FINAL REPORT - GCF

REPORT OF THE ACTIVITIES DEVELOPED IN THE STATE OF TOCANTINS, YEAR 2014

Technical team:

Eliana Pareja, Instituto Ecológica

Larissa Tega da Fonseca, Sustainable Carbon

Marcelo H. S. Haddad, Sustainable Carbon

Peterson Sacconi, Instituto Ecológica

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1. INTRODUCTION

1.1 Conditions of the State of Tocantins and description of livestock as an important factor in deforestation in the State

Nowadays, the State of Tocantins needs to find ways to promote the welfare of its population without accepting that their natural heritage has to be used or degraded to extinction, as if it had no value. It is true that the State is facing the challenge of promoting growth and combating poverty while considering the environmental costs involved in development policies.

Sustainable development cannot be based on a predatory model of the environmental use. The outline of sustainability involves a limitation defined at different growth proposals.

Tocantins is a relatively young State in a developing region. There is still time to develop techniques for the sustainable use of natural resources, benefiting those who possess them and all others who benefit from its existence.

In the state of Tocantins, cattle ranching has been developed through three production systems: extensive livestock farming, where animals are usually kept in native pastures without additional feeding and occupying a large area; the semi-intensive or rotational system where livestock are kept on pasturelands with a higher weight gain; and finally the intensive system, with large numbers of animals in a small area, achieving a higher weight gain than the latter and thus, a higher profitability (SEAGRO, 2014).

Tocantins is still one of the Brazilian States with the greatest tradition in beef cattle and had a cattle herd (beef and milk) of more than 8.2 million heads in 2013, where livestock occupy the largest area of the Tocantins pastures, highlighting the important contribution to the livestock sector, and moreover, providing a significant increase to deforestation (SEAGRO, 2014).

Regarding the Cerrado biome, there was a large increase in the deforestation as from 1950 due to the expansion of agricultural frontiers and public policies for the occupation of the central-western region of Brazil. The major contributions to the Brazilian CO_2 emissions are derived from changes in land use and agriculture, accounting for more than 75% of all emissions in the country (MCTI, 2010).

The deforestation activities, i.e., the conversion of forests to agricultural lands, have significantly contributed to this. The combined effects of climate change, deforestation and fires result in the decrease of the flora and fauna of the biome. Therefore, researches on vulnerability

and adaptation to the impacts of climate change are extremely necessary, particularly in the agriculture, forestry and water resources sectors in the State of Tocantins (TOCANTINS, 2012).

1.2 Brazilian GHG emissions in the land-use change and forestry sector

In October, 2010, the Ministry of Science Technology and Innovation (MCTI) launched the Second National GHG Inventory (MCTI, 2010), inventorying greenhouse gases (GHG) emissions divided by national sectors of activity. This inventory has the year-basis of 2000, but additionally, it also shows the values for the other years, from 1990 to 2005. It is concluded by this document that Brazilian GHG emissions increased by about 60% between 1990 and 2005, from 1,400 $MtCO_2e$ to 2193 $MtCO_2e$.

Around 77% of Brazil's CO_2 emissions come from the land-use change and forestry sector. Considering the global warming potential (GWP), almost 61% of Brazil's emissions come from these sectors (MCTI, 2010). Table 1 below shows national emissions divided by the sectors that were inventoried.

Table 1. Brazilian GHG emissions divided by activity sectors in 2005

Sector	$MtCO_2e$	Participation (%)
Energy	329	15.0
Industrial Processes	78	3.6
Agriculture	416	18.9
Land-use change and Forestry	1,329	60.6
Waste treatment	41	1.9
Total	2,193	100

Source: MCTI (2010)

Figure 1 below shows the distribution of 2.193 $MtCO_2e$ that were emitted in 2005, making it possible to identify the significant participation of Land Use Change and Forestry sector in the Brazilian emissions (around 61%), followed by agriculture, and then by the energy sector (MCTI, 2010).

