the municipal farmers interested in adopting the innovations.

As a direct result of Secma structuring, today the municipal government is competent to license about 250 activities of low environmental impact. Other important effects of the structuring of this secretariat were the creation of a Municipal Environmental Policy and the approval of the Environmental and Urban Arborization Codes. The Municipal Environmental Fund was also created, funded by fines and terms of conduct adjustment issued by the Mato Grosso Public Ministry .The fund's resources are mainly used in educational campaigns, such as annual campaigns to prevent forest fires.

Positive Points

The project trained and qualified a team of 22 technicians, most of whom continue to work with environmental management in the municipality. In addition to the four technicians who remain in the municipal government, others work in NGOs and some as teachers in local higher education institutions.

The project allowed Secma to create a very good infrastructure to operate in municipal environmental and land use management - this included vehicles, computers and geodetic GPS devices. Even after the end of the project, the evaluation team found that such infrastructure was well maintained and, more importantly, in use.

In addition to its infrastructure and technical capacity, Secma achieved something much more important: recognition and confidence among the Alta Floresta farmers.

The environment regularization of the municipality allowed an unprecedented agreement with McDonald's to purchase meat from two Alta Floresta suppliers. Despite the low commercial impact, the news had great media impact and repercussion in the city, because Alta Floresta was associated with the production of "sustainable meat".

Challenges

The city has to deal with Secma's financial difficulties, mainly to ensure the continuity of a qualified technical team. Alta Floresta is small and has a low tax base. This is particularly important in the current context where soybean farming is rapidly expanding in the municipality, which will require new secretariat capabilities such as water quality monitoring, especially for the detection of pesticide residues.

It is necessary to discuss environmental management beyond CAR. Despite the general acceptance of the principle of protection and recovery of springs, other topics such as the Legal Reserve are not on the municipality agenda.

5.2.2. Specific objective 4: Facilitated access of Alta Floresta farmers to environmental and land regularization

The greatest impact of the project is the execution of CAR. In 2012 the municipality reached the goal required to leave the priority list - 80% of the municipal territory registered. This was made possible by the effective mobilization work conducted by Secma, the size and qualification of the team, and the availability of equipment and vehicles purchased with project resources.

One of the biggest criticisms of CAR is its complexity and high cost, particularly for family farmers. The municipal government of Alta Floresta prioritized their inclusion in the registry. Few owners of small areas would be able to afford the costs of executing CAR and obtaining the Single Environmental License (LAU), which was around R$ 6,500.00 in the local market, while the family farmer paid only a total of R$ 700.00 in taxes, as shown in Table 4:

Table 4. CAR estimated costs in Alta Floresta – private X project

Private contract	R$	Realized by project	R$
CAR Technical Elaboration	2.500,00	CAR registry by SECMA	300,00
LAU Technical Elaboratio	4.000,00	LAU registry by SECMA	400,00
Total por propriedade	6.500,00		700,00

Source: Secma

One CAR strategy that helped include the less capitalized owners was the division of the municipality into four zones and the allocation of a technical team responsible for the cadastre in each zone. The technicians mobilized the community leaders in each of these areas and, with their help, held 68 meetings with the farmers to explain the need for CAR and how to do it. Thus, the project facilitated access to farms distant from the urban center, which are usually those farmers with greater financial difficulties.

In just two years, the project team had completed 2,040 CAR projects, which served 2,801 farms covering 159,028.15 ha. With these results and the decrease in deforestation between 2008 and 2011, Alta Floresta was able to leave the list of priority municipalities.

Positive Points

The Amazon's Water Springs provided the city with the necessary resources so it could quickly include 80% of its territory in CAR and leave the list of the largest deforesters in the Amazon. These resources served as an important subsidy for less capitalized farmers to register CAR, paying only the registration fees.

Despite the unquestionable importance of complying with legal requirements, the project left a much larger legacy: the institutionalization of a narrative in support of environmental regularization and the recovery of APPs, particularly of springs. This last aspect was reinforced by the coincidence of a great drought in 2010. The drought limited urban water supply and harmed agriculture. The urgent need to mitigate the drought effects made the protection and recovery of springs a priority in the municipality. Secma remained committed to this, even when it no longer had Amazon Water Springs project resources while Amazon Water Springs project awaited FA approval of a second phase .

5. Results

Challenges

The biggest challenge is to include the 18% of municipal territory not yet in CAR. According to Secma technicians, these areas belong to a few owners who are resistant to environmental regulation and who refuse to join CAR. Perhaps the only way for them to change their minds is to apply legal sanctions.

Despite all advances in environmental regularization and the existence of a legal reserve deficit, it is still possible to obtain legal deforestation, as there are areas that have not yet reached the legal limit. Of course any deforestation is environmentally undesirable. The municipal government therefore needs to find ways to discourage the opening of new forest areas.

6. Project monitoring and management

To analyse project management and monitoring, aspects regarding logistics capacity and resource execution were observed, as well as the bottlenecks to fulfill activities and involve partners in project control.

Activities and financial management were monitored directly by Secma project management. The technical team, made up of graduates of municpal schools, supported this, led by people with experience in public management.

Positive Points

To monitor the project, the team formed and trained by Secma held weekly meetings to define methods, responsibilities and deadlines. Thus, important instruments were created for management and planning, to achieve goals and objectives, and control financial resources.

The project complied with the mandates of the Performance Reports (RED) and rendered accounts after each goal and service was completed. The possibility of using surplus resources from a certain disbursement for subsequent needs -was also an important way to guarantee activities scheduled only in later goals.

In order to follow up on project tmonitoring, the Monitoring and Evaluation Committee was set up, composed of the working partners, including the institutions linked to the Municipal Council for the Development of the Environment (COMDEMA) and farmer associations. Table 1 shows the composition of the Committee and the level of participation of its participating institutions.

6. Project monitoring and management

Table 1. Monitoring and evaluation committee of the Amazon's Water Springs project.

Institution	Participation Level
North Loggers Union/Simenorte, Sintaf, Municipal Secretaries of Infrastructure, Health, Industry, Commerce and Tourism, Education, CDL, Rotary Club, Lions, Guardiões da Cidadania and City Council	Institutions that form the Comdema
Instituto Floresta, Unemat, Sema, ICV, Execute Comissiono of the Cocoa Farming PLan/CEPLAC and Ibama	Institutions that form the omdema and are partners of the project e são parceiras do projeto
Embrapa, IOV, Commerce Federation of Federação do Comerciários de Mato Grosso/FEC, Municipal Secretary of Agriculture, Mato Grosso Federal University/UFMT, Avina Foundation, Instituto Socioambienal/ISA e Rural Union	Institutions that are partners of the project
Farmers Association Representative	Associations of rural communities that are partners of the project

Source: Amazon's Water Springs project Executive Report (2012)

This Committee met every 6 months under Comdema. The meetings were used to follow up the project goals based on the monitoring plan. Reports were also presented and discussed with project partners and members of the Council.

The monitoring plan was highlighted as an important instrument which, presented together with the activity report, enabled the team to reflect on the progress and challenges in the project's execution.

Also within the scope of the Committee, meetings were held in the municipal rural area, in order to monitor the achievement of goals in loco.

Challenges

Among the difficulties found, emphasis was placed on the complexity of the monitoring instruments, monitoring and project reporting, such as the semi-structured report models of the Amazon Fund.

Despite good dialogue with the donor, available to clear doubts about project management and monitoring, management still found it difficult to reconcile disbursements and goals. This occurred when it was necessary to rethink the planning of activities, even if it only meant reversing the order of execution of planned expenditures.

7. Conclusions

The formation of human capital, the learning achieved and the institutions created in the municipality (Municipal Environment Code, Environment Council and the decentralization of some of Sema's licensing activities for Secma) had great positive impact on environmental issues and raised farmer awareness on the conservation of forest areas.

The project prepared the environment for a scenario of opportunities. It built credibility in an institutional, environmental and land use framework for other institutions to enter with new sources of resources[3]. Today the municipality is in a better position to hold discussions with donors.

The project team's technical ability and commitment were essential to its success. The use of professionals from the region provided greater involvement of the team in the project, building social fabric and human capital in the municipality.

Supporting local initiatives to carry out CAR and immediately initiating the recovery of forest liabilities in the APPs, besides being innovative, is undoubtedly a big leap towards implementing the Program of Environmental Regulation (PRA) provided for in the Brazilian Forest Code. There are still many challenges to be overcome, ranging from the analysis and validation of CARs that are being developed, to the effective implementation of environmental liability recovery programs, in addition to the effective performance of Environmental Reserve Quotas (CRA).

The Amazon Water Springs project was of great relevance because it dealt with an important theme of Brazilian environmental policy. Furthermore, it allowed Alta Floresta to emerge from a situation of environmental illegality through local governance initiatives coordinated by municipal public authorities. This was done through a joint effort to make aware and mobilize local society on the importance of recovering degraded APPs.

Therefore, the Amazon Fund has contributed significantly as one of the most important financial instruments to support the implementation of environmental policies aimed at combating deforestation associated with sustainable development in the Amazon.

The impacts outlined in this assessment report show that supporting the development of CAR and the reforestation of APPs are important contributions to legal compliance and mitigation of carbon emissions generated by deforestation in the region. Currently, Alta Floresta has institutions focused on environmental management. This puts the municipality at the forefront of pioneering initiatives implementing environmental policies focused on sustainable development and ready to enable programs and businesses that lead to safe development paths.

In this context, the Amazon Fund can still contribute much more, because we have no doubt that, in order to guarantee the sustainability of these initiatives and environmental policies, we still depend on the strengthening of the local structures that guarantee its effectiveness. Thus, it is expected that the inputs and recommendations generated may foster discussions and new initiatives for the sustainable development of the Amazon.

3) Some examples are: Moore Foundation and Vale Fund with support for the Novo Campo project coordinated by the ICV, Althelia Climate Fund with the partnership with the Sustainable Livestock of Amazonia / PECSA, Avina Foundation.

8. Recommendations

		TO WHOM						
		Executor	City Hall	Beneficiares	Estate	MMA	Amazon Fund	Donors
General objective 1	Carefully analyze the insertion of productive activities in this type of project given the difficulty of structuring value chains and measuring the gains from the project.	✓					✓	
	Collect data on income and productivity growth in a systematic way. Partnerships with technical assistance agencies, for example, can assist the project in this task.	✓						
	Consider that public policies that promote family farming, such as the PAA and PNAE, can contribute to the strengthening of new production activities and arrangements. The importance of organic farming promoted in phase 2 of the project stands out.					✓		
	Expand the adoption of pasture management. Insert production control methods to raise costs and benefits. Look for partners such as the Municipal Department of Agriculture, the Matogrossense Technical Assistance Research and Rural Extension Company (EMPAER) and the SEBRAE.		✓					
	Analyze the possibility of including surplus restored APP area as additionality in the Clean Development Mechanism (CDM).	✓						
	Consider using new technologies, such as drones, to increase the efficiency of APP monitoring.	✓	✓					
General objective 2	Use data from existing deforestation and burning monitoring systems in real time to minimize the risk of illegal deforestation increases.	✓	✓					
	Explore the gains associated with the "green county" image in order to attract new environmental projects and productive investments.		✓	✓				
	Advance in matters related to the environmental sustainability of the municipality beyond the recovery of springs and degraded areas. The "green municipality" label should be better explored to legitimize the expansion of the environmental agenda.	✓	✓	✓				
	Institutionalize some successes, such as protection of springs. Expand urban environmental licensing skills to raise funds for environmental projects.		✓					
Management and monitor	Offer guides, manuals and even training that could clarify the use of instruments of reconciliation between disbursements and goals.						✓	
	The Communication Plan budget must be within the project from the beginning, since it is a type of activity which does not easily obtain resources, except later, from other sources.	✓	✓					
	Create strategies that simplify the re-allocation of financial resources, for better implementation without comprimising expected results.						✓	
	Promote greater participation of the project's evaluation and monitoring committeeto review goals, as well as more effort to achieve them and spread results to civil society.	✓						
Gerais	Systematize and disseminate this experience and seek ways to support municipalities with good governance. Organize visits of delegations from other municipalities, with the participation of mayors, secretaries, technicians and farmers.				✓	✓		
	Scale up the execution of environmental regularization and sustainable development projects through strategies such as the "intermunicipal consortia".					✓	✓	
	Look for non-reimbursable external resources, such as those provided by the Amazon Fund.	✓	✓					
	Create other instruments such as ecological ICMS, payment for environmental services for additionality, environmental compensation, among others.				✓	✓		
	Invest in the protagonism of municipalities, for these, when trained, organized and empowered, can accomplish environmental management with significant results.					✓	✓	✓

9. Lessons learned

The Amazon Water Springs project shows us that municipalities can be relevant actors, capable of engaging in carrying out projects as well as in environmental and land use management.

Experience also shows - on a small scale - that various challenges can be overcome with good governance and local participation. Hence, scaling up initiatives like this is not as difficult as it was supposed to be a few years ago.

The creation of an arena of dialogue with actors from various areas can break the resistance that some sectors of society have in relation to environmental projects. The initial aversion to any form of environmental control in the municipality gave way to near unanimity regarding the need to register with CAR, with good collective resonance to recover and preserve APPs.

Municipalities in which there is a consolidated sociotechnical base, with trained human resources and experience in collaborative work in networks, for example, have a good chance of success in the execution of environmental and land use management projects.

Projects with objectives that require continuous and long-term activities should seek an exit strategy and / or long-term financing mechanisms to ensure its continuity.

10. Bibliography

- ALTIERI, Flávio. Relatório analítico dos resultados obtidos na análise da situação da recuperação florestal no projeto Sementes do Portal. Belém do Pará, Pará. 2016.

- DELOS, Desarrollo Local Sostenible. Disponible em: http://www.eumed.net/rev/delos/22/alta-floresta.html. Acessado em 17 de setembro de 2016.
2

- FARIA (s.d.). Perspectivas de desenvolvimento local sustentável em Alta Floresta / MT.

- Instituto Brasileiro de Geografia e Estatística (IBGE). Mapa da Amazônia Legal - Fronteira Agrícola. Mapas. Sem data. Disponível em: http://www.ibge.gov.br/home/geociencias/geografia/mapas_doc3.shtm. Acessado em 01/08/2015.

- Instituto Nacional de Pesquisas espaciais – INPE. Projeto PRODES. Sem data. Disponível em: http://www.obt.inpe.br/prodes. Acessado em 10/08/2016.

- Ministério do Meio Ambiente (MMA). Lista de municípios prioritários para controle. http://www.mma.gov.br/estruturas/sedr/_arquivos/portaria_mma_n_28_de_24012008_munic_prioritrios_para_o_controle_do_desmatamento_na_amaznia_138.pdf

- MMA. Portaria nº 28, 24/01/2008. Acessado em 11/11/2016. http://www.mma.gov.br/florestas/controle-e-preven%C3%A7%C3%A3o-do-desmatamento/plano-de-a%C3%A7%C3%A3o-para-amaz%C3%B4nia-ppcdam

- QUEIROZ, J.M.; MELLO, A., SERRÃO, M.; GELUDA, L. & SANTOS, A. Brazilian tax policy: proposing a financial mechanism to low carbon practices in São Felix do Xingu. In: International Society for Ecological Economics (ISEE), 2014, Reykjavík, Islândia.

- Secretaria Municipal de Meio Ambiente. projeto Olhos D'Água da Amazônia. Relatório Executivo: 2012/ José Alessandro Rodrigues (organização). Alta Floresta, 2014. 136p.

- Sindicato dos produtores rurais de Paragominas. Pecuária verde: produtividade, legalidade e bem estar na fazenda. Paragominas, 2014.

- WHATELY, Marussia (2013) Programa Municípios Verdes: lições aprendidas e desafios para 2013/2014.Belém, PA: Pará. Governo do Estado. Programa Municípios Verdes. 96p.

- Tersitsch, Marco E. C.; Correa, Juliano; Rajão, Raoni; Börner, Jan. Controle Sintético do efeito do projeto Olhos D´Água da Amazônia sobre o CAR e o desmatamento em Alta Floresta: um estudo de contrafactual. Avaliação de Efetividade: Projeto Olhos D'água da Amazônia. 2016

11. Glossary

- Permanent Preservation Area (APP) – areas required by the Forest Code to protect springs, water bodies and some hills
- Legal Reserve – Proportion of the farm to be kept in forest set by the Forest Code
- Technical Assistance and Rural Extension (ATER)
- National Development Bank (BNDES)
- Rural Environment Registration (CAR)
- Executive Committee of the Cocoa Farming Plan (CEPLAC)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- Difference in differences (DID)
- Brazilian Agricultural Research Corporation (Embrapa)
- Mato Grosso Commerce Federation (FEC/MT)
- Strengths, Weaknesses, Opportunities, and Threats (SWOT)
- Amazon Fund (FA)
- Greenhouse Gases (GHG)
- Brazilian Institute of Environment and Renewable Resources (IBAMA)
- Life Center Institute (ICV)
- National Institute of Colonization and Agrarian Reform (INCRA)
- Unified Environmental License (LAU)
- Synthetic Control Method (SCM)
- Fiscal Module (MF) a land measure, below four of which defines a small farmer. Alta Floresta = 100 ha
- Ministry of the Environment (MMA)
- Normalized Diference Vegetation Index (NDVI)
- Organization for Economic Co-operation and Development (OCDE)
- Sustainable Livestock of the Amazon (PECSA)
- Plan of Action to Prevent and Control Deforestation in the Legal Amazon (PPCDAm)
- Food Acquisition Program (PAA)
- Environmental Regularization Program (PRA)
- National School Feeding Program (PNAE)
- Reducing Emissions from Deforestation and Forest Degradation (REDD+)
- Municipal Secretary of Environment of Alta Floresta (SECMA)
- Far North Loggers' Association / Simenorte
- Demonstration Units (DUs)
- United Nations Framework Convention on Climate Change (UNFCCC)
- Mato Grosso State University (UNEMAT)
- Mato Grosso Federal University (UFMT)

REDD+ Safeguards

Criteria	Guiding questions
1. Actions that are complementing or consistent with the objectives of national forest programs and other relevant international conventions and agréments.	**Has the project been aligned with PPCDAM and state plans for prevention and control of deforestation?** The Plan for the Prevention and Control of Deforestation in the Amazon (PPCDAm) and the Plan for Prevention and Control of Deforestation and Forest Fires in Mato Grosso, as part of their command and control axis, include the execution of CAR to, among other activities, identify areas of legal reserve and permanent preservation and, within their axis of sustainable production, increase the value of the standing forest, through sustainable activities of economic value that enable a forest economy. The Amazon Water Springs project had CAR as one of its main lines of action. In addition, it promoted reforestation activites for Permanent Preservation Areas (APPs), mainly of springs on family farms (below 4 MF). The recovery model was based on the SAFs with native species and others of economic value, in an attempt to create economic alternatives for these farms. Therefore the project was aligned with the policies foreseen in the PPCDAm and in the State Plan. **To which other federal public policies or international agreements has the project demonstrated alignment? In what aspects?** The project showed alignment with the Forest Code (Law 12,651 / 2012), with the National Policy on Climate Change (Law 12,187 / 2009) and the National REDD+ Strategies. The related aspects are mainly the execution of CAR, reforestation and recovery of degraded forests., important points for Forest Code implementation . **Has the project contributed or could it come to contribute directly or indirectly to reducing emissions from deforestation or forest degradation? In what way?** The project is already contributing to the reduction of forest degradation and the increase of the forest carbon stock through the recuperation of native vegetation and pastures and the planting of exotic species in PPAs
2. Transparent and effective national forest governance structures, with a view to national sovereignty and national legislation.	**To what extent has the project promoted the articulation between different actors (public sector, private sector, third sector or local communities)? Have instances of shared governance been used? Which?** The project had worked well with public and private sectors and with the third sector. NGOs, municipal government and the Farmer association had prominent roles in building and implementing the project. The communities became involved in farmer mobilization of , mainly to visit demonstration areas. **To what extent has the project contributed to strengthen public instruments and forest and territorial management processes?** The project's Monitoring and Evaluation Committee functioned as a subcommittee of Alta Floresta's Municipal Environment Council. This avoided competition and overlapping responsibilities between two collegiate bodies, facilitated the formation of the former and the strengthening of the latter. The project provided equipment and training to technicians of the Municipal Department of Environment to work with georeferencing, a fundamental monitoring and land use management tool. In addition, CAR, which is at the center of the project, is an essential tool of any land and forest management system.

Criteria	Guiding questions
3. Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into account relevant international obligations, circumstance and national laws and noting that the UN General Assembly adopted the United Nations Declaration on the Rights of Indigenous Peoples.	**To what extent has the project influenced the constitutional rights associated with the possession and formal destination of land in its area of activity?** The area consists basically of private lands, two conservation units (Cristalino State Park and the Cristalino Private Reserve for the Protection of Natural Heritage - RPPN). There are no indigenous lands and traditional peoples. **To what extent has the project influenced the sustainable use of natural resources in its area of activity?** The Amazon Water Springs project has positively influenced the sustainable use of forest resources as reforestation was carried out in APPs, especially in spring areas. DThe debate with and farme awareness of s the importance of conserving water resources advanced greatly. **If the project had as direct beneficiaries indigenous peoples, traditional communities or family farmers: were their socio-cultural systems and traditional knowledge considered and respected throughout the project?** The project had as its main focus family farmers who, in this region, are mostly from the southern and southeastern regions of Brazil, who arrived in the region through a private colonization project.

Criteria	Guiding questions
4. Full and effective participation of stakeholders, particularly indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of Decision 1/CP 16	**What participatory planning and management tools did the project apply during planning and decision making?** Meetings were held to clarify and prepare proposals in a participatory manner. These participatory planning workshops were carried out within the Committee's framework for monitoring and evaluation of the project. The Council had a follow-up role for the project. **In case of projects with economic purposes: were any benefits arising from the project accessed in a fair, transparent and equitable way by the beneficiaries, avoiding a concentration of resources?** As reported in this report, economic benefits were not measured. However, the project used cost tracking systems transparently. No differences were detected in relation to the topic. The project did not provide unequivocal material benefits to farmers. Persuasion and negotiation was done in such a way that caused farmers to give up areas of their farms for environmental recovery in exchange for seeds, seedlings and fencing.materials Access to these opportunities has been facilitated to all farmers in a transparent manner without concentration of resources. Thus, owners managed to appropriate some SAF products for subsistence and were able to develop beekeeping for sale. **To what extent has the project provided the general public and its beneficiaries with free access and easy understanding of information related to project activities?** The project created a Monitoring and Evaluation Committee that, in a participatory way, defined the expenses and oversaw the acquisition of raw materials and the investments made. In addition, the technicians, hired by project contractors, provided general information and supported the board. The project had an effective communication plan to disseminate its activities, results and impacts to both the rural and urban population . The communication plan was carried out through the radio, TV, internet and newspapers for advertising and direct marketing, event coverage, elaboration of visual identity for the project, booklets, folders, billboards, Olhos D'Água da Amazonia newspaper, events. The project and the municipality gained recognition for the success of the activities carried out. **Has the project set up a good monitoring system for results and impacts? Has the project monitored and systematically disseminated the results and their effects?** The project monitored the expansion of the recovered areas until the time of its completion. The municipal government is still working on this, but at a relatively high cost and, given budget constraints, with limited efficiency. At the time of the evaluation, the Municipal Department of Environment sought resources to set up a monitoring system with drones.

Criteria	Guiding questions
5. Actions consistent with the conservation of natural forests and biological diversity, ensuring that the actions referred to in paragraph 70 Decision 1 / CP 16 are not used for the conversion of natural forests but rather to encourage the protection and conservation of natural forests and their ecosystem services and to improve other social and environmental benefits.	**How did the project contribute to the expansion or consolidation of protected areas?** The project did not work in protected areas. **How did it contribute to the recovery of deforested or degraded areas?** Through the reforestation of 1,200 hectares of degraded APP areas on family farms (<4 MF). All recovery was in APP areas. According to the results obtained by the orbital analysis, this reforestation allowed a 27% increase in forest coverage in the project's areas of activity, with a decrease of 10% in exposed soil areas (see BOX 1 of the Report). **In case of restoration activities and reforestation of areas, did the methods used prioritize native species?** The project promoted a floristic survey to support the choice of species. However, the promotion of SAFs was an integral part of the activities, which demand exotic species in order to increase their productive potential and attractiveness to farmers. Thus, a balance in the use of native and exotic species was attempted in an experimental fashion. As reported by the project, about 60% of the species used were native. **To what extent has the project helped to establish recovery models with an emphasis on economic use?** The methodology used for reforestation, through the SAFs, was muvuca (mix of seeds planted in lines), with forest enrichment by seedlings from the second year. There is still no economic return from the use of these areas except for the occasional sale of honey by a few farmers. However, e interviews indicated farmers do not have high expectations of obtaining return, but nevertheless demonstrate satisfaction with the environmental results of the recovery of springs.

Criteria	Guiding questions
6. Actions to address the risks of reversals in REDD + results.	**What factors constitute risks to the permanence of REDD + results? How did the project address them?** The Amazon Water Springs project sought to value forest recovery of degraded areas and APPs, using SAFs, with economic and environmental potential. The risks verified for permanence of the results were: the project started before the new forest code (2010), so an average of 30-50 meters were recovered from the banks of the creeks and springs. The new Code requires only 5 meters for small farms (up to 1 MF). As most of the areas recovered belong to farmers with up to 1 MF, there is the possibility that some farmers might deforest part of the recovered areas. Nevertheless, during the interviews, the farmers showed interest in maintaining the areas, both for the environmental benefits and that new deforestation would entail costs (removal of the fence, cleaning of the area and replacement of the fence) with low return. A second risk is the entry of grains (soybeans) in the region, which increases the pressure to convert land use, the possibility of land concentration and the increased large scale use of herbicides and pesticides . Introduction of fish farming projects that have used APPs areas to build tanks, which leads to the conversion of land use in degraded areas where there should be reforestation.
7. Actions to reduce the shift of carbon emissions to other áreas.	**Has there been a shift in emissions avoided by project actions to other areas?** The project contributed towards maintaining small farmers in the municipality. Alta Floresta is located in the so-called Amazon deforestation arc and is one of the regions in which there is great pressure to expand livestock and grain farming activities (IBGE, soy expansion data in the region). This leads to the migration of mining, cattle farming and logging to the north, mainly to the municipality of Apiacás and to the states of Pará and Amazonas. This dynamic is associated with changes in soil use in this region of Mato Grosso, which has expanded the soybean chain due to the asphalting of BR 163 and the area where three hydroelectric plants are being built.

12. Annexes II. Report of the results obtained in the analyzing the state of forest recovery.

Report of the results obtained in the analyzing the state of forest recovery.

Author: Flavio Augusto Altieri dos Santos

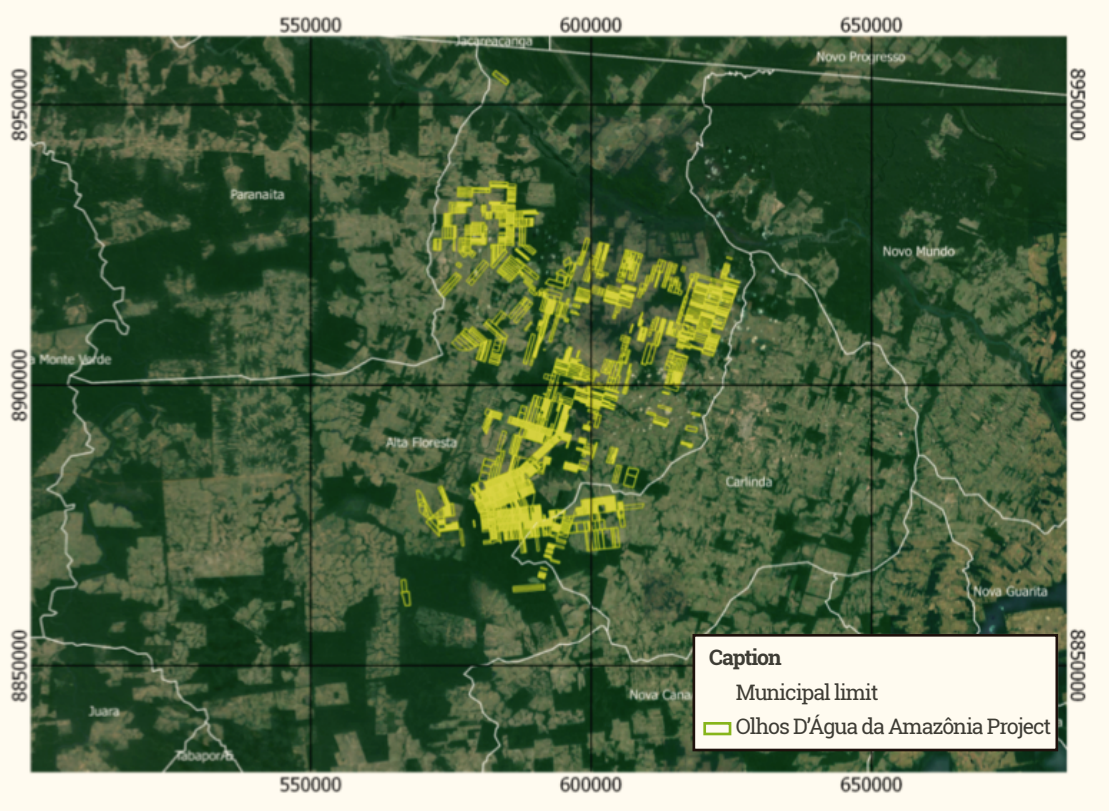
Objective

To identify and evaluate the process of vegetal recomposition within the permanent preservation areas contained in farmsAmazon Water Springs project farms, in the Amazon.

Study areas

The study area comprises the farms of the Amazon Water Springs project in the Amazon, located in the state of Mato Grosso (Figure 1), which has as its characteristic vegetation the transition from forest to cerrado.

Figure 1. Geographic location of the properties of the Olhos D'Água project in the Amazon.



Materials and Method

For the development of this study, a cartographic database in digital format was used, made up of vectorial cartographic data encompassing geographical boundaries of the 2,117 farms included in the Amazon Water Springs project in the Amazon, with 1,217 belonging to Phase I of implantation and 760 to Phase II (Figure 2-a). Hydrographic data corresponding to each of the farms of the Amazon Water Springs project in the Amazon (Figure 2-b) were also used.

Analysis of the vegetation recovery process behaviors of each property area was performed based on the images generated by the RapidEye Satellite System, a total of 26 scenes for the two dates (2011 and 2015, Figure 3). The images were selected so as to allow the analysis of variation change over time in these areas, to identify the analysis of variations in soil and vegetation features in the images of 2011, before the project, and 2015, post-execution of recovery activities of APP vegetation areas.

Figure 2. Database of property boundaries of the Amazon Water Eye Project (Phase I in yellow and Phase II in blue)

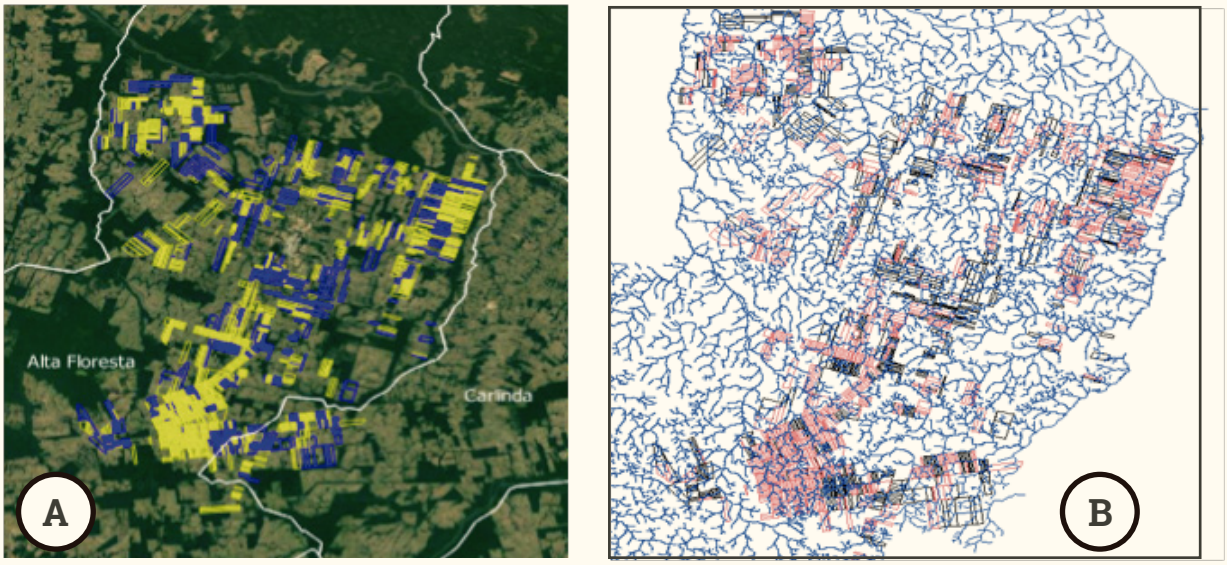
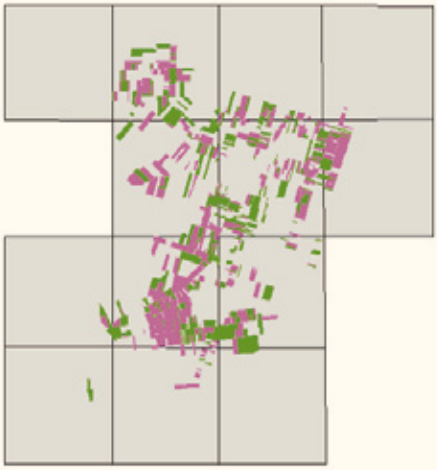


Figure 3. Distribution of scenes from RapidEye images used in the analysis of the Amazon's Water Springs project in the Amazon.



RapidEye is a system composed of five remote sensing satellites, all located in the same orbit. Its range of image collection is 77 km wide and 1,500 km long (RapidEye, 2012). Table 1 presents the main characteristics of the satellite and its sensors, as well as its spatial and spectral resolutions.