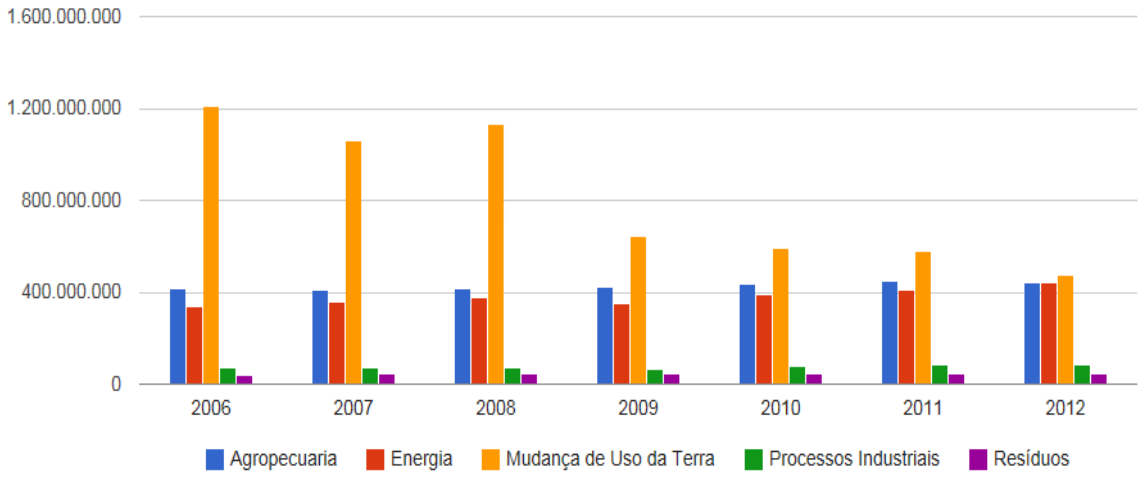
Figure 1. National GHG emissions by activity sector in 2005

Source: MCTI (2010)

As demonstrated by the Second National GHG Inventory (MCTI, 2010), the two main sectors responsible for greenhouse gas emissions are agriculture and land-use change and forestry, accounting for almost 80% of total national emissions.

However, according to the System for Estimating Greenhouse Gases Emissions (SEEG), the emissions from the land-use change and forestry sector has been decreasing and reached almost the same levels of energy and agriculture sectors in 2012, according to Figure 2 below.

Figure 2. National GHG emissions by activity sector, in tCO_2e

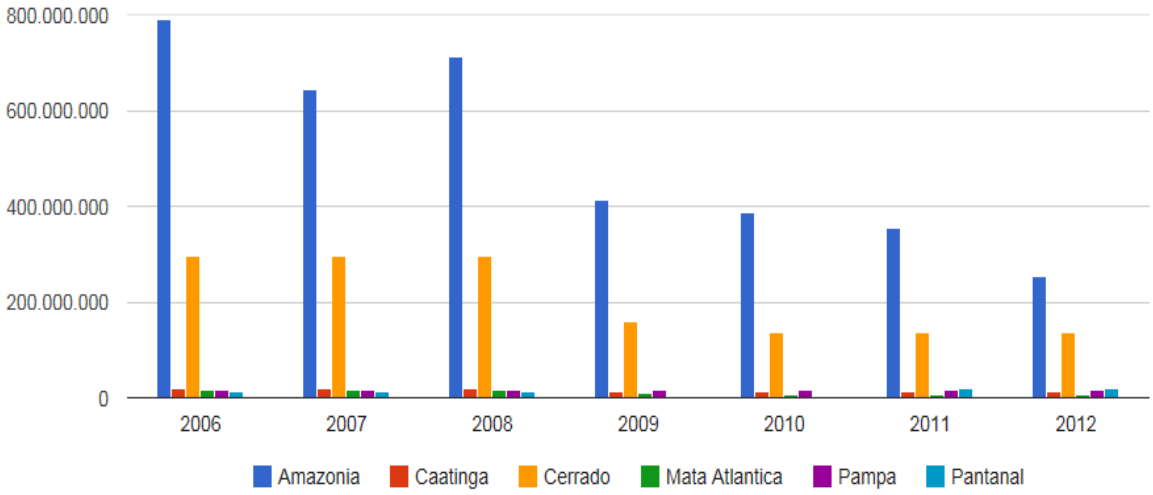


Source: SEEG (2014)

However, it can be observed at Figure 2 that GHG emissions in all other sectors of activities are increasing. Furthermore, there was a new increase in emissions from the Land-Use Change and Forestry sector in 2013 and 2014 due to deforestation. Figure 3 below shows the

GHG emissions due to deforestation by biome. The Amazon biome accounts for the largest share of emissions in the sector, followed by the Cerrado biome.

Figure 3. GHG emissions from the Land-Use Change and Forestry sector, divided per biome, in tCO_2e



Source: SEEG (2014)

1.3 REDD+ and the carbono market

Given the high rates of GHG emissions caused by the reduction of the forest cover, international discussions started to include projects that avoid deforestation as an eligible activity to receive carbon credits as an incentive to maintain the forest.

REDD+, which was first introduced in the Bali Road Map in 2007, was better defined at COP-16, in order to include the mitigation of climate change in the forestry sector through five activities:

a) Reducing emissions from deforestation;

b) Reducing emissions from forest degradation;

c) Conservation of forest carbon stocks;

d) Sustainable management of forests; and

e) Enhancement of forest carbon stocks.