Characteristic	Information
Number of Sattelites	5
Orbit	Heliosynchronous with 630 km of altitude
Equator crossing	+/- 11:00h local time
Type of sensor	Multispectral pushbroom imager
Spectral bands	Blue, Green, Red, Red-Edge, Near-infrared
Pixel Spacing	6,5 in nadir
Pixel size (orthorectified)	5,0 m
Image Size	Approximately 77km wide with length between 50 and 300 km, 462 Mbytes/25 km along the orbit for 5 bands
Satellite life span	7 years
Revisiting time	Daily out of nadir / 5,5 days (in nadir)
Horizontal Datum	WGS84
Quantization bits	12 bits

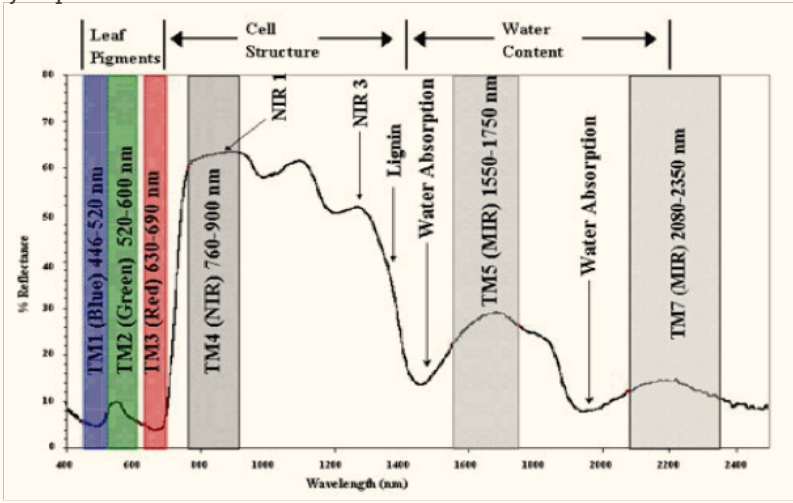
Source. Adapted from RapidEye

The 2011 images , due to displacement problems in relation to farms limits ations and rivers, as well as to the 2015 images , were adjusted using georeferencing techniques executed in ARCGIS 10.3 software, applying a model of linear polynomial correction with ten control points and adjusted to Universal Transverse Mercator Projection System (UTM) and WGS84 ellipsoid reference system. The control points were obtained in the 2015 RapidEye orthorectified images.

Due to the reduced dimensions of the areas of recovered farms to be analyzed in relation to the spatial resolution conditions of the RapidEye image, hindering a visual interpretation of the changes occurring during the period between 2011 and 2015, the images were processed to generate the Normalized Difference Vegetation Index (NDVI). Due to the high energy absorption of the plants being recorded in the red spectrum range (Red), while the near-infrared band (NIR) recorded the behavior of the plant cell structure (Figure 4), the NDVI is used for environmental context analysis involving vegetation. The NDVI has values that range from -1 to 1, values closer to 1 identifying vigorous vegetation area and values of zero and below being related to water. The vegetation variations of NDVI above zero to approximately 0.5, are precisely the vegetation with less The determination of NDVI is obtained by the following equation:

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

Figure 4. RapidEye Spectral Bands

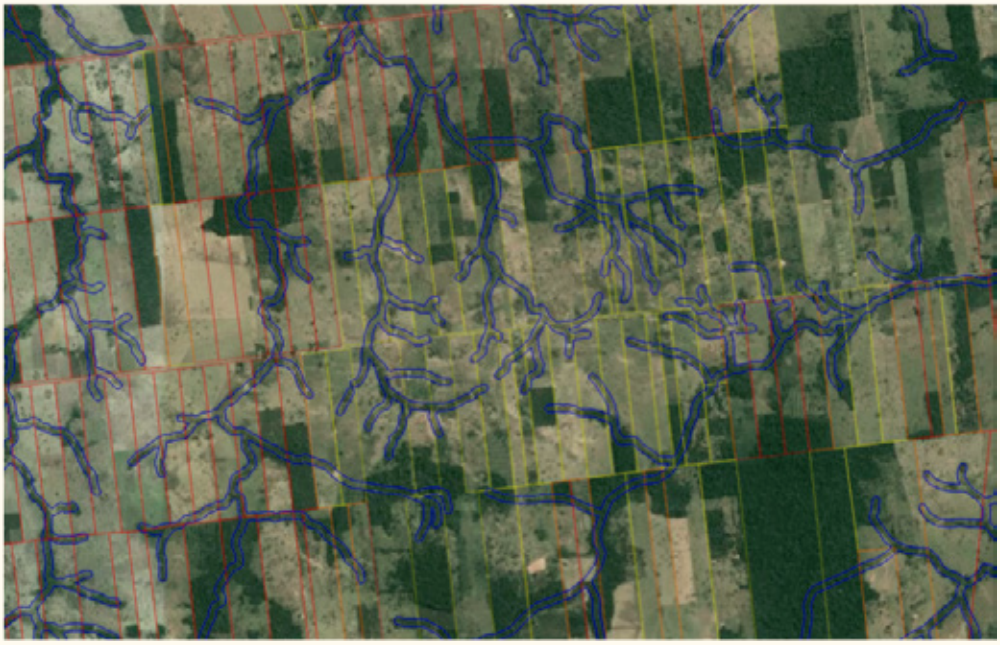


!

The matrix (image) and vector data processing were all performed in an ARCGIS geodatabase database structure, where they were systematized for a single projection system, the UTM, and WGS84 reference ellipsoid. The NDVI images were sliced into classes and evaluated individually to identify those that best corresponded to soil and vegetation classes.

The determination of the permanent preservation areas (APPs) destined for vegetation recovery in each property of the Olho D'água project in the Amazon was obtained from the surrounding lines (buffer) generated at a standard distance of the same 30m from the hydrographs (Figure 5)

Figure 5. Delimitation of the analyzed areas of each property based on the 30 m buffer.



For APP areas of the Amazon Water Springs project, three classes were identified. The first, called Soil, correspond to an area with nonexistence of any type of shrub or taller species, and which presents soil exposure as a main characteristic. The second class, called Veg-1, which most likely presents an area with characteristics of a vegetal recomposition resulting from the artificial introduction of plant species or from a naturally occurring recomposition from its abandonment and introduction of species by means of bird or wind. The third and last class, Veg-2, is related to older vegetation types, which already existed in the APP area in the base year of the analysis, 2011, and which may also have undergone enrichment from the planting of new native species in the area.

The evaluation of the reforested areas recovery process was carried out based on the comparison between the increase or decrease of the soil and vegetation classes exclusively, using as a starting point the difference between results found in the year 2011 and 2015 according to the equations below:

Variation Soil = Soil2015 - Soil2011
Variation Vegetation = Vegetation2015 - Vegetation2011

For positive values of ***Variation Soil***, it can be affirmed that there has probably been a reduction in the existing vegetation along the analysed period, if the value of the ***Variation Soil*** is negative, the interpretation is that there has probably been a recovery of vegetation.

The ***Variation Vegetation*** works as a confirmation of the ***Variation Soil***, that is, if the result is positive, it implies a probable vegetation recovery, being negative, it can be affirmed that a probable suppression of vegetation occurred in the analyzed period. The entire analysis was performed by property and then consolidated to get an overall value of the project as a whole.

Result

The results obtained from NDVI image analysis for the APP areas corresponding to each property of this project (Figure 6), are systematized by their implementation phase and fully presented in Appendix 1 (Phase I), Appendix 2 (Phase II) and summarized in table 2. In total, 1,695 farms of the 1,977 in the database were analyzed, in which 1,004 refer to Phase I and 691 to Phase II. The others did not present water bodies within the limits of the farms.

Based on this data, considering the 1,004 farms analyzed in Phase I, it was verified that an increase of vegetated area (Veg-1) probably occurred. In absolute numbers this increment was of approximately 216,20 ha, about 30.6%. This can also be validated based on the results found for the Soil class, which presented a probable reduction of approximately 125.84 ha (10.71%). In relation to the Veg-2 class, an increase of 515.33 (25.95%) was also observed. This significant increase in Veg-2 may have occurred considering that in the NDVI images of 2011, this already existing vegetation probably had its vegetative vigor compromised due to several factors. Among them, for example, is hydric stress, which due to the passage of time and the fact that the area remained at rest, without productive activity, may have regained their previous condition. Another issue that may have contributed to this increase in the Veg-2 class is the fact that these areas may have undergone a process of enrichment with native plant species, thereby increasing their vegetative vigor and thereby increasing NDVI values In the year 2015.

Figure 6. Sample of NDVI classification for the Amazon's Water Springs project's properties.

In relation to the analysis of the 620 farms belonging to Phase II of the project, a probable increase of vegetation area (Veg-1), of approximately 48.83 ha (7.61%), and a probable reduction of the exposed soil area of approximately 50,590 ha (5.48%) were also observed. As for the Veg-2 class, the analysis shows an increase of only 14.42 ha (0.81%).

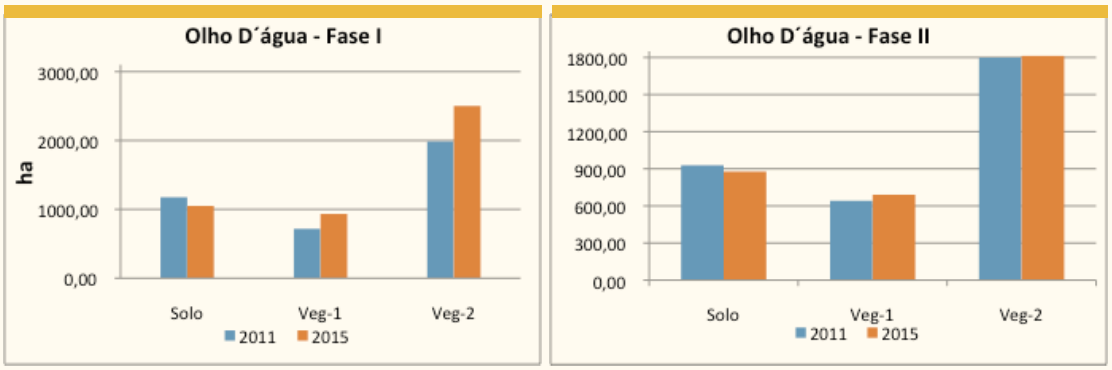
The numbers of probable recovering vegetation areas is greater in the analysis of Phase I farms than in Phase II of the project. This may be justified by the number of farms analyzed in the first phase (1,004), which is almost twice as large as the second (620), as well as the time of its implementation. The sum of all areas of the farms per phase was 46,737.39 ha (Phase I) and 32,262.36 ha (Phase II).

Based on the sum of all areas of the farms, a positive variation of vegetation in the areas to be recovered by the Amazon Water Springs project was noted, as well as observed in the graphs of figure 5. In the evaluation by implementation phase, among the 1,004 of Phase I, 1,096 (94.73%) presented some type of positive increase. Among the 620 in Phase II, 616 (99.35%) presented increased values in vegetation. These increases observed in the two phases of the project may be due to practices of recomposition of exposed soil or of enrichment of the existing vegetation. The sum of the orbit results of both Phase I and II between 2011 and 2015, presented in table 2, shows that, in general, there has probably been a recovery of approximately 794.89 ha in the 1,977 farms evaluated.

Tabele 2. Summary of the exposed soil and vegetation areas evolution in the period of 2011 (base year) and 2015

Nº de Propried	Área Total	2011 analysis (ha)			2015 analysis (ha)			Period analysis (ha)		
		Solo	Veg-1	Veg-2	Solo	Veg-1	Veg-2	Solo	Veg-1	Veg-2
Phase I I-1157	46737.39	1175.42	716.84	1985.94	1049.58	933.04	2501.28	-125.84	216.2	515.33
Phase II II-620	38262.36	928.12	641.46	1797.69	877.23	690.29	1812.21	-50.89	48.83	14.52
								Sub-Total	265.03	529.77
								General Total	**794.89**	

Figure 7. Graph demonstrating the variations recorded in the Amazon Water Springs Project (Phase I and II) in the period from 2011 to 2015.



12. Annexes II. Report of the results obtained in the analyzing the state of forest recovery.

Conclusion of data and methods

The method used was chosen based on the available data, the time planned for study and the absence of field activities to check the results obtained.

In relation to the data, we observed that the main problem is restricted to the satellite image available for analysis, with a resolution of 5 meters, making it impossible to make a greater distinction between the elements investigated, such as vegetation, soil and water. This would be possible through an image of better spatial resolution, as of those generated by GeoEye satellites with a spatial resolution of 43 cm. Regardless of the image of a satellite´s optical sensor, it is impossible to measure vegetation development considering technical aspects related to its growth, such as stem height and diameter.

In relation to the results obtained for the Olho D'água da Amazônia project, the absolute values could be increased for all classes, had distance values of 50m been adopted in the methodology to determine APP areas instead of the 30 m used in the determination of the buffer areas.

In regards to flooded areas (lakes and tanks), the method even allows them to be detected, depending on their size and condition at the moment the satellite image is obtained. In situations where they do not have sufficient size and are also very close to higher vegetation, their identification is compromised, due to the RapidEye resolution. In other words, the better the resolution of the sensor, the easier the identification and mapping of minor targets becomes.

On results

In general, the results obtained should be evaluated not only by the values obtained, but mainly by indications that a regeneration process is actually taking place in these areas.
Another important issue to consider is related to the time elapsed between the base year (effective start of the project in 2010) and the year of comparative analysis (2015). It is certainly not such a long period to observe significant changes in a process of reforestation, mainly from the point of view of a satellite image analysis, since it is known through literature that at least 30 years are necessary for the altered area to have its forest recomposed almost to its natural condition.

Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

Authors: Marco Elías Cisneros Tersitsch
Juliano Correa
Raoni Rajão
Jan Börner

Introduction

After decades of large forest loss in the Brazilian Amazon, in the mid-2000s the annual deforestation rate fell by 80% in the region. Large-scale patterns of deforestation have been reduced and the country is now seeking ways to deal with deforestation attributed to small and medium-sized land farms. The Amazon Water Springs project is part of this new strategy, complementing with local intervention measures public policies to combat deforestation adopted since 2004. Between 2011 and 2013, the Amazon Fund project provided financial resources to the municipal government of Alta Floresta, in the north of Mato Grosso, in the amount of R$ 2,781,340.40, in order to support municipal environmental management. For this reason, the project financed an environmental asessment, promoted farm registration with the Rural Environmental Registry (CAR), promoted activities to restore permanent preservation areas and offered support to sustainable production activities and agroforestry systems.

The present study aims to analyze the effect of the Amazon Water Springs project on the growth of CAR registries and on the reduction of deforestation in Alta Floresta. In order to verify this impact, it is necessary to separate the global effects of record growth in CAR and of the reduction of deforestation from the effects which result from this specific project. For this we use the synthetic control methodology. It was not possible to evaluate other areas where the project acted because of the lack of comparable data from other municipalities. The results suggest that an additional 13.6% of these registrations were registered due to the project in the area eligible for CAR in Alta Floresta between 2011 and 2012 compared to a counterfactual scenario. The positive impact of the intervention, supported by a series of statistical tests, can be interpreted as causal in relation to the increase of CAR registrations . However, the study of the project effect the decrease in deforestation does not find sufficient satisfactory relation to infer a causal relation. At the same time it was not possible to verify a reduction in the rate of municipal deforestation in relation to a counterfactual scenario. Therefore, possible impacts on the reduction of deforestation could not be evaluated. The next chapter presents the social, economic and environmental context' in which the project was implemented. Chapter 3 presents the methodology used for the evaluation. Chapter 4 explains data sources and processing. The results are presented in Chapter 5 and discussed in Chapter 6.

Alta Floresta and deforestation reduction policies

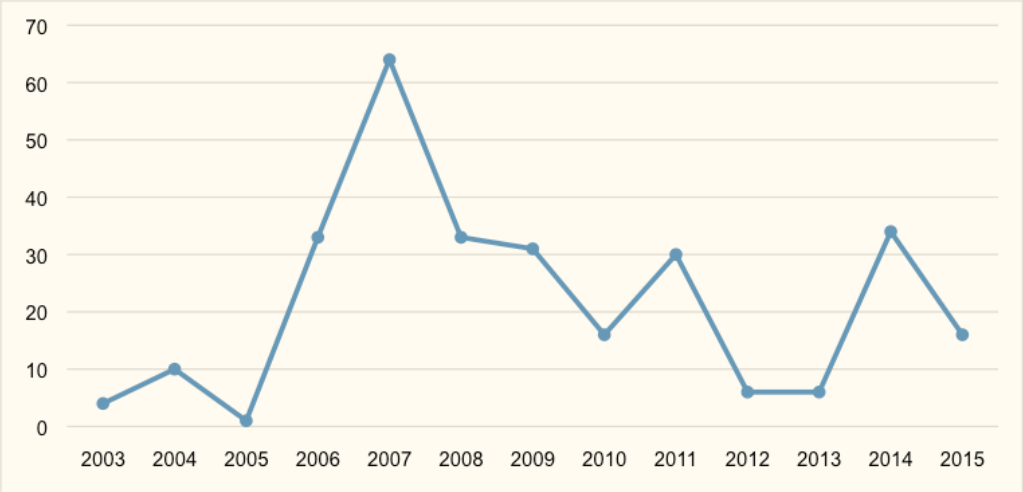
Alta Floresta was created in 1980 from a private colonization project instituted four years earlier. In these little more than three decades its economy consisted of agriculture, livestock and mineral and vegetable extraction: economic factors historically linked as the main drivers of deforestation in the municipality. The region underwent an accelerated process of deforestation, reaching a 42% loss of forested area in 2000. Even with the slowdown of forest loss in recent years, the municipality had lost 55% of its primary forests by 2015 [18].