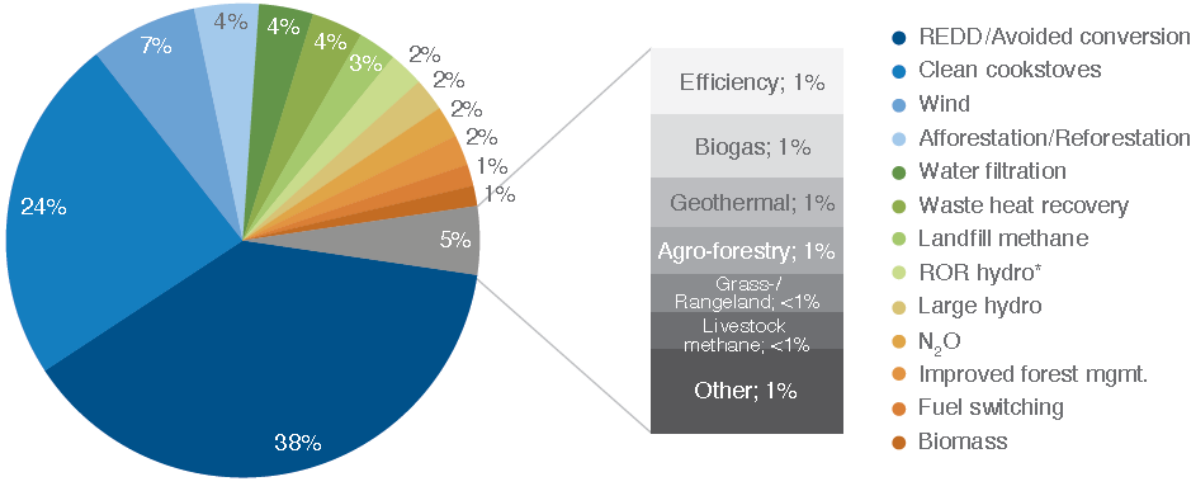
The carbon credit market was created under the Kyoto Protocol, which entered into force in 2005. This protocol allows the use of flexibility mechanisms for Annex I countries to meet their GHG reduction targets. One of these flexibility mechanisms is called the Clean Development

Mechanism (CDM), which allows the trade of carbon credits between Annex I countries and developing countries (non-Annex I). The rules and regulations of this mechanism are dictated and set by the UNFCCC.

The CDM only accepts afforestation and reforestation projects. Activities of forest conservation and avoided deforestation were excluded from the CDM due to many controversies that are still present against such projects. REDD+ mechanisms has not been accepted into the CDM yet, and therefore, avoided deforestation projects, forest conservation, and increasing forest carbon stocks, are only a new opportunity within the voluntary carbon market.

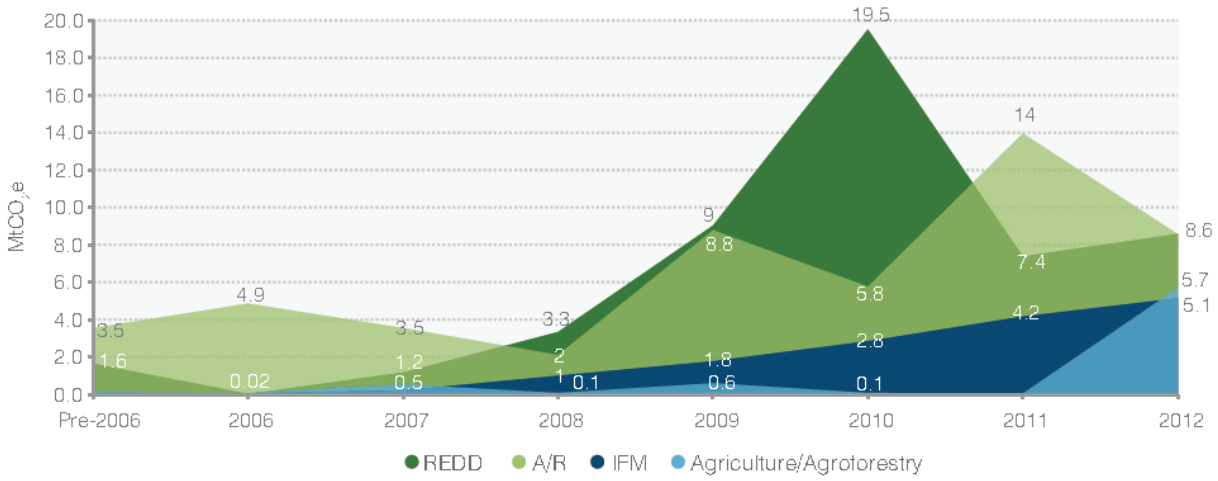
REDD+ projects that include forest conservation and reforestation were the major contributors to the transactions occurred in 2013 within the voluntary carbon markets, representing approximately 42% of the total market, according to the State of the Voluntary Carbon Markets (2014) illustrated in the Figure 4 below. Figure 5 shows the historical participation of forest carbon projects in the carbon market.

Figure 4. Historical volumes transacted by project type in 2013



Source: State of Voluntary Carbon Markets (2014)

Figure 5. Historical volumes transacted by project type in 2012, in $MtCO_2e$



Source: State of Forest Carbon Markets (2013)

As the name indicates, the voluntary market transacts carbon credits but does not comply with regulatory requirements. Both credit buyers and project developers participate voluntarily in this market. The rules of this market are set by *Standards*, which establish criteria and procedures for the development of such projects; however many of these requirements are taken from the CDM rules. There are several types of Standards, each outlining the eligible projects activities, the specific requirements and the steps necessary for their approval (HADDAD, 2013).

The main Standards utilized to develop forest projects in the voluntary carbon market are:

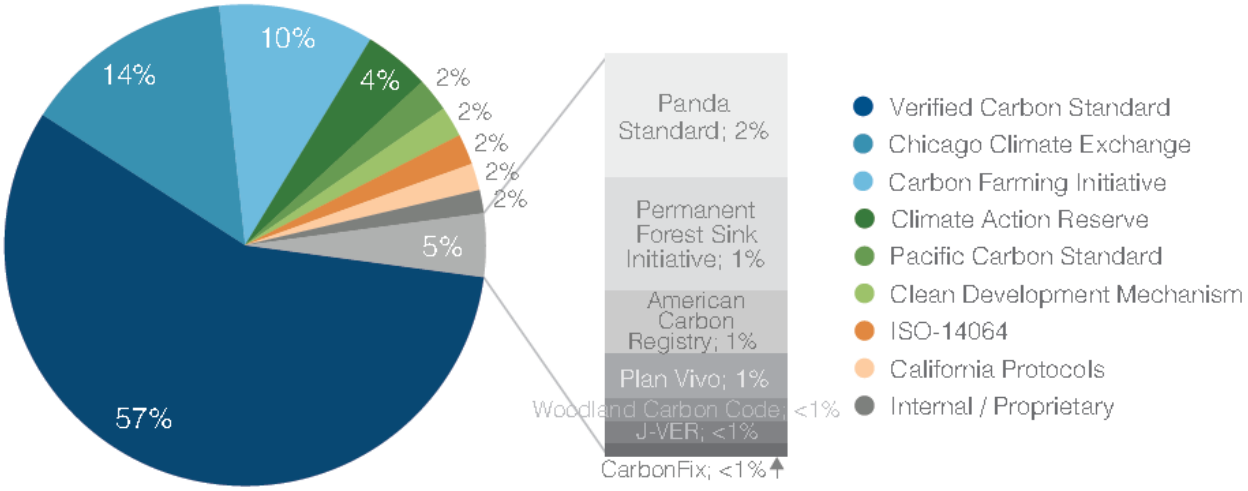
a) Verified Carbon Standard (VCS): counts for over 50% of the forest carbon market in 2012, it is the main Standard utilized to develop forestry projects (State of Forest Carbon Markets 2013).

b) American Carbon Registry (ACR): founded in 1996, is one of the oldest carbon platforms. Includes projects for afforestation/reforestation of degraded areas, avoided deforestation, improved forest management and sustainable agricultural practices.

c) Climate Action Reserve (CAR): it is utilized to develop carbon projects in North America. Includes projects for afforestation, reforestation, improved forest management, avoided deforestation and sustainable agricultural practices.

Figure 6 below shows the participation of each Standard in the forest carbon market.

Figure 6. Standards participation in the forests carbon market, 2012



Source: State of Forest Carbon Markets (2013)

1.4 The Governors' Climate and Forests Task Force (GCF)

The Governors' Climate and Forests Task Force (GCF) is a unique subnational collaboration between 22 states and provinces from Brazil, Indonesia, Mexico, Nigeria, Peru, Spain, and the United States. The GCF seeks to advance jurisdictional programs designed to promote low emissions rural development and reduced emissions from deforestation and land use (REDD+) and link these activities with emerging greenhouse gas (GHG) compliance regimes and other pay-for-performance opportunities. More than 20% of the world's tropical forests are in GCF states and provinces, including more than 75% of Brazil's and more than half of Indonesia's.

The GCF focuses on all aspects of the effort to reduce emissions from deforestation and establish lasting frameworks for low emissions development. It facilitates the exchange of experiences and lessons learned across leading states and provinces; synchronizes efforts across these jurisdictions to develop policies and programs that provide realistic pathways to forest-maintaining rural development; supports processes for multi-stakeholder participation and engagement; and seeks financing for jurisdictional programs

This study has been developed with the GCF Fund grants. The GCF Fund is a non-profit, nimble and transparent climate finance facility which was established by the GCF in 2011. The GCF Fund enhances training, capacity building, and exchange among GCF member states, provinces and regional governments within the context of a broader alignment with national

REDD+ strategies and low emissions development strategies. It achieves these goals by supporting initiatives through two umbrellas of funding: collective needs and proof of concept.