The process of deforestation experienced by Alta Floresta followed the general trend observed in the largest number of the most deforested Amazon municipalities of the. According to Margulis (2004), the deforestation process and the expansion of livestock production in the region only makes economic sense if we consider the low cost of

land, the favorable conditions for cattle production with few raw materials and labor, with abundant rainfall, adequate air temperature and humidity and various types of pasture available. The study also suggests that most of the deforestation occurs in medium and small farms, financial viability being the main motivating factor seeing that it guaranteed that one can sell deforested land already prepared for livestock for a far higher price at a future date, covering the opportunity costs . In the specific case of Alta Floresta, the study found, with interviews and panels with local farmers, that in 2004 the price of land with forest of a property about 40 km distant from urban centers was R$ 250 per hectare, while the hectare of deforested land was almost 5 times more valued, R$ 1,200 per hectare. On the other hand, the return on cattle production per hectare in Alta Floresta was only R$ 138.91 per year with an average yield of 1.18 animals per hectare. In this context, the expansion of the cattle herd occurs as a means of consolidating the deforested areas, even with low profitability from livestock [23].

Since 2003, technological and organizational changes that have enabled the emergence of new practices to control deforestation in the Amazon [4, 7, 9, 22, 19, 24] within the federal government . In order to meet the demand of IBAMA inspectors (Brazilian Institute of the Environment and Renewable Natural Resources) that requested deforestation data more frequently, INPE (National Institute of Space Research) developed the Real Time Deforestation Detection System (DETER). From these new technologies and a substantial increase in IBAMA's number of inspectors, the number of operations and infraction notices (AI) for illegal deforestation issued by IBAMA significantly increased in the Legal Amazon. In 2004, there were only 26 joint operations that counted on 549 IBAMA, Army, Military, Federal and Highway Police agents. In 2007, however, there were 134 operations were, involving 3,102 agents [28]. Studies point to the role of the command and control activities carried out by IBAMA in the significant reduction in deforestation observed between 2008 and 2015. For example, Arima et al. (2014) and Assunção et al. (2014) estimated that the performance of IBAMA inspectors reduced Amazon deforestation between 3.5 and 11 thousand km2. Among the studies that demonstrate the effectiveness of IBAMA's activities, the Hargrave and Kis-Katos (2013) analysis was adapted to the biome level, from which it was estimated that a 1% increase in the number of infraction notices leads to a 0.2% reduction in deforestation at the municipality level. In the specific case of Alta Floresta (see Figure 1), there was a leap in the number of infraction notices starting from less than 10 by 2005 and reaching over 60 in 2007 [25,26,27,28].

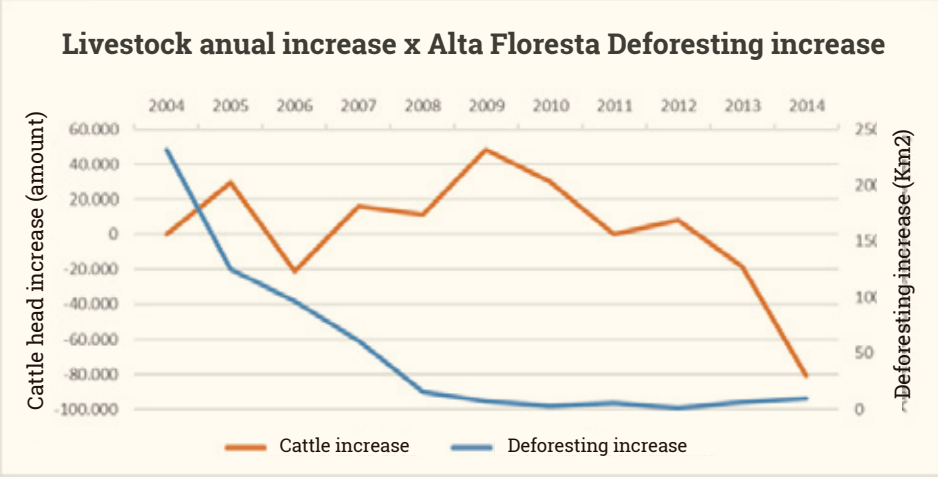
Figure 1. Number of infraction notices (AI) issued by IBAMA in the municipality of Alta Floresta (SICAFI / IBAMA)



Another important measure that seems to have contributed to the decrease in deforestation in Alta Floresta was the creation of the so-called deforestation "blacklist" [9]. In 2008, the Ministry of the Environment issued a decree [17] with criteria for a list of priority municipalities for activities to prevent and control deforestation in the Amazon Biome. This "blacklist", with 36 municipalities, brought together municipalities that accounted for more than 50% of deforestation and the largest deforested areas in the last 3 years. In addition to damaging the reputation of businesses in these areas, the blacklist also restricts credit and bank financing, selling products, selling land and even transferring farms by inheritance. When the blacklist was established, Alta Floresta had already substantially reduced its rate of deforestation from levels of over 100 km2 to below 15 km2. However, in order to be removed from the list, not only was necessary it to continue to reduce deforestation but also to carry out the rural environmental register (CAR) of 80% of the eligible areas. The Rural Environmental Registry (CAR) is a georeferenced cadastre that serves as a basis for environmental control, forest restoration monitoring, and the implementation of sustainable agroforestry systems. In Mato Grosso, CAR emerged as a simplified and declaratory version of the Rural Property Licensing System (SLAPR) that was created in 1999 by the State Environment Foundation (FEMA). One of the main initial challenges for the implementation of CAR are the high costs of registering the property. When carried out individually by geoprocessing professionals, according to a professional from an office in the city, it costs R$5,000 for a medium sized property.

In response to these challenges, Alta Floresta sought in 2008 the support of the Amazon Fund to carry ouy the Amazon Water Springs project. This project stands out as one of the pioneering initiatives funded by the Amazon Fund through public-private partnerships to complement Brazil's efforts to conserve forests and combat deforestation. This makes the project an ideal case study to assess the effects of public-private initiatives and to gain insight into the design of conservation projects in areas of tropical agriculture. This analysis thus focuses on two measurable variables of results: annual deforestation rates and annual CAR registries. Because the Amazon Water Springs project started a few years ago, this evaluation is limitedto capturing only its initial effects. The long-term effects and adaptation to the new agricultural practices can not be captured in this analysis. Deforestation measures are only available up to 2015, five years after the treatment. In addition, geographic data from CAR registries by municipality are not publicly available and private databases are limited until 2012, excluding the last year of the project.

Figure 2. Rate of deforestation and annual growth of livestock in Alta Floresta (INPE and IBGE)



After four years on the black list, Alta Floresta was able to meet the criteria established by the Ministry of the Environment in 2012. In addition, it is possible to notice that there was an annual increase in cattle herd between 2007 and 2012, even with the maintenance of low levels of deforestation (Figure 2). In 2004 the municipality had 723,871 head of cattle and reached its peak in 2012 with 846,769 head [13]. This suggests that there was a decoupling between this economic activity and the conversion of native forest in the region. In the next session we will evaluate the role of the project in this result, focusing on the reduction of deforestation and CAR registration process carried out in the municipality.

Methodology – Synthetic Control

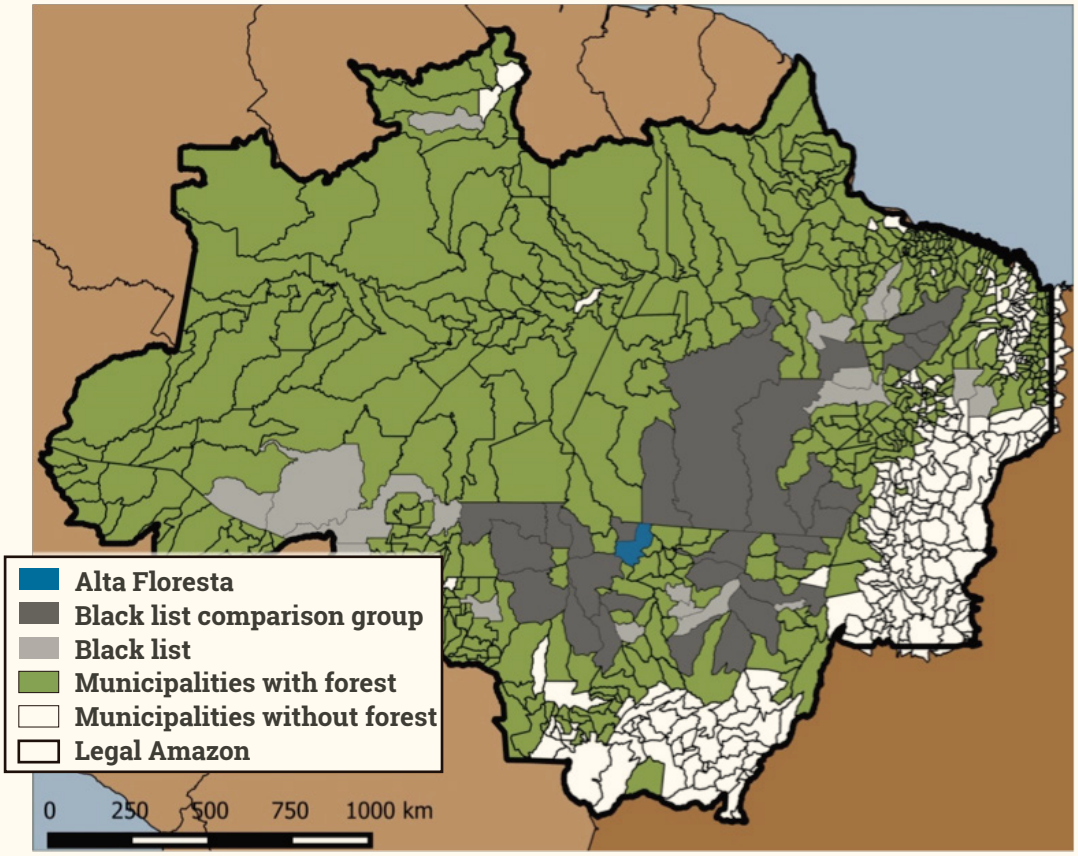
Near-experimental methods have been used with increased frequency to evaluate environmental conservation policies and projects [3, 5, 8, 10, 19, 22]. These methods rely on large sampling in many units treated to assess a causal relationship between results and interventions. Since the Amazon Water Springs project was implemented in only one municipality, it is not possible to evaluate its effects using experimental methods. In these cases, many researchers adopt case study methodologies and panel studies that compare the results of areas that have undergone intervention with other areas often selected without objective criteria. In order to go beyond the limitations of panel and case studies, Abadie and Gardeazabal (2003) present the Synthetic Control Method (SCM). SCM is a generalization of the Differences in Differences (DID) method, applied to cases where only one or a few units are treated [2]. But instead of a subjective selection of untreated units, SCM uses a data-driven approach to find the control group. For that, the Synthetic Control Method analyzes the trajectory of the analyzed units before the beginning of the intervention to find a control group that resembles the behavior of the treated unit as if it had not been treated [2, 1].

The Amazon Water Springs project was implemented between 2011 and 2013 in Alta Floresta, Mato Grosso (see Figure 3). In 2008 the municipality was included among the 36 of the MMA deforestation blacklist, exposing it to a series of restrictions and federal environmental conservation interventions [3,9]. To separate the effects of the insertion of the municipality in the black list from the effects of the Amazon Water Springs project, in a first round Alta Floresta was compared with the other districts included in the black list of deforestation. As at the time of the intervention only the states of Mato Grosso and Pará had the Rural Environmental Registry in operation, in addition, the sample was restricted to the municipalities belonging to these two states totaling 31 participating municipalities.

From the data provided by the set of participants (31 black list municipalities of Mato Grosso and Pará), the SCM constructs a synthetic control unit which is the weighted average of the untreated municipalities. The analysis can be described in four steps:

1) construction of a control unit similar to that of the treated unit;
2) evaluating the quality of the synthetic control;
3) estimating the effect of the impact after the start of treatment;
4) testing the robustness of the results.

Figure 3. Alta Floresta and the municipalities of MMA's critical deforestation list



The synthetic control of Alta Floresta has the purpose of having similar characteristics to those of before the application of the treatment in this municipality. Thus, the mean results (Y) and other covariates before the intervention are evaluated. The synthetic control is constructed from a linear combination of all control units of the set of participants. For example, the synthetic control is a unit built to be a percentage A of municipality 1, a percentage B of municipality 2, etc. Ideally, the goal is to find a linear combination that results in perfect equality with the characteristics of the unit treated before the start of the treatment. However, since this is unlikely, the method minimizes the distance between the values of the covariates of the synthetic control and the treated unit. To avoid excessive influence, each covariant is weighted according to the predictive weight of its result. Covariates with no importance for the prediction of pre-intervention results receive smaller weights, while important covariates receive larger weights. As a result, the synthetic control resembles the trajectory of the outcome of the treated unit due to its similarity to the predictive covariates. Abadie et al. (2010) show that due to similarity in the pre-treatment trends the SCM is a generalization of the Differences-in-Differences method and can be used to find an average treatment effect in the treated unit [1].

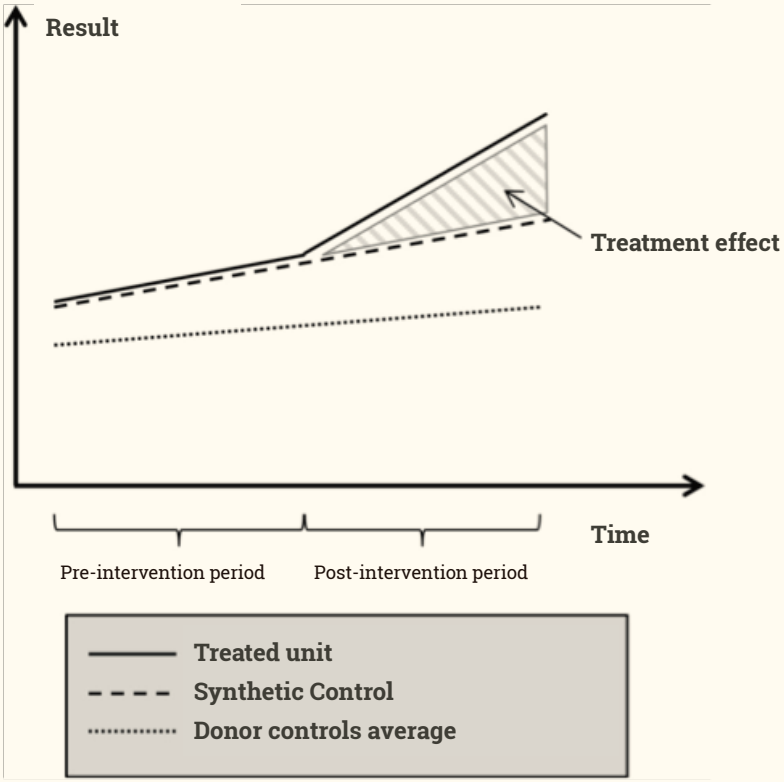
In a second step, the quality of the synthetic control unit is evaluated by the proximity of the values of its result with the actual treated results. The measurement used is the mean square prediction error (MSPE):

$$(Y1 - Y0W^*)'(Y1 - Y0W^*)$$

Where is the vector of the results of the unit treated in the preintervention period, is the results matrix of all controls in the preintervention period, and is the ideal weight vector given by the simple weight of each control unit of the group of participants. The evaluation of the quality of the adjustment is a good subjective extension and will focus on the years before the intervention, but after the blacklist policy (2008-2010). If a good synthetic control is found, then the impact of the effect is calculated as the absolute difference between the treated unit and the synthetic unit. Figure 4 describes SCM as a measure of treatment effect. After the similarity production, in the pre-intervention tendencies, any difference between the synthetic result and the treated one can be interpreted as casual. The sum of differences after treatment initiation is then defined as treatment effect.

Figure 4. The Synthetic Control Method

Note: the figure is adapted from Feil e Feld (2016) [20]



The estimate of the treatment effect described in the previous step may contain a level of substantial uncertainty. Synthetic control is a linear combination of the observed controls, and therefore is the result of an interpolation process and for that reason the measured effect may not indicate a causal relationship. That is why Abadie et al. (2010) recommends including in the SCM studies a permutation test in order to test the statistical significance of the measured effect [1]. In particular, the permutation tests seek to test for each of the municipalities, that are part of the control group, the existence of some "placebo" effect hypothesizing the presence of the intervention. If the actual effect stands out over the placebo effect, it can be concluded that a causal relationship was measured. In addition to performing this test for the 30 municipalities of the control group, statistical inference was performed on the synthetic control by means of the bootstrap methodology in order to calculate the standard errors of the estimates [21].