2. OBJECTIVES

The main objectives of this study are:

- ✓ Identify the potential of REDD+ mechanisms in the farms that were surveyed in the State of Tocantins;
- ✓ Create a database with the surveyed properties;
- ✓ Organize workshops and courses for the dissemination of knowledge and experiences; and
- ✓ Improve the infrastructure for a Jurisdictional System of REDD+ in the State of Tocantins.

Thus, this study aims to promote financial valuation for the maintenance and enhancement of forest carbon stocks that result in the reduction of GHG emissions from the land use-change and forestry project activities, which account for the majority of the Brazilian GHG emissions.

In addition, this project represents an excellent opportunity for combining low carbon agriculture with REDD+ activities, providing a solid base to work with Jurisdictional REDD+ in the State of Tocantins.

3. METHODOLOGY

In order to achieve the objectives proposed in this report, interviews with farmers located in several counties of the State of Tocantins were performed. The responses were analyzed in order to assess the situation of land use, deforestation agents, types of REDD+ projects that can be developed, and the potential for reduction of GHG emissions by the proposed mechanisms, among others.

These data were compiled in a report, resulting in a database of land use change in the state of Tocantins. The work was carried out following a methodology, which was performed according to the steps outlined below. In addition, the roles of each party involved in this study are also described.

3.1 Tocantins's properties profile analysis and defining strategies for data gathering

First of all, Ecologica Institute and Sustainable Carbon defined strategies for collecting and organizing the information regarding farms in the state of Tocantins. For this, Sustainable Carbon conducted a review of available information on the profile of rural properties in the State and also the possibilities for reaching out to them. Thus, data from national, state and local agencies were used to develop this first step.

As a result of this step, the essential landowners were identified (depending on farm size, location, activities undertaken, among others). Furthermore, the development of questionnaires was defined as the most suitable data collection instrument in order to meet the objectives of this study.

3.2 Identifying relevant agents and interview scheduling

Ecologica Institute and Sustainable Carbon raised potential sources of information that may have the necessary knowledge to meet the objectives of this study. It was prioritized Governmental institutions, non-governmental organizations, educational institutions, researchers, technicians and companies in the agricultural sector, as well as influential farmers in their regions.

The assistance of these agents was important to identify a wide range of farmers in the State. From this, attempts to organize interviews with these owners were made. It is important to note that some people were not available for a live interview, and for this reason questionnaires were sent by e-mail.

These partnerships also aimed to collect the maximum of information while also saving on time visits. Given the representation of partner agents in the State of Tocantins, it was considered that a significant number of farmers were interviewed.

According to Marconi and Lakatos (1996), the sampling method used for field research can be defined as intentional or non-random sampling. The intentional sample selected a sufficient amount of rural producers that could present a potential for development of REDD+ projects in the State of Tocantins.

3.3 Questionnaire elaboration

Taking into account the singular characteristics of each stakeholder identified in the previous step, questionnaires were prepared for the data collection. Sustainable Carbon and

Ecologica Institute established that questionnaires would be the best tool for the development of this report, as it would allow the participation of a greater number of owners with significant time savings while also facilitating the data processing from the survey results.

The questionnaires elaboration was focused on simplicity for ease of understanding, and thus increasing the chances of conducting interviews with less educated owners. Beyond that, it was also taken the following precautions: confirm that the important issues for the research were included; analyze the best method to prepare each issue; and care in the use of clear language and common technical terms. The geographical boundary of this study was defined as the State of Tocantins. Thus, respondents were informed that all questions should be answered with information about your property and region.

The questionnaires are divided into three sections. The first section identifies the property location and owner data. The second section brings questions about the description of the properties, such as size, biome, area of remnant native vegetation, and activities developed within the property. The third section refers to more specific questions for eligibility of REDD+ projects, such as a description of the region, the main agents of deforestation in the region, among others.

The questionnaire also presented a brief introduction about the purpose of this study. At the end of the questionnaire, a field to input notes and detailed information was available. A model of the questionnaire is in Annex I.

3.4 Interviews and questionnaire application

Data collection was done through interviews with farmers, guided by structured questionnaires as described above. Preferably, the questionnaires were applied in a live interview due to the greater flexibility that this method presents. However, some interviews were also conducted by phone or in other cases, questionnaires were sent and replied via internet.