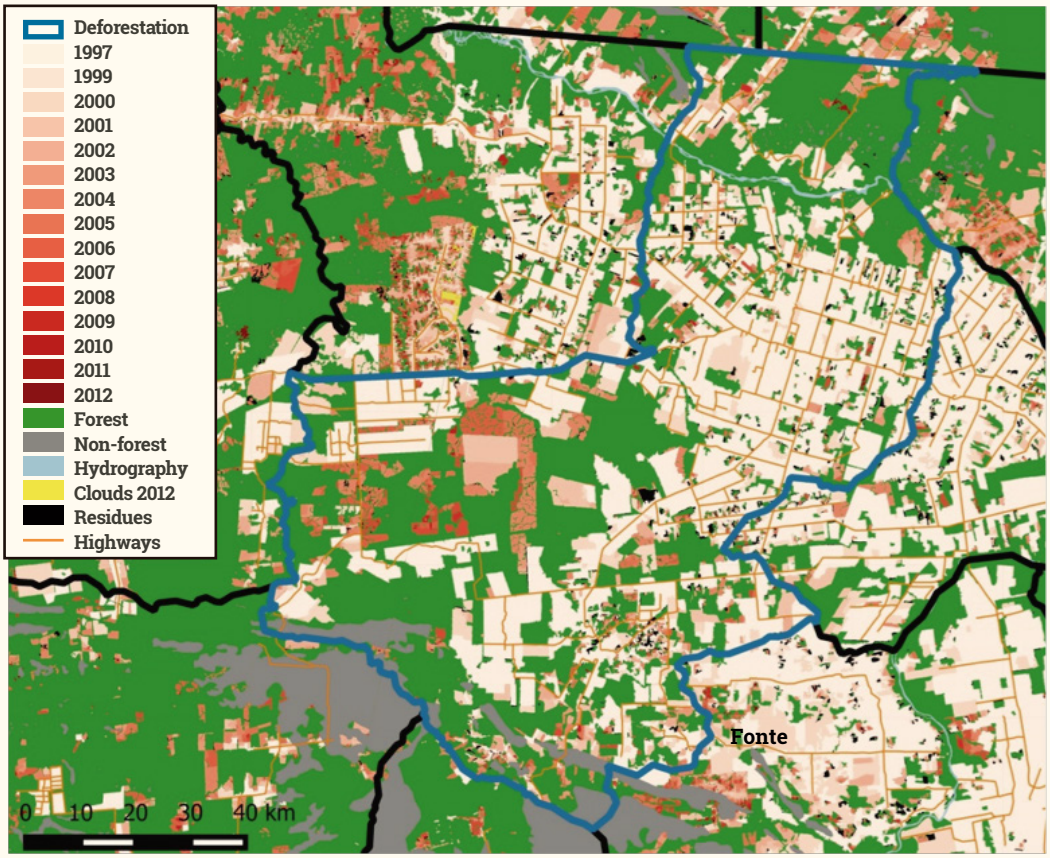
Data

The period of this analysis includes data from the municipalities of the Amazon from 2002 to 2014. The CAR registry data were obtained from the secretaries of environment of the states in collaboration with the Institute of Environmental Research of the Amazon (IPAM), and only considered data by CAR until 2012. The CAR registries were measured as areas covered by spatial polygons, and, in this manner, the proportion of area recorded in CAR was calculated in relation to the area of the eligible municipalities (see Figure 5). The eligible area was defined as the area of municipalities excluding protected areas (protected areas for sustainable use and full protection) and indigenous territories. The resulting variable is defined as the annual percentage increase in CAR coverage in municipalities. This percentage measurement is consistently below official statistics due to two technical factors: First, the baseline was constructed based on conservation units established prior to 2003. Secondly, farm polygons in CAR database often overlap or are recorded more than once. The PostgreSQL database with a PostGIS spatial extension was used to account for the registered areas only.

Figure 5. CAR Registries in Alta Floresta in 2012

Forest cover data and annual deforestation rates were obtained through the INPE PRODES system [18] (See Figure 6). Considered in this study were prediction covariates that include characteristics of public policies such as quantity of farms with CAR registries and forest cover, which encompass characteristics of environmental policies, socioeconomic characteristics, technologies and agricultural characteristics. A complete list of covariates and their data sources are presented in Table 1

Figuref 6. Desmatamento em Alta Floresta



12. Annexes III. Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

Varable	Year	Source
Inclusion and exit of the deforestation black list	2008-2012	Decree 6.321/2007 e Order 28/2008, Order 102, 203/2009, Order 66,67,68/2010, Order 138, 139, 175/2011, Order 187,322,323,324/2012 [17]
Deforestation	2002-2012	INPE-PRODES [18]
Forest Coverage	2002	INPE-PRODES [18]
Savanna Coverage	2002	INPE-PRODES [18]
Hydrography coverage	2002	INPE-PRODES [18]
Average cloud coverage	2008-2010	INPE-PRODES [18]
List of municipalities and borders	2007	IBGE
Protection areas	2002-2012	IBAMA [11]
Indigenous areas	2002-2012	IBAMA [11]
Rural Credit	2002-2012	BCB [6]
GDP (1 year lag)	2002-2011	IBGE [16]
IPCA (Official Inflation Index)	2002-2012	IBGE [15]
Field inspections (1 year lag)	2001-2012	IBAMA [12]
Density of properties (per km2)	2006	IBGE Censo Agrícola [13]
Involvement of small properties	2006	IBGE Censo Agrícola [13]
Participation of landowners	2006	IBGE Censo Agrícola [13]
Number of tractors per farm	2006	IBGE Censo Agrícola [13]
Cattle stock rate	2006	IBGE Censo Agrícola [13]
Population density	2007	IBGE Censo Demográfico [14]
Distance to Brasilia (Estimated)		Own calculation
Land properties registered in the Rural Environmental Registry (CAR)	2002-2012	Database provided by the Institute of Environmental Research of the Amazon (IPAM) in October 2013

Source. Source of Data

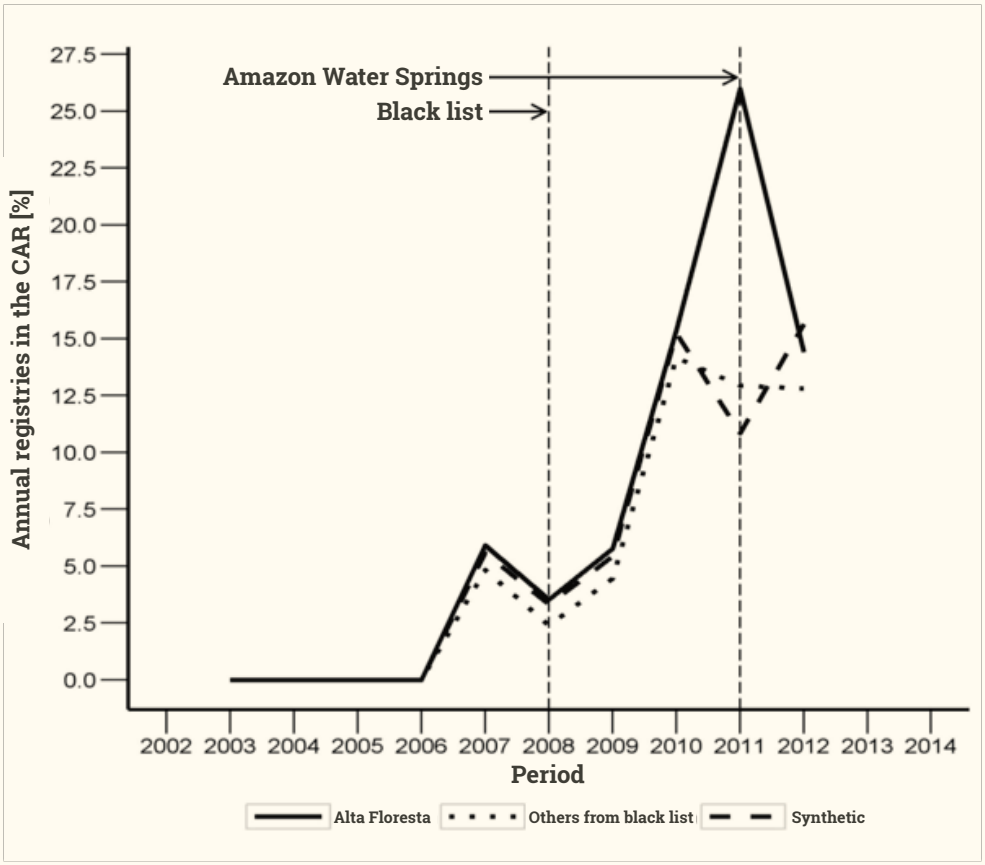
Results

One of the main objectives of the Amazon Water Springs Project was to provide rural assistance and subsidize the registration of small farms in the Rural Environmental Registry (CAR). An increase in georeferenced records can facilitate the monitoring and enforcement of deforestation law regarding private property. However, this study also evaluates possible initial impacts on deforestation dynamics as a function of the Amazon Water Springs project.

Registration in the Rural Cadastre

Figure 7 depicts the history of CAR registries over time for Alta Floresta, for the set of participants in the control group, and for the synthetic control of Alta Floresta. Annual CAR records are null until the year 2006, when the previous system, SLAPR (rural property licensing system) began to receive records that would later be transformed into CAR. Then, with the implementation of the Mato Grosso Legal program and the creation of the State Rural Environmental Registry in 2008 as a first step in the regularization process, the number of registrations began to increase (Complementary Law No. 343/2008). On average, registrations increased until 2012, the last available year. The farms registered in Alta Floresta during the years of 2008 and 2009 represented an annual increase of around 5% of the area of the municipality registered with CAR. In 2010, this scenario tripled, when new registrations with CAR reached a rate of 15% and in 2011 the new registrations already indicated an increase of about 25% of the area of the municipality registered with CAR. The rate of registrations fell the following year, indicating a possible saturation of the effect related to the registration of the small farms that are the project's target. By the end of 2012 a total of 69% of the area of the municipality was registered with CAR, but it is likely that this number continued to increase in the following years, since in August 2016 the state of Mato Grosso reached 92% of the registered area [29].

Figure 7. New CAR registrations anual growth



12. Annexes III. Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

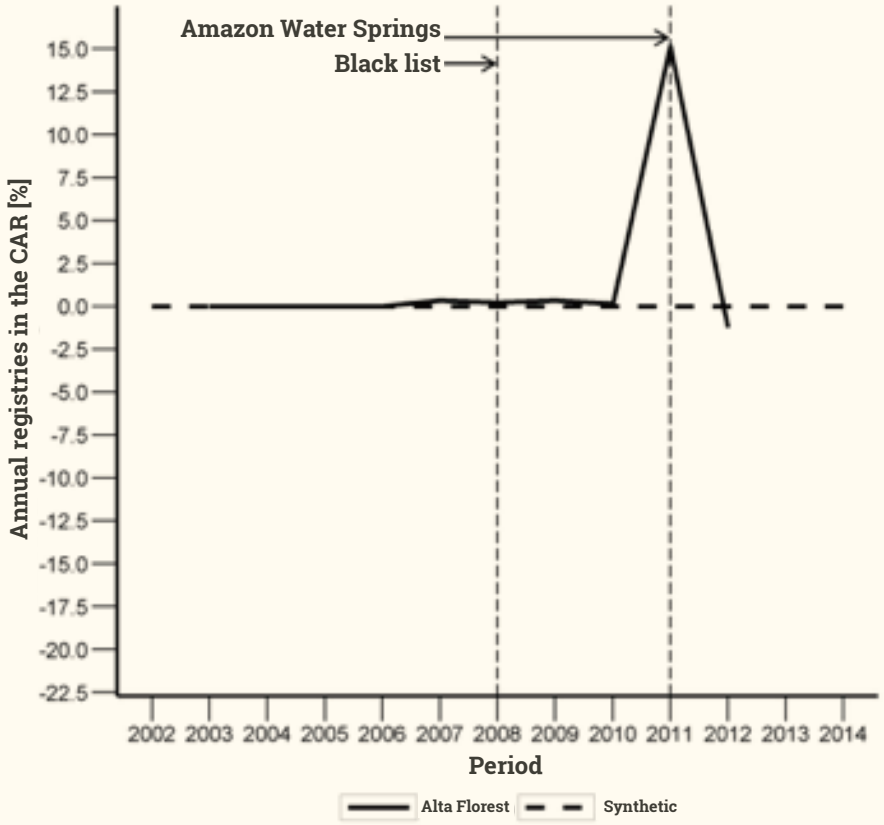
Figure 7 represents the synthetic control as a result of the linear combination of a variety of municipalities: 14.8% of Colniza, 1.1% of Juara, 9.9% of Querência, etc. The complete list of weights assigned to each municipality is shown in Table 2. A first visual interpretation of Figure 7 indicates a very good quality of the synthetic control. The trend of CAR registries within a pre-intervention period is well approximated with synthetic control. Table 1 shows the values of the covariates for Alta Floresta, for the synthetic control and for the mean of the group of control group participants. The last column shows the relative weights attributed by the SCM to the predictive covariates. High-weight covariates play an important role in predicting new registrations withCAR. The covariates with higher weights were fully protected areas and the number of tractors per farm.

Table 2. Synthetic weights for Alta Floresta for prediction CAR registries

Weights	Municipalities	Weight	Municipalities
0	Altamira	0	Confresa
0	Brasil Novo	0	Cotriguaçu
0	Cumaru do Norte	0	Gaúcha do Norte
0	Dom Eliseu	0.111	Juara
0	Novo Progresso	0	Juína
0	Novo Repartimento	0	Marcelândia
0	Paragominas	0.001	Nova Bandeirantes
0	Rondon do Pará	0	Nova Ubiratã
0	Santa Maria das Barreiras	0.058	Paranaíta
0.21	Santana do Araguaia	0.052	Peixoto de Azevedo
0	São Félix do Xingu	0	Porto dos Gaúchos
0.071	Ulianópolis	0.099	Querência
0	Aripuanã	0	São Félix do Araguaia
0	Brasnorte	0.25	Vila Rica
0.148	Colniza	0	Nova Maringá

Figure 8 shows the difference in the annual growth rate of CAR registration between the values observed in Alta Floresta and the synthetic control. It is verified that the separation interval between these trends is irrelevant until 2010 and presents a significant difference in 2011, returning to zero in 2012 due to the fall in the rate of CAR registrations CAR in Alta Floresta and the increase of the synethetic control rate. Therefore, as a result of the Amazon Water Springs project, there is an increase in the annual rate of CAR registrations of 13.9 between 2011 and 2012.

Figure 8. Annual growth difference between records in CAR in Alta Floresta and in synthetic control



This result is based on the synthetic control found and a "boomed" result on only one year of increase in CAR registries. This raises questions about the causality of the measured effect that could have been driven by random data such as spurious data for 2011. To test whether spurious data directed the results, we applied permutation tests and construction of confidence intervals for the synthetic control trend used.

Figure 9 shows once again the difference between the synthetic control and the trend observed in the growth of CAR records in Alta Floresta. Additionally, this same difference is presented for each of the 30 untreated municipalities, simulating each of them as if they had been treated. Thus, 30 municipalities of the set of participants in the control group resulted in 30 simulated synthetic controls and 30 difference trends between the annual growth of CAR registration CAR and their respective simulated synthetic controls. Many of these placebo simulations show significant differences before the intervention in 2011. The reason is that the SCM cannot produce good synthetic controls for municipalities with extreme values (near distributions limits), since the synthetic control is a linear combination of several municipalities and therefore may only be within the convex grouping of this combination.

Figure 9. Annual growth difference between registries in the placebo CAR in all 31 municipalities and their respective synthetic controls

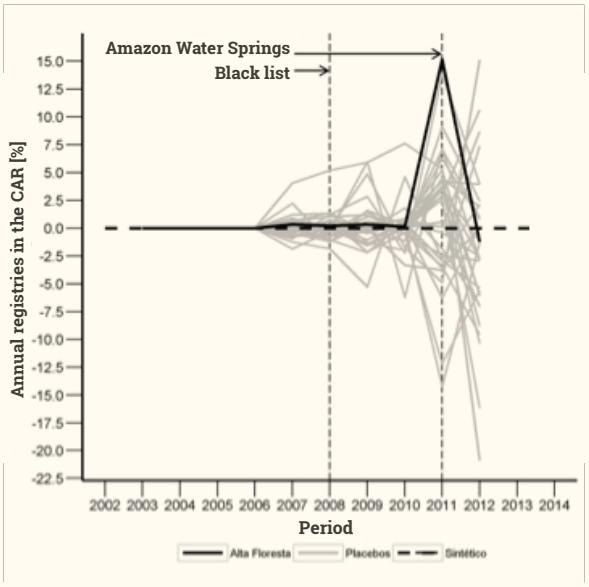
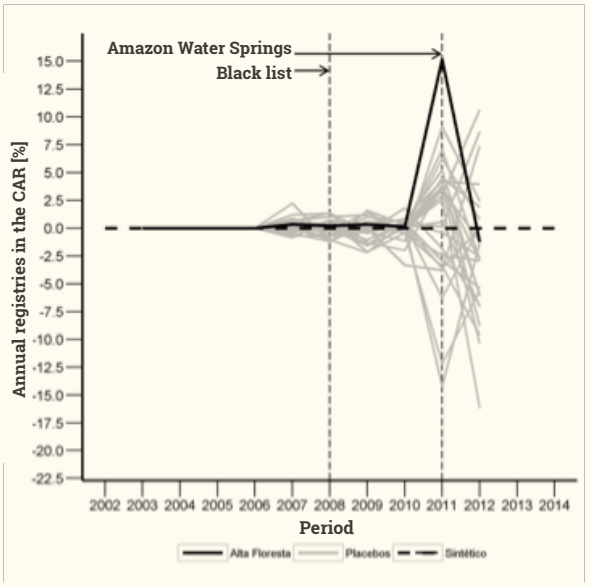


Figure 10. Annual growth difference between placebo CAR registries in 26 municipalities of the control group (except municipalities with pre MSPE intervention 40 times greater than Alta Floresta) and their respective synthetic controls



Thus, in order to exclude placebo tendencies with extreme values, the goal was to eliminate the trends with high mean square error prediction (MSPE) during the pre-intervention period (2005-2010). In Figure 10, placebo tendencies with MSPE 40 times higher than the MSPE of the synthetic control of Alta Floresta are excluded. The 26 remaining placebo trend charts show that most of the effects of these treatments are below the calculated effects for Alta Floresta. In Figure 11, the samples are restricted during the pre-intervention period to trends with MSPEs smaller than 10 times the MSPE of the Alta Floresta synthetic control. Only 17 observations were found, with mostly positive impacts and with slightly lower values than our Alta Floresta treatment unit. Finally, in Figure 12, the range is restricted for twice the MSPE of the Alta Floresta value. In this case there are only 8 observations with a good comparative adherence left. This analysis shows that it is unlikely to have a hidden artifact not specified in the data used in the impact calculated in CAR records through the Amazon Water Springs project.

12. Annexes III.

Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

Figure 11. Difference of annual growth between placebo CAR records in 17 control municipalities (except municipalities with pre-MSPE intervention 10 times higher than that of Alta Floresta) and their respective synthetic controls

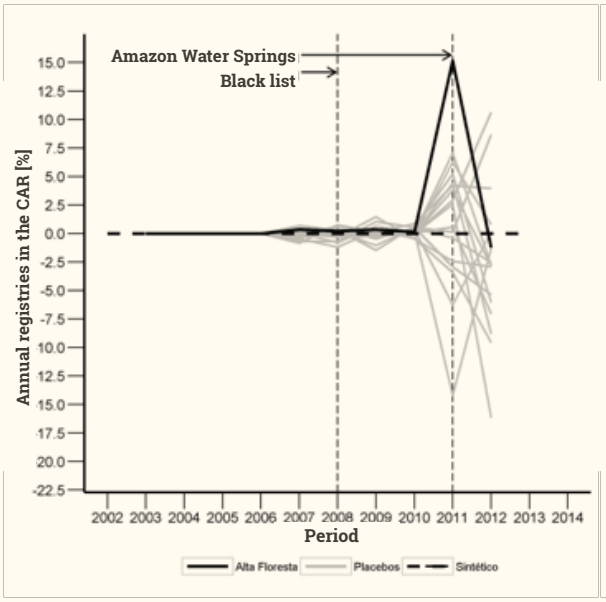
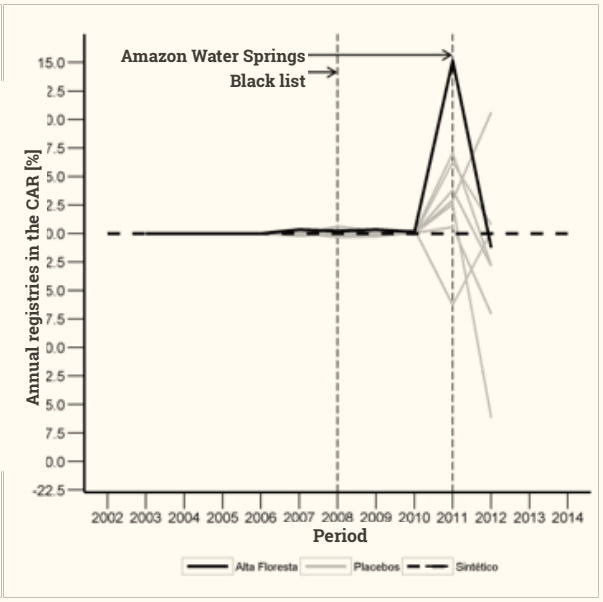
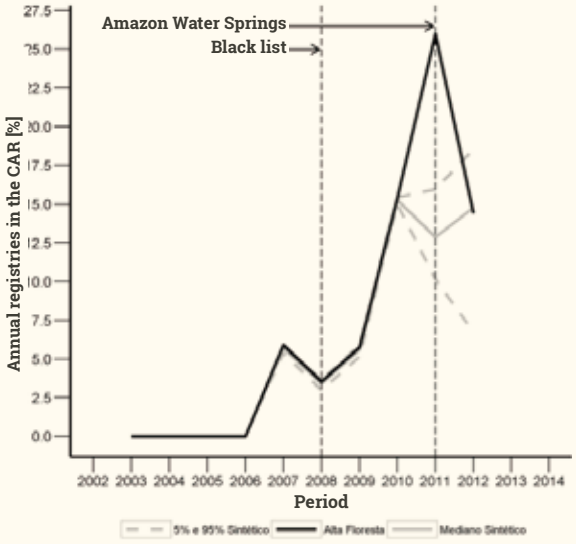


Figure 12. Difference of annual growth among placebo CAR records in 8 control municipalities (except municipalities with MSPE pre-intervention 2 times higher than that of Alta Floresta) and their respective synthetic controls



A second test to address the uncertainties of synthetic control quality was introduced by Sills et al. (2015). According to these authors [21], levels of significance for the synthetic control trend were constructed with the bootstrapping technique.. The search for the synthetic control for Alta Floresta was iteratively and randomly repeated 1,000 times, excluding 10 different municipalities at a time from the set of participants in the control group. The resulting distribution of synthetic control tendencies is shown in Figure 13, where the percentage of 5%, the average of 95% and the values of each year are plotted. These confidence limits are very narrow during the preintervention period. However, the synthetic control of Alta Floresta is within the 10% significance level. In line with the previous test, the new CAR records observed in 2011 are significantly larger than the synthetic control resulting from the bootstrapping. The 2012 registrations again have an insignificant difference compared to the synthetic control.

Figure 13. . Bootstrapped Significance of Alta Floresta Synthetic



The impact analysis for the Amazon Water Springs project showed a robust and significant effect on the growth rate of CAR registrations. The SCM provided a robust synthetic control with high similarity with the tendency in the results before the beginning of the treatment. The difference in the annual growth rate of CAR registries after the beginning of the treatment may be interpreted as a causal effect. It was concluded that 13.9% of the eligible municipal area, or 1,230 Km2, would not have been registered with CAR without an intervention project during our time period of analysis.

Deforesting

Regardless of the success of the Amazon Water Springs project in including most of the eligible Alta Floresta land in CAR registries, another relevant issue is whether the project's implementation has reduced deforestation rates. Before presenting a formal assessment, it is important to have a close look at deforestation trends in Alta Floresta.

Figure 14 shows the trend of deforestation in Alta Floresta in comparison with the average of the other municipalities that belonged to the blacklist at the time of the study. In the initial period, in 2002, 4,444km2 or 40.6% of the area of the municipality was deforested. Until 2008 an additional 7.3% of forest areas were cleared, while between 2008 and 2014 only 0.4% of the area of the municipality was cleared.

Alta Floresta presented average deforestation rates equivalent to its black list peers until 2008. From 2008 onwards the municipality presented lower rates than its peers. Figure 14 shows that from 2008 onwards the trend of the deforestation rate in Alta Floresta followed the trend of the 5% of blacklist municipalities that had lower rates. With this statistical summary we try to emphasize the three important characteristics of Alta Floresta: the historical rates of deforestation have always been very high; less than half of the county's original forest area is still standing; and the sharp decline in deforestation rates is unprecedented.

Figure 14. Trends in deforestation in Alta Floresta and in the blacklist control group

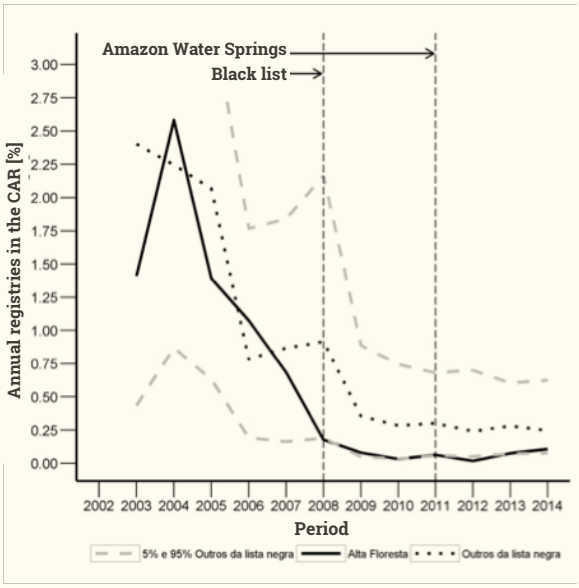


Figure 15 presents the SCM results for deforestation. The synthetic control was constructed with the municipalities of Confresa and Juína with percentage weights of 46.6% and 44.4%, respectively (see table 3). The main predictor covariate for the pre-intervention deforestation trend were historical deforestation levels representing more than 60% of the weight, followed by the farm coverage area with 8% and the amount of public credits available to farmers with 7% of the weight (See table 5). Figure 15 shows that the quality of the synthetic control is low for this analysis. Specifically the differences in trends in annual deforestation rates between the treated municipality and the synthetic control is significant for the time period before treatment began. The trend of deforestation in Alta Floresta can not be reproduced with the set of participants in the control group. This result is not surprising, since the trend of deforestation in Alta Floresta is initially in the middle of the upper distribution and, as of 2008, below the lower distribution. This extreme behavior could not be reproduced with a weighted average of the blacklist municipalities simply because the SCM can not produce good synthetic controls for municipalities with extreme values close to the distribution boundaries.

Figure 15. Deforestation rate in Alta Floresta and the Alta Floresta synthetic

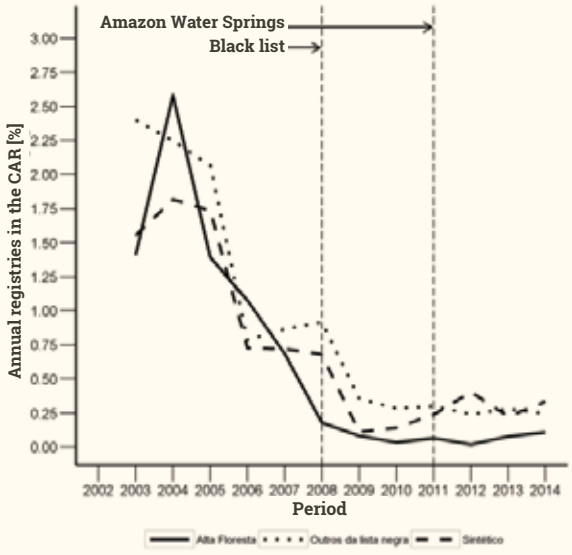


Table 3. Synthetic weights for Alta Floresta High Forest to predict deforestation rates

Weights	Municipalities	Weights	Municipalities
0	Altamira	0.466	Confresa
0	Brasil Novo	0	Cotriguaçu
0	Cumaru do Norte	0	Gaúcha do Norte
0	Dom Eliseu	0	Juara
0	Novo Progresso	0.444	Juína
0	Novo Repartimento	0	Marcelândia
0	Paragominas	0	Nova Bandeirantes
0	Rondon do Pará	0	Nova Ubiratã
0	Santa Maria das Barreiras	0.087	Paranaíta
0	Santana do Araguaia	0	Peixoto de Azevedo
0	São Félix do Xingu	0	Porto dos Gaúchos
0	Ulianópolis	0	Querência
0	Aripuanã	0	São Félix do Araguaia
0	Brasnorte	0.002	Vila Rica
0	Colniza	0	Nova Maringá

Alta Floresta presents low rates of deforestation after the start of the project in 2011, lower than the average of the blacklist municipalities belonging to the group of participants in the control group, and smaller than the synthetic control. However, these differences are probably driven by different unobserved characteristics for the remaining municipalities. As a result, it is not possible to draw any conclusions from a possible impact of the Amazon Water Springs project on deforestation rates in the municipalities.

Conclusion

It is possible to conclude that the Amazon Water Springs project played an important role in the effort of having Alta Florestal removed from the deforestation black list. Strong evidence for this can be seen in the increase, above the general trend observed in the control group, of the number and area registered with CAR. Many of these areas were registered with funds from the Amazon Fund-supported project, but it is possible to assume that this effect includes not only the small farms that entered the system, but also the untreated neighbors, since they are indirectly motivated to register due to the project's intervention. In addition, the municipal environment secretariat's assistance for monitoring, enforcement and environmental liability measures may also have led to an increase in voluntary registration of farms without direct intervention.

In regards to the project's effect on reducing the deforestation rates of Alta Floresta, we did not find sufficient inferences in this study to indicate a direct cause-effect relationship. It is noteworthy that, although cattle ranching is one of the main drivers of deforestation in Alta Floresta, there was a decoupling between cattle herd growth and deforestation rate in the project's time span. Although it is not possible to affirm the existence of a direct cause-effect relationship between the project and the reduction of deforestation, it is possible to assume that it contributed to the maintenance of low rates of deforestation due to the incentive given to intensify cattle raising as a consequence of the project's activities .

It is also necessary to recognize that there is space to achieve even more substantial results in the reduction of deforestation with the investments in CAR carried out by the Amazon Water Springs project. As pointed out by Rajão, Azevedo et al (2015) and Azevedo, Rajão et al. (2014) either with the SLAPR between 2000-2008, or with CAR in the 2008-2012 period, little effectiveness was obtained from systematic deforestation reduction results [28, 30]. It was observed by the authors that this low effectiveness stems from the fact that both federal agencies such as the Brazilian Environmental Institute (IBAMA) as well as state agencies such as SEMA (Secretariats of the Environment) have not used these systems as an instrument of command and control through the issuance of notifications and notices of infraction by mail. This can be explained by the adoption of a strategy that sought to privilege the registration campaigns in these systems to the detriment of their use to control of deforestation through punitive activities that could dissuade farmers to seek CAR registration. At the same time there is a lack of concrete economic incentives to reduce deforestation within the farms and to restore permanent protection areas and legal reserves. This indicates that in the future the governance infrastructure established by the Amazon Water Springs project could be mobilized towards a substantial improvement in the municipality's environmental governance and the achievement of zero illegal deforestation in the region.

12. Annexes III. Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

References

1] Alberto Abadie, Alexis Diamond, and Jens Hainmueller. Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program. Journal of the American Statistical Association, 105(490):493–505, 2010.

[2] Alberto Abadie and Javier Gardeazabal. The economic costs of conflict: A case study of the basque country. The American Economic Review, 93(1): pp. 113–132, 2003.

[3] Eugenio Y. Arima, Paulo Barreto, Elis Araújo, and Britaldo Soares-Filho. Public policies can reduce tropical deforestation: Lessons and challenges from Brazil. Land Use Policy, 41(0):465 – 473, 2014.

[4] Juliano Assunção, Clarissa Gandour, Romero Rocha, and Rudi Rocha. Does credit affect deforestation? evidence from a rural credit policy in the Brazilian Amazon. Technical report, Climate Policy Initiative - PUC-Rio, 2013.

[5] Juliano Assunção, Clarissa Gandour, and Rudib Rocha. Deforestation slowdown in the legal Amazon: Prices or policies. Technical report, Climate Policy Initiative - PUC-Rio, 2012.

[6] BCB. Anuário estatístico do crédito rural, 2015.

[7] Jan Börner, Krisztina Kis-Katos, Jorge Hargrave, and Konstantin König. Post-crackdown effectiveness of field-based forest law enforcement in the Brazilian Amazon. PLoS ONE, 10(4):1–19, 04 2015.

[8] CEPAL-IPEA-GIZ. Avaliação do Plano de Ação para Prevenção e Controle do Desmatamento na Amazônia Legal (PPCDAm). 2011.

[9] Elías Cisneros, Sophie Lian Zhou, and Jan Börner. Naming and shaming for conservation: Evidence from the Brazilian Amazon. PLoS ONE, 10(9):1 – 24, September 2015.

[10] Jorge Hargrave and Krisztina Kis-Katos. Economic causes of deforestation in the Brazilian Amazon: A panel data analysis for the 2000s. Environmental and Resource Economics, 54(4):471–494, 2013.

[11] IBAMA. Sistema compartilhado de informações ambientais, 2013.

[12] IBAMA. Consulta pública de autuações ambientais e embargos, 2015.

[13] IBGE. Agropecuário IC, 2006.

[14] IBGE. Censo demográfico, 2007.

[15] IBGE. Índice nacional de preços ao consumidor amplo (IPCA), 2013.

[16] IBGE. Produto interno bruto dos municípios, 2013.

[17] Imprensa Nacional do Brasil. Diário Oficial da União, decreto 6.321/2007 e portaria nº 28/2008, portaria nº 102/2009, portaria nº 66/2010, portaria nº 138/2011, portaria nº 139/2011, portaria nº 175/2011, portaria nº 187/2012., 2007.

[18] INPE. PRODES - monitoramento da floresta amazônica brasileira por satélite, 2016.