The field surveys were conducted by Ecologica Institute, Sustainable Carbon and partners, from 06-May-2014 to 28-October-2014. Although most interviews were made spontaneously, some of them were scheduled. In total, 76 questionnaires were filled by landowners in the State of Tocantins.

3.5 Data compilation

After the questionnaires were applied, Sustainable Carbon performed data verification and then, carried out its compilation. The data analysis consisted in considering if all questions were answered, if the answers were readable, if the instructions were followed correctly, and if there was some inconsistency in the responses. In the occurrence of any of these problems, Sustainable Carbon team made new contact with the respondent in order to clarify any doubts. In case the owner was not able to resolve the doubts, the data provided were discarded.

Data obtained from questionnaires were compiled in spreadsheets. This method includes the electronic tabulation, where each response was fed into Microsoft Excel® spreadsheets. These spreadsheets were developed by Sustainable Carbon. From this spreadsheet, tables and graphs were generated for easy results analysis. Reviews and information obtained from the questionnaires were organized in Word® documents, which helped the interpretation of results.

3.6 Data interpretation

After the compilation of the data obtained via questionnaire, the data interpretation was started, which was divided in 2 sections:

- ✓ Analysis of registered properties: biomes present in the properties, classification of developed land use activities, land tenure, agents and drivers of deforestation in the region, if there is any authorization for deforestation, if they have knowledge of the law TO-Legal, compliance and maintenance of the legal reserve and permanent preservation areas;
- ✓ Analysis of potential for development of REDD+ projects: analysis of eligibility, calculation of the eligible area, calculation of the GHG emission reductions for each mechanism.

In order to calculate the eligible areas for the development of REDD+ projects, only the properties that had the land tenure regularized were considered. Furthermore, according to the ACR requirements, project areas that have been cleared of trees within the ten years prior to the project start date are not eligible.

The following conditions were considered for the calculation of GHG emission reductions by mechanisms A/R and REDD+ in registered areas, both in the Amazon and Cerrado. These mechanisms will be better described in the section 4.2 below.

The year 2011 was considered the start date for REDD+ projects. Furthermore, it was assumed that the lifetime of the project is 40 years, i.e., lasting until 2050. Thus, in accordance to ACR (2010), the lands that had any deforestation as from the year 2000 were not eligible for forestry carbon projects development.

Furthermore, a leakage of 10% was conservative estimated from the emission reduction generated. Thus, it is attributed to REDD+ projects to cause an imbalance of market and/or displacement of use and land occupation activities.

The buffer used in the calculations was 25%. Thus, it is assumed there is a significant risk of the project areas to suffer pressure from deforestation and degradation, and this large buffer tends to prevent against non-permanence of carbon stocks in the project areas.

Both the evaluation of the leakage, as the analysis of the buffer should be monitored in every verification. It is likely that with the financial revenues from carbon credits and reinvestment in the projects, a better management will be carried out, thereby reducing these figures in the next monitoring periods. However, for these estimates, it was considered that these parameters will remain the same throughout the project lifetime.

3.7 Elaboration of the final report on the evaluation of Tocantins's land properties

Once the data collection and interpretation was done, Sustainable Carbon and Ecologica Institute elaborated this report in order to describe the results and conclusions achieved regarding the analysis of registered properties and the potential of REDD+ for the State of Tocantins.

4. SURVEY DATA

4.1 Data and characteristics of the State of Tocantins used for results interpretation

4.1.1 Forests and carbon stock

According to SFB (2010), Brazil officially adopts the concept of forest defined by FAO (2004): a land area of more than 0.5 ha, with a tree canopy cover of more than 10%, and the trees should be capable of reaching a height of 5 m *in situ*, and of meeting the canopy cover requirement. This does not include land that is predominantly under agricultural or urban use.

According to this concept adopted by Brazil, approximately 79% of the existing cover vegetation in the country in 2002 could be classified as forest and 20% did not meet the forest definition. The remaining 1% fell within transition areas and pioneer formations (MMA, 2012). Table 2 below shows the percentage of different vegetation types in relation to cover vegetation existing in this biome in 2002.

Table 2. Percentage of different vegetation types in relation to the vegetation cover per biome in 2002

Biome	Forest vegetation type	Non-Forest Vegetation
Amazon	95.03%	4.97%
Cerrado	60.80%	39.20%

Source: MMA (2012)

MCTI (2010) conducted transition matrices between the categories of land use between 1994 and 2002, analyzing the area of each land use change observed by biome and its CO_2 emissions. From these matrices, it was possible to estimate the average CO_2 emissions per hectare deforested in each biome, selecting only the transitions between categories of forest that resulted in categories of deforestation. Following this rationale, having the areas of land use change and their emissions, the average carbon emissions per deforested area for each biome was calculated, as shown in Table 3. Note that these values do not correspond to the carbon stock of the biome, but only an average estimate of the carbon that is released by clearing a hectare of this forest biome. It is worth noting that these numbers may vary greatly within a biome, as each one comprises various types of forest formations. Therefore, at the project level, a more detailed analysis is necessary.