[19] Christoph Nolte, Arun Agrawal, Kirsten M. Silvius, and Britaldo S. Soares-Filho. Governance regime and location influence avoided deforestation success of protected areas in the Brazilian Amazon. Proceedings of the National Academy of Sciences, 110(13):4956–4961, 2013.

[20] Christian F Pfeil and Lars P Feld. Does the swiss debt brake induce sound federal finances? a synthetic control analysis. Cesifo working paper, CESifo Group, 2016.

[21] Erin O. Sills, Diego Herrera, A. Justin Kirkpatrick, Amintas Brandão, Jr., Rebecca Dickson, Simon Hall, Subhrendu Pattanayak, David Shoch, Mariana Vedoveto, Luisa Young, and Alexander Pfaff. Estimating the impacts of local policy innovation: The synthetic control method applied to tropical deforestation. PLoS ONE, 10(7):e0132590, 07 2015.

[22] Britaldo Soares-Filho, Paulo Moutinho, Daniel Nepstad, Anthony Anderson, Hermann Rodrigues, Ricardo Garcia, Laura Dietzsch, Frank Merry, Maria Bowman, Letícia Hissa, Rafaella Silvestrini, and Cláudio Maretti. Role of Brazilian Amazon protected areas in climate change mitigation. Proceedings of the National Academy of Sciences, 107(24):10821–10826, 2010.

[23] Margulis, Sergio. Causas do desmatamento da Amazônia brasileira. Banco Mundial, 2004.

[24] RAJÃO, Raoni; VURDUBAKIS, Theo. On the pragmatics of inscription: Detecting deforestation in the Brazilian Amazon. Theory, Culture & Society, v. 30, n. 4, p. 151-177, 2013.

[25] ARIMA, Eugenio Y. et al. Public policies can reduce tropical deforestation: Lessons and challenges from Brazil. Land Use Policy, v. 41, p. 465-473, 2014.

[26] ASSUNÇÃO, Juliano; GANDOUR, Clarissa; ROCHA, Romero. Deterring deforestation in the Brazilian Amazon: environmental monitoring and law enforcement. 2014.

[27] HARGRAVE, Jorge; KIS-KATOS, Krisztina. Economic causes of deforestation in the Brazilian Amazon: a panel data analysis for the 2000s. Environmental and Resource Economics, v. 54, n. 4, p. 471-494, 2013.

[28] RAJÃO, Raoni. ALENCAR, Ane., AZEVEDO, Andréa A, A revolução tecnológica do IBAMA e os limites do comando e controle na Amazônia. IPAM. Boletim Amazônia em Pauta, N. 4. Brasília, DF. 8p, 2015

[29] SFC. Serviço Florestal Brasileiro. Boletim informativo do Cadastro Ambiental Rural, 2016

[30] AZEVEDO, A. A. et al. Cadastro Ambiental Rural e sua influência na dinâmica do desmatamento na Amazônia Legal. Boletim Amazônia em Pauta, v. 3, n. 2014, p. 1-16, 2014.

12. Annexes III. Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

Annex

Table 1: Predictives and registries weights in CAR

	Alta Floresta	Alta Floresta Synthetic Control	Black List	Predictive weights
Coverage of indigenous territory	0.00	0.09	0.15	0.006
Coverage of Environmental Protection Areas – Sustainable Use	0.00	0.00	0.02	0.060
Coverage of Environmental Protection Areas - Full	0.02	0.02	0.02	0.099
Rural Credit per capita (1 year lag)	425.38	1066.80	1406.18	0.030
GDP per capita (1 year lag)	11532.80	11347.78	12670.84	0.067
N° of environmental fines per km^2 (1 year lag)	0.01	0.00	0.00	0.000
Average of CAR Registries [%] (2005 - 2007)	0.02	0.02	0.02	0.227
Average of CAR Registries [%] (2008 - 2010)	0.08	0.08	0.07	0.205
Forest coverage (2002)	0.50	0.61	0.66	0.000
Savanna coverage (2002)	28789.23	47567.03	74825.65	0.050
Hydrographic Coverage (2002)	0.00	0.00	0.01	0.059
Average cloud coverage (2008-2010)	0.00	0.01	0.01	0.009
Population density	5.47	2.58	2.06	0.000
Density of properties	0.26	0.17	0.13	0.000
Participation of small properties	0.75	0.72	0.62	0.027
Farms coverage	0.59	0.53	0.42	0.035
N° of tractors per farm	0.20	0.20	0.28	0.066
Cattle stock rate	1.64	1.19	1.14	0.000
Participation of landowners	83.60	81.70	79.76	0.058
Distance to Brasília	13.92	13.72	13.86	0.001

12. Annexes III.

Synthetic control of the effect of the Amazon Water Springs project on CAR and deforestation in Alta Floresta: a counterfactual study.

Annex

Table 2: Predictives and weights of Deforestation

	Alta Floresta	Alta Floresta Synthetic Control	Black List	Predictive weights
Coverage of indigenous territory	0.00	0.29	0.15	0.00
Coverage of Environmental Protection Areas – Sustainable Use	0.00	0.00	0.02	0.04
Coverage of Environmental Protection Areas - Full	0.02	0.04	0.02	0.00
Rural Credit per capita (1 year lag)	425.38	583.60	1406.18	0.07
GDP per capita (1 year lag)	11532.80	10736.06	12670.84	0.04
N° of environmental fines per km (1 year lag)	0.01	0.00	0.00	0.00
Average of CAR Registries [%] (2005 - 2007)	0.01	0.01	0.01	0.37
Average of CAR Registries [%] (2008 - 2010)	0.00	0.00	0.01	0.23
Forest coverage (2002)	0.50	0.59	0.66	0.05
Savanna coverage (2002)	28789.23	70902.60	74825.65	0.02
Hydrographic Coverage (2002)	0.00	0.00	0.01	0.03
Average cloud coverage (2008-2010)	0.00	0.00	0.01	0.01
Population density	5.47	2.58	2.06	0.02
Density of properties	0.26	0.22	0.13	0.01
Participation of small properties	0.75	0.62	0.62	0.00
Farms coverage	0.59	0.54	0.42	0.08
N° of tractors per farm	0.20	0.10	0.28	0.01
Cattle stock rate	1.64	1.04	1.14	0.00
Participation of landowners	83.60	89.13	79.76	0.00
Distance to Brasília	13.92	13.77	13.86	0.01

12. Annexes IV.

Table with results from the workshop about Strengths, Weaknesses, Opportunities and Threats (SWOT)

Table with results from the workshop about Strengths, Weaknesses, Opportunities and Threats (SWOT)

STRENGTHS: Was the objective of the project reached? Which were the main reasons or strengths explaining this result?	OPPORTUNITIES: What new opportunities has the project generated or can generate in the municipality?	WEAKNESSES : What are the difficulties in achieving the results ?	THREATS: Is there anything that threatens the sustainability of the results? What are the principal risks for continuity and / or effectiveness of the activities?
Commited technical team	IADB Sustainable rural project	Not getting differentiated prices for farmers who have adopted good practices	Continuity and intensification of the dialogue among agencies responsible for the environment, agriculture, economy
Municipality adopting environmental and land regularization	Access to new opportunities / projects for the municipality	Modifications on limits and APPs and RLs in environmental legislation (federal and state)	Continuity of technical assistance for new production chains
Follow-up of the project	Access to owners' rural credit	The commercialization of fish farming still occurs by middlemen. Lack of local arrangement (APL da CdV).	Discontinuity in the monitoring and control of APPs recovered in the project
Gradual change in farmers' attitudes	Organization of property (APP, RL, appropriate use)	Not having the chain of meliponiculture structured	Increase / return of fires and deforestation with the introduction of new production chains (eg soybeans, grains, fish farming, etc.)
Search for resolutions at the Local Level	Production without pesticides; introduction of agroecology	Appropriation of new value chains by secretariats and related bodies (agriculture, EMPAER, etc.)	Increased use of safeguards and pesticides for water resources
Greater knowledge of legislation due to the project's technical support (for small farmers)	New products in the local market	Lack of stimulus to cooperativism and associativism	Discontinuity in recovery of APPs may compromise water resources / supply
Local valorization of project mobilization	New labor markets opening	LFarmerittle interest in cooperativism due to negative experiences	Changes in municipal and environment management may threaten the continuity of environmental activities
Partnerships with several institutions (Farmer association, ICV, SEMA, INCRA, UNEMAT, etc.)	Increased dialogue with universities to support farmers for a better balance between the economic-environmental-social	Rural schools that are not geared to farm needs	
Municipality activities regain credibility	Valorization of the area (small owners) / New spaces and fairs for commercialization (agroecology)	Involvement of the ATER body and university since the beginning of the project (partnerships)	
internal changes on farms, bringing opportunities from outside	Insertion of ecosystem services / payment for environmental services (PES)		
Interaction among several different actors (engagement)	Expanding municipal environmental management with environmental education		
Quality of life contributing to the permanence of people in rural areas	Continuity / monitoring of springs recovery		
	Municipal work with ICV to promote dairy farming		

12. Annexes V. List of interviewees during the field mission

List of interviewees during the field mission

NAME	INSTITUTION/ ORGANIZATION	FUNCTION
Diego Alves Barbosa Antônio	EMBRAPA	Forest researcher
Flávio Fernandes Júnior -	EMBRAPA	Deputy Head of Technology Transfers
Joselita Giordani	IBAMA	IBAMA Unit Chief
Eriberto Muller	ICV	Technician
Renato Farias	ICV	Executive director
Alexandre Olival	Instituto Ouro Verde	General Coordinator
Asiel Bezerra	Prefeitura de Alta Floresta	Mayor of Alta Floresta
Maria Izaura	Prefeitura de Alta Floresta	Former Mayor
Aparecida Sicuto	Secma	Former Secretary for the Environment
Gercilene Meira	Secma	Interim Secretary for the Environment
Irene Duarte	Secma	Former Secretary for the Environment
Jose Alesando Rodrigues	Secma	Project Coordinator
Chico Gamba	Secretaria de Agricultura de Alta Floresta	Former Secretary of Agriculture
Paul Halmenschlagel	Sicredi	Employee
Celia Regina Araújo Soares	UNEMAT	Teacher - information about the herbarium
Ediglei Pereira da Silva	UNEMAT	Teacher
Celso Bevilaqua	Pecuarista	Former Farmer association President
Luis Caione	Agricultura familiar	farmer
Paulo Bertun	Agricultura familiar	farmer
Paulo Joel	Agricultura familiar	farmer

Notice that non-structured interviews have also been conducted with farmers in the Alta Floresta fair.

Participants of the consultation round

Name	Organization	Position/function	Purpose
1. Monique Ferreira	DPCD/MMA	Diretora	Deforestation and REDD+
2. Mauro Pires	DEX/MMA	Diretor	Deforestation and Sustainable Production
3. Jose Alesando Rodrigues	Municipal Secretary of Environment Alta Floresta MT	Coordenador Projeto	Reference Group
4. Aparecida Sicuto	Municipal Secretary of Environment Alta Floresta MT	Secretaria	Reference Group
5. Leonardo de Oliveira Santos	Monitoring and Evaluation Management BNDES		Reference Group
6. Renato L. Proença de Gouvea	Monitoring and Evaluation Management BNDES		Reference Group
7. Juliana Santiago	Fund Management Department Amazônia BNDES		Reference Group
8. Angela Albernaz	Fund Management Department Amazônia BNDES		Reference Group
9. Bernardo Braune	Fund Management Department Amazônia BNDES		Reference Group
10. Pedro Ivo Guedes	Fund Management Department		Reference Group
11. Helmut Eger	GIZ	Diretor de Projetos	Reference Group
12. Janina Budi	GIZ	Assessora	Reference Group
13. Fabiano Toni	Avaliador	-	Report presenter
14. Julia Queiroz	Avaliadora	-	Report presenter
15. Raoni Rajão	Minas Gerais Federal University Professor	-	Diagnosis on the effectiveness of CAR in Alta Floresta
16. Juliano Corrêa	Doctorate fellow at Minas Gerais Federal Unversit	-	Diagnosis on the effectiveness of CAR in Alta Floresta
17. Bernardo Anache	Evaluator	-	Report presenter
18. Heliandro Maia	Evaluator	-	Report presenter

Term of Reference (ToR)

1. Introduction and general information

1.1 Description of the project

Title of project: **Olhos D'Água da Amazônia - Amazon's Water Springs Responsible** body: **Municipality of Alta Floresta, Mato Grosso State**
Period of project: **1st quarter of 2011 to 4th quarter of 2013**

The Amazon Water Springs project was developed in Alta Floresta-MT which was responsible for the project's execution and with financial support from the Amazon Fund. Its objectives were to strengthen the Municipal Department of Environment in the activities of monitoring, control and environmental responsibility; facilitate the access of farmers to land and environmental regularization; recover degraded areas with identified forest deficits, and train farmers to implement agroforestry and extractivist systems.

Throughout its execution, the project received the total amount of R$ 2,781,340.40. Its main focus was farmers, cattle breeders and family farmers. The main result was the participation and enrollment of small farmers into the Rural Environmental Registry (CAR), reaching a total of 82% of the farmers in the municipality. The results achieved in this project, related to CAR, were the main reason for the municipality leaving the list of municipalities that most deforested the Amazon.

1.2 Context of project

Alta Floresta is located in the extreme north of the state of Mato Grosso, covering a territory of 8,976,204 km², with a population of 49,877 inhabitants (IBGE, 2014). Its main economic activities are: livestock slaughter and dairy farming (about 720 thousand head), planting of temporary crops, such as corn, soybeans and sugarcane rice, and timber extraction. By having a large amount of natural resources in its territory and untaken lands, a large road network and being located far from large urban centers, Alta Floresta suffered intense illegal exploitation of natural resources, which, consequently, caused a high rate of irregular deforestation. In 2008, due to the high annual rates of deforestation, the municipality was included by the Ministry of Environment (MMA) into the list of priority municipalities for activities to monitor and control deforestation.

Livestock and logging are the main vectors of deforestation in the municipality. As a consequence of the nature of occupation in the territory and of the economic activities developed, a constant increase of environmental degradation can be observed. Of the approximately 8,000 existing springs, only 4,000 were preserved in 2010, and in 2012, the deforested area of Alta Floresta corresponded to 54% of its total area. Among these areas, according to data from Alta Floresta's Municipal Secretariat of the Environment, those of permanent preservation were the most endangered.

In this context, the Amazon Water Springs project contributed to the reduction of deforestation and enabled the municipality to adapt to the environmental legalization process in search of more sustainable development. The government of Alta Floresta coordinated the activities carried out through its Municipal Department of Environment. To this end, a large number of institutional partners and civil society organizations were brought in. Some of the main partners are: the State University of Mato Grosso (UNEMAT), the Center for Life Institute (ICV), the Ouro Verde Institute (IOV), the Avina Foundation, the National Institute for Colonization and Agrarian Reform (INCRA) The Brazilian Agricultural Research Corporation (Embrapa), the State Secretariat of Environment for the State of Mato Grosso (SEMA-MT), the Municipal Secretariat of Agriculture of Alta Floresta and the Farmer association of Alta Floresta.

2. Purpose and objectives of the evaluation

The main purpose of the project's evaluation is to measure the results achieved, their effects and the sustainability of the changes caused by their implementation.

All the projects supported by the Amazon Fund follow an individualized logical framework in which results are defined (products and services to be delivered or outputs), direct effects of the intervention (specific objectives or outcomes) and indirect effects (general objectives or impacts) to be achieved. This is the project's intervention logic, also called the theory of change because it represents a thinking model that explains how the project is expected to cause a desired change. The logical framework of the project is available on the Amazon Fund website.[4]

The main objectives of the evaluation are:

- Assist the Amazon Fund in reporting back to donors about the type of project supported and its effects;
- Facilitate institutional learning of the Fund itself, contributing to project improvement and investment prioritizing, thus subsidizing decision-making;
- Verify compliance of the projects supported by the Amazon Fund with the Cancun safeguards agreed under the UNFCCC for REDD+ activities;
- Verify the alignment of the projects with the PPCDAm and the state plans of prevention and control of deforestation;
- Analyze the strengths and weaknesses of project intervention;
- Identify challenges and lessons learned; and
- Find out to what extent the project is relevant, efficient, effective, sustainable and generates impacts.

3. Task description

3.1 Object and focus of evaluation

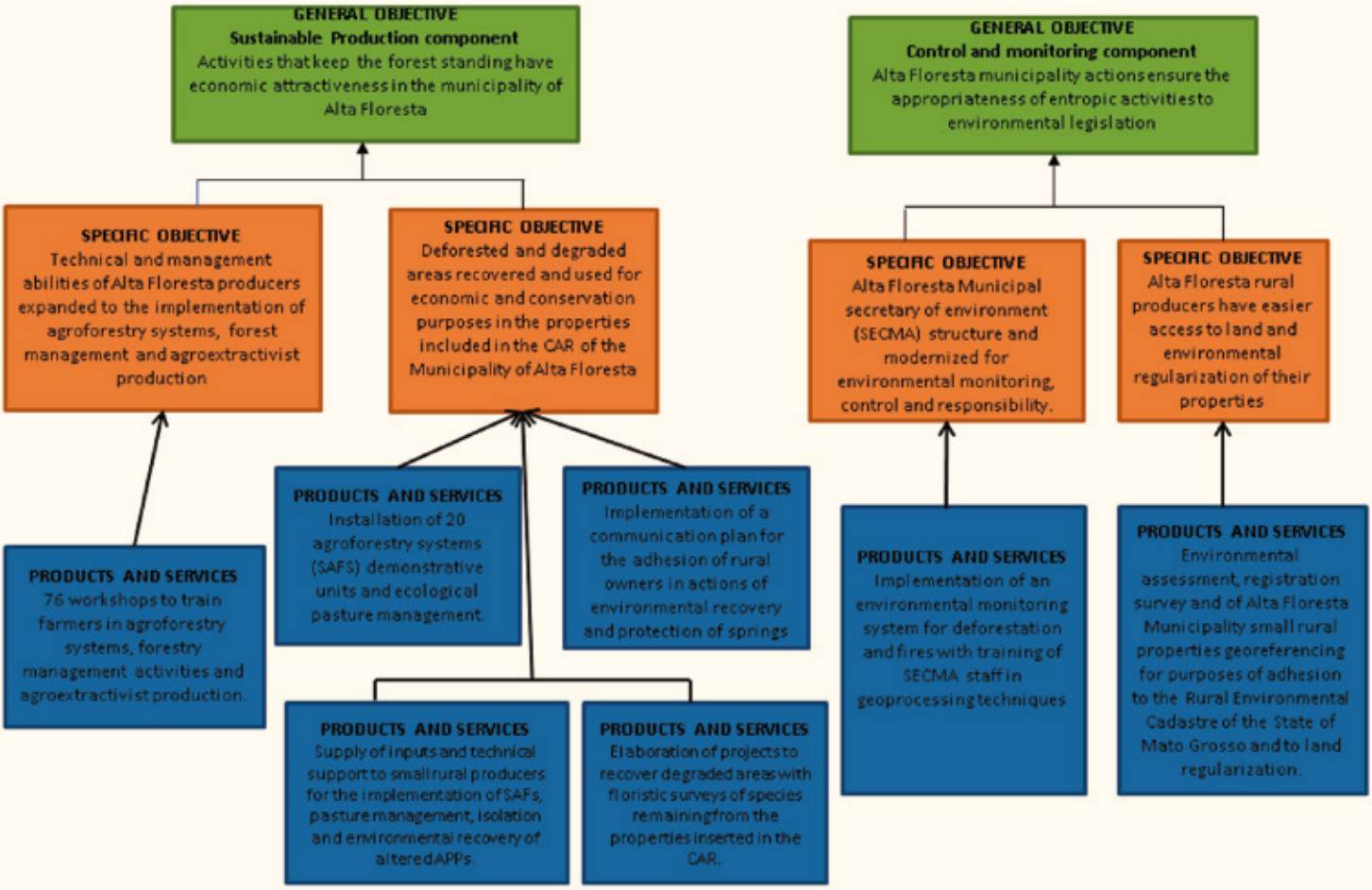
The project was implemented in the years 2011 to 2013, operating throughout Alta Floresta. In this way, the evaluation's focus are the areas in which the project had intervention, taking into account the following worked results:

- Institutionally strengthen the Secretariat of the Environment for monitoring, control and accountability of environmental activities;
- Facilitate the access of farmers to land and environmental regularization, with emphasis on adherence to CAR;
- Recover degraded areas and those with forest deficits identified in permanent preservation areas (APPs); and,
- Empower farmers to implement agroforestry and agro-extractive production systems.

3.2 The project's intervention logic

Objective Tree of the Logical Framework of the Amazonian Water Eyes project:

4) http://www.fundoamazonia.gov.br/FundoAmazonia/fam/site_pt/Esquerdo/projetos_Apoiados/Lista_projetos/Municipio_Alta_Floresta



3.3 Key questions and evaluation criteria

The evaluation of the effectiveness of the Amazon Water Springs project in Amazonia will follow the guidelines and criteria specified in the document "Evaluation of Effectiveness of Projects Supported by the Amazon Fund - Conceptual Framework". These criteria are based on the OECD, the REDD + safeguards defined by the Framework Convention (Annex I of Decision 1 / CP 1641 and the guidelines of Decision 12 / CP 17) and the selected cross-cutting criteria. For each criteria, a basic script guiding questions to be applied and answered in the evaluation of the project is presented and should be complemented in its design report (1st Product to be presented by the evaluation team), as seen fit by the evaluation team. Below is the summary table of criteria and respective guiding questions:

3.3.1 OECD Criteria, Cross-cutting Issues and Evaluation Questions

Criteria	Guiding Questions
Relevance	• To what extent are project objectives still valid at the time of finalization? • Are the immediate activities and outcomes of the project consistent with the achievement of the project's objectives? • Are the immediate project activities and outcomes consistent with expected effects and impacts?
Effectiveness	• Have the project's (specific) objectives been or will be met? • • What are the main factors that influence whether or not direct goals are met?
Efficiency	• What is the cost-effectiveness of the activities carried out? • • Are the means applied reasonable in relation to the results obtained? • • Were goals met within the deadlines? • • Are there alternative ways to get the same results with less cost / means?
Impact	• What were the main changes generated as a result of the project? • • What were the main effects that contributed to the achievement of the objective? • • What activities or events outside the project contributed to the achievement of the observed changes? • • Did the project make any difference to the beneficiaries? • • Does the project have scale in the region or influence other initiatives?
Sustainability	• To what extent do project benefits last after the end of Amazon Fund funding? • What were the main factors that influenced the sustainability of the project? • What risks should be monitored to ensure the sustainability achieved?
Cross-cutting criteria	
Poverty reduction	• To what extent has the project contributed effectively to economic alternatives that value the standing forest and the sustainable use of natural resources? • To what extent has the project had a positive impact on reducing poverty, social inclusion and improving the living conditions of beneficiaries living in its area of activity? • Has the project succeeded in promoting and increasing production in value chains of timber and non-timber forest products originating from sustainable management?
Gender equity	• Has the project succeeded in integrating gender issues into its strategies and interventions or addressed the issue in an independent way? How? • • Was there separation by gender in data collection for project planning and monitoring? • • How did the project contribute to gender equity?

3.3.2 REDD+ safeguards and Evaluating questions

Criteria	Guiding questions
1. Activities complementing or consistent with the objectives of national forest programs and other relevant international conventions and agreements	• Is the project alligned with PPCDAM and the state plans for deforestation prevention and control? • To what other federal public policies or international agreements is the project alligned to? In what Points? • Has the project contributed or may come to contribute directly or indirectly to the reduction of emissions from deforestation or forest degradation? In what way?
2. Transparent and effective national forest governance structures, with a view to national sovereignty and national legislation	• To what extent has the project promoted the articulation between various actors (public sector, private sector, third sector or local communities)? Have instances of shared governance been used? Which? • To what extent has the project contributed to strenghtening public instruments and forest and land use management processes?
3. Respect for the knowledge and rights of indigenous peoples and members of local communities, taking into account relevant international obligations, national circumstances and laws and noting that the UN General Assembly adopted the United Nations Declaration on the Rights of Indigenous Peoples	• To what extent has the project has influenced the constitutional rights associated to the possession and formal destination of land in its area of activity? • To what extent has the project influenced the sustainable use of the natural resources in its area of activity? • If the project had as direct beneficiaries indigenous peoples, traditional communities or family farmers: were their socio-cultural systems and traditional knowledge considered and respected throughout the project? • Are there any effects that interfere with the traditional way of life of these groups? What kind of effects: in the economic or social organization, or in the use of available space and resources? In what way do they interfere?
4. Full and effective participation of stakeholders, in particular indigenous peoples and local communities, in the activities referred to in paragraphs 70 and 72 of Decision 1 / CP 16	• How did the project guarantee prior consent and local / traditional choice of representatives of its beneficiaries (especially indigenous peoples and traditional communities)? • Which participatory planning and management tools did the project apply during planning and decision making? • In case of projects with economic purposes: were any benefits arising from the project accessed in a fair, transparent and equitable way by the beneficiaries, avoiding a concentration of resources? • To what extent has the project provided the general public and its beneficiaries with free access and easy understanding of information related to project activities? • Was the project able to set up a good monitoring system for results and impacts? Has the project monitored and systematically communicated the results and their effects?
5. Activities consistent with the conservation of natural forests and biological diversity, ensuring that the activities referred to in paragraph 70 Decision 1 / CP 16 are not used for the conversion of natural forests but rather to encourage the protection and conservation of natural forests and their ecosystem services and to improve other social and environmental benefits	• How did the project contribute to the expansion or consolidation of protected areas? • How did it contribute to the recuperation of deforested or degraded areas? • In the case of restoration and reforestation activities, did the methodologies used prioritize native species? • To what extent has the project contributed to establishing recovery models with an emphasis on economic use?
6. Activities to address the risks of reversals in REDD + results	• Which factors constitute risks to the permanence of REDD + results? How did the project address them?
7. Activities to reduce the shift of carbono emissions to other areas.	• Have there been a shift of emissions prevented by the project to other areas?

4. Methodology

The methodology to be applied in the evaluation should be based on the criteria and objectives contained in the document "Evaluation of Effectiveness of Projects Supported by the Amazon Fund - Conceptual Framework".
It is expected that the following products will be generated: the Evaluation Design Report and the Evaluation Effectiveness Report on the Amazon Water Springs project. And also, at an intermediate stage, a Preliminary Effectiveness Evaluation Report, a product to be used in the consultation round.

Below is the methodology proposed for each phase and its respective stages:

Preparation phase:

• At this stage, it is necessary to define the objectives and carry out the planning of the evaluation of the Amazon Water Springs project . After preparing the TdR/ToR and hiring the team of evaluators, the key documents should be organized. To this end, the documents, data and reports that will be used to carry out the evaluation shall be identified, together with BNDES and the organization responsible for execution. The Evaluation team will systematically carry out data collection from secondary sources, which aims to compose a "memorandum" that will serve as a source of reference, leveling and memory-aid of all information related to the project to be evaluated.

Implementation phase:

• Evaluation design and tools. The Evaluation Design Report to be prepared by the team of evaluators should present the roadmap of the evaluation task, the detailed methodology and the tools that will be used during the evaluation task. This report should have the following roadmap: (a) Project's basic data; (B) Introduction; (C) TdR analysis; (D) Division of tasks, Work Plan and Logistics; (E) Design / Methodology; and (f) Appendices.

• Data collection and analysis. The methodology should be diversified, using three forms of data collection: i) Non-reactive (secondary sources: project documentation, public and scientific data available in the project area, in addition to the key documents already organized in the preparation phase); ii) Poll (field research: it can be by standardized questionnaires, interviews with individuals or groups and by the use of analysis tools such as SWOT); and iii) Observation (during the visits, participatory or individual; a counterfactual approach can be used, that is, comparing with similar cases outside the project). This is the first phase of data analysis, which aims to analyze intervention logic, the products and services performed by the project and the results achieved.

• Field mission. Its objective is to perform part of the data collection in-loco in a visit to the region where the project operates. The Evaluation Team will conduct a field visit for the time deemed necessary (to be detailed in the Evaluation Design Report), until the maximum span of 8 days.

• Preliminary report. After the field mission, the evaluation team should complement the analysis of the collected data. Therefore, a preliminary report evaluating the project's effectiveness should be generated. The division of assignments and tasks of each evaluation team member should be detailed in the evaluation design report.

Analysis and dissemination phase:

• Data analysis consolidation: Along with the complementary inputs of the Consultation Round, there should be a new analysis based on the comments and justifications presented by the project participants and the participating peers.

• Final report. The methodology and composition of the Effectiveness Evaluation Report of the Amazon Water Springs project are in the document "Effectiveness Evaluation of Projects Supported by the Amazon Fund - Conceptual Framework".

• Dissemination of results. The Evaluation Report on the Effectiveness of the Amazon Water Springs project and its executive summary will be published on the Amazon Fund website (www.fundoamazonia.gov.br).

5. Activities, products and deadlines

• The following schedule presents the basic roadmap for the evaluation of the Amazon Water Springs project. The table contains the activities, services and products and deadlines of the effectiveness evaluation process.dade.

12. Annexes VI. Term of Reference (ToR)

	Activities	Responsible person	Working days	Deadlines	Products
1	Release TdR, receive and organize proposals from consultants	GIZ (responsible for hiring)	15	10/06/2016	Consultants' proposals received and organized
2	Hire consultants and form evaluation team (consultants + GIZ)	GIZ	10	15/07/2016	Consultants hired and team formed
3	Prepare initial meeting of the team with Amazon Fund/ Hire the organization responsible for the evaluated project/ Analyse relevant documents/ Elaborate proposal for the evaluation design report	GIZ	15	25/07/2016	Proposal for the evaluation design report
4	Comment on the proposal for the evaluation design report	GERAV/BNDES DEFAM/BNDES Organization responsible for the project	3	29/07/2016	Proposal for the evaluation design report with comments
5	Revise evaluation design report	Evaluation team	3	04/08/2016	Evaluation design report revised
6	Approve revised report	GERAV/BNDES DEFAM/BNDES	3	09/08/2016	(Final) Evaluation design report
7	Implement evaluation / Conduct field mission / Systematize results etc / Prepare and deliver preliminary evaluation report	Evaluation team	25	26/09/2016	-
8	Present results (Consultation round)	Evaluation team	1	11/10/2016	Preliminary evaluation report with considerations related in the round
9	Comment on preliminary evaluation report	GERAV/BNDES DEFAM/BNDES Organization responsible for the project	5	20/10/2016	Preliminary evaluation report with comments sent after the round
10	Prepare Final evaluation report	Evaluation team	5	30/10/2016	Effectiveness Evaluation Report
11	Incorporate the presentation, preface, executive summary complementary content into the final report	Evaluation team	3	05/11/2016	Effectiveness Evaluation Report in release format
12	Translation of the final evaluation report and its appendixes	Translator/ Evaluation team	10	24/11/2016	Effectiveness Evaluation Report in release format (English)
13	Resease and distribute the Effectiveness Evaluation Report	Amazon Fund team	-	28/11/2016	Upload to BNDES site on Internet
Number of working days			**98**	--	--

6. Evaluation Team

The Amazon Water Springs project will be evaluated by a team composed of four people, two (2) experts from GIZ and two (2) external consultants to be hired by GIZ after a call published in the Brazilian Network for Monitoring and Evaluation. GIZ experts will have the following profile: one (1) senior with experience in evaluating projects and public policies in the topics covered and one (1) junior to support data collection and the elaboration of thematic diagnoses under the team's guidance. The external consultants should have the following profile: one (1) senior or full consultant, with experience in project evaluation and knowledge in institutional strengthening and environmental regularization issues and one (1) full consultant with experience in project evaluation, knowledge in forest issues and recovery of forests and degraded areas. Regarding the qualifications of the evaluators, they include the following requirements:

• Technical knowledge. The team of evaluators, in a multidisciplinary way, must have knowledge about public policies in the area of sustainable development and environment, knowledge on the elaboration, monitoring and evaluation of socio-environmental projects and on the themes addressed by the project, mainly: institutional strengthening, degraded forest areas recovery and training in forest issues.

• Methodological knowledge. The team of evaluators must be aware of the methodologies that will be used to evaluate the project, especially those related to methods for collecting and analyzing data, measuring the achievement of results and qualifying effects achieved. In addition, it is important to know instruments that allow the combination of methods to triangulate data collection, in order to increase the reliability of the results.

• Regional expertise. The team of evaluators should be aware of the regional issues of the Amazon that are dealt with under the projects supported by the Amazon Fund. It is desirable that they have professional experience in the Amazon.

Consultants cannot have any previous involvement or particular link with the project to be evaluated. The evaluation team will work without external interference, will have access to the project data to be evaluated and will obtain support to gather all necessary information. GIZ experts and consultants should treat all documentation of the Amazon Fund and the project to be evaluated with confidentiality, except for the information that should be included in the Effectiveness Evaluation Report.

7. Reports

Two reports will be produced during the evaluation process: the Evaluation Design Report and the Evaluation Report on the Effectiveness of the Amazon Water Springs project. The content of these reports will comply with what is established in item 8.1.7 of the document "Evaluation of Effectiveness of Projects Supported by the Amazon Fund - Conceptual Framework".

8. Coordination/ Responsabilities

The evaluation of the effectiveness of the Amazon Water Springs project in the Amazon will be accompanied by a Reference Group, with the following composition:

A) Representatives of the Effectiveness and Employment Evaluation Management of the BNDES Planning Area;
B) Representatives of the Management Department of the BNDES Amazon Fund;
C) Representatives of GIZ, within the scope of the Technical Cooperation project in force;
D) Representatives of the Alta Floresta government, responsible for the execution of the project to be evaluated; and
E) Evaluation team members.

The coordination of the evaluation work will be carried out by GIZ. The responsibilities of each part that make up the Reference Group are defined in item 5.1 of the document "Evaluation of Effectiveness of Projects Supported by the Amazon Fund - Conceptual Framework".

Dezembro 2016

Effectiveness Evaluation Report

AMAZON'S WATER SPRINGS PROJECT

cooperação alemã
giz
FUNDO AMAZÔNIA
BNDES O banco nacional do desenvolvimento
MINISTÉRIO DO PLANEJAMENTO, DESENVOLVIMENTO E GESTÃO
MINISTÉRIO DO MEIO AMBIENTE
BRASIL