Table 3. Estimate of the average carbon emissions per hectare deforested by biome

Biome	Carbon emission per hectare deforested (tC/ha)
Amazon	135.1
Cerrado	74.0

Source: MCTI (2010)

4.1.2 Deforestation in the Brazilian biomes

Table 4 summarizes the status of the vegetation cover of the Amazon and Cerrado biomes in 2010, and also the annual deforestation rate from 2002 to 2010, compared to the remaining forest in 2002.

Table 4. Situation of the vegetation cover per biome in 2010 and the respective annual deforestation rate [1]

Biome	Area (km²)	Deforestation until 2010 (km²)	Deforestation until 2010 (%)	Deforestation since 2002 to 2010 (km²)	Deforestation annual rate since 2002 to 2010 (% per year)
Amazon	4,196,943	752,805	17.94%	125,494	0.44%
Cerrado	2,039,386	989,918	48.54%	99,180	1.08%

Sources: MMA (2012) and MCTI (2013)

It is important to note that these values do not correspond to the deforestation rate in the project area, but they are only an estimate of the deforestation rate in the biome. Therefore, at the project level, a more detailed analysis should be necessary.

4.1.3 Forest recovery

The IPCC (2003) defines the growth rates of the above-ground biomass according to the following parameters: type of forest, climatic conditions of the region and altitude. Moreover, these rates are also separated by the age of the planted forest, where it is estimated that the above-ground biomass has a higher increase during the first 20 years. Thereafter, this rate decreases, because the trees decelerate the natural growth with age, up to reach equilibrium when they reach the climax.

This growth rate is indicated by the mean annual increment (MAI), which specifies the biomass growth of a particular plant per unit area per year. Through the MAI of the dry ton of biomass matter (tdm), it is possible to calculate the amount of CO_2 sequestered per year by specific vegetation in an area. Therefore, it is necessary to multiply the MAI by 0.5 to estimate the

[1] The MMA (2012) and the MCTI (2013) consider the suppression of native vegetation such as deforestation, even if the original coverage is not characterized as forest.

fraction of carbon in the dry biomass and subsequently by 44/12, which is the ratio of the molecular weights of CO_2 to carbon (IPCC, 2003).

Table 5 presents the MAIs per biome, considering only above ground biomass, separated by age class and the average altitude of the region.

Table 5. Mean annual increment of the above ground biomass per biome (tdm/ha.year)

Biome	Age class	MAI (tdm/ha.year)	
		Altitude < 1.000 m	**Altitude ≥ 1.000 m**
Amazon	≤ 20 years	10	5
	> 20 years	1.9	1.4
Cerrado	≤ 20 years	4	1.8
	> 20 years	1	0.4

Source: *Intergovernmental Panel on Climate Change* (2003)

Along with the growth of the above ground biomass, there is also the development of roots and trunks located below the ground, as they are also one of the carbon stocks. The SFB (2014) estimated the amount of carbon stored in natural forests, divided by biome, by compartment and by year. From these data, it is possible to identify a relationship between the average biomass below and above ground, which is shown in Table 6, which follows. It is important to note that this ratio is only an estimate, and a more detailed analysis at the project level is required.

Table 6. Average ratio between above and below ground biomass per biome

Biome	Ratio above/below ground biomass
Amazon	0.19
Cerrado	0.59

Source: SFB (2014)

4.1.4 Legal requirements for rural properties

Brazil has legislation that rules the protection, conservation, and possible forests removal on private lands since, at least, 1965. However, unfortunately, despite attempts by successive changes and adjustments over time, the Forest Code has been systematically ignored and not imposed by the Brazilian Government, with a low implementation by the national agricultural sector.

Since May 25th, 2012, a new forestry code was in force in Brazil, Law nº 12.651. The main objective is to establish general standards for the protection of vegetation under permanent preservation areas (PPA) and legal reserve areas (LRA), the forest exploitation, the supply of forest raw material, control of the origin of forest products and the control and prevention of forest fires. It also includes provision of economic and financial instruments for achieving their goals (ZAKIA; PINTO, 2013).

The new law defines areas, on farms, which need to be protected and maintained as forests. There are two kinds: (I) Permanent Preservation Areas (PPA), which should be protected because of the physical and ecological fragility; (II) Legal Reserve Areas (LRAs), which represent a proportion of the area of the property that must maintain the native forest cover, along with the PPAs, contributing to the biodiversity conservation.

Furthermore, there are other important concepts:

- Legal Amazon: the States of Acre, Pará, Amazonas, Roraima, Rondônia, Mato Grosso and Amapá and the regions north of the parallel 13° S, the States of Goiás and Tocantins, and to the west of 44° W of State of Maranhão;
- Permanent Preservation Areas, PPA: protected areas covered or not by native vegetation, with the environmental function of protecting the hydric resources, the landscape, the geological stability and biodiversity, facilitate gene flow of flora and fauna, protecting the soil and assure the well-being of human populations.
- Legal Reserve Area (LRA): area located within a rural property or possession with the duties of ensuring sustainable economic use of natural resources of the rural property, to assist the conservation and rehabilitation of ecological processes and to promote the conservation of biodiversity, as well as shelter and protection of wildlife and native flora.
- Consolidated Rural Area: an area of rural property with human occupation, existing before July 22nd, 2008, with buildings, improvements or agroforestry activities, admitted in the latter case the adoption of the fallow scheme.

Every rural property must maintain the area with native cover vegetation, as a legal reserve, regardless of the rules on Permanent Preservation Areas (PPAs). The Legal Reserve Area must meet the following minimum percentages, in relation to the total property area:

• Located within the Legal Amazon:

a) 80% (eighty percent), in the property located on forest area;

b) 35% (thirty five percent), in the property located on Cerrado area;

c) 20% (twenty percent), in the property located on grasslands.

• Located in other regions of the country:

a) 20% (twenty percent).

Thus, almost all of the State of Tocantins is located within the boundaries of the Legal Amazon. In addition, a large portion of the State is located within the Cerrado biome, so it is necessary to maintain at least 35% of the property as legal reserve. If the property is located in the Amazon biome with the presence of forests, a percentage of 80% of the size of the property should be conserved. Figure 7 below illustrates the biomes in the State of Tocantins.

Figure 7. Biomes in the State of Tocantins

Another important condition for rural properties is the registration under the National Institute of Colonization and Agrarian Reform (INCRA), thus enabling the issuance of the Certificate of Registration of Rural Property (CCIR). To perform any notarial change of ownership, INCRA requires its georeferencing, which consists in the description of the rural property in their characteristics, limits and boundaries, indicating the coordinates of the vertices defining the rural properties, georeferenced to the Brazilian Geodetic System.

4.1.5 Law nº 2.713/2013 – Environmental Adaptation Program for the Rural Property and Activity - TO-LEGAL

The Environmental Adaptation Program for the Rural Property and Activity - TO-LEGAL aims to promote the regularization of rural properties and possessions inserting them into the

Rural Environmental Registration System – CAR, from the Nature Institute of Tocantins - NATURATINS.

The CAR is a nationwide electronic registration with the competent environmental agency under the National System of Information on the Environment (SINIMA), mandatory for all rural properties in order to integrate environmental information of rural properties and possessions, composing a database for control, monitoring, environmental and economic planning and to combat deforestation.

The purpose of CAR is to perform the delineation of property and land use, especially regarding the Legal Reserve Areas (LRA), Permanent Preservation Area (PPA), Restricted Use Areas (RUA), remnants of native vegetation, consolidated and disturbed areas (planting and pastures etc.). The final product of CAR exposes forms of land use, the remaining native vegetation and environmental liabilities by the farmer. The CAR is the instrument that allows the rural property owner to declare their environmental situation in relation to these obligations, the first step for environmental regularization of a rural property.

Thus, the CAR is a necessary tool for the environmental regularization of rural properties that will demonstrate whether the property is environmentally regular or is in the regularization process of the commitments set forth in the Forest Code (Law No. 12.651/2012), relating to PPA, RUA and LRA. The CAR is just one tool of the environmental regularization that can be used to begin the licensing process of the development and/or production activities subjected to licensing.

This register is a declaratory act that every owner, possessor rural or legally appointed representative must carry out within one (1) year from 06-May-2014.

The rural owner or possessor that spontaneously require the registration in CAR cannot be fined based on the Tocantins State Laws, as long as the deforestation was performed until 22-July-2008 and the responsible is complying with its obligations under the Deed of Commitment signed with NATURATINS. Additionally, this property may have access to agricultural credit, with the possibility of agricultural financing with lower interest rates and higher payments limits.

In addition, the environmental regularization of rural properties through CAR, which is encouraged by the TO-Legal Program, will provide environmental services such as maintenance of water resources, improvement of the pollination, climate control, decrease in the occurrence of pests and diseases, nutrient cycling, among others.

4.2 American Carbon Registry (ACR)

Founded in 1996 in the United States, the ACR is a program for GHG accounting in order to verify and issue carbon credits in the voluntary market. This standard is recognized worldwide for ensuring that the reduction of GHG emissions and their removal are real, measurable, additional, permanent, independently verified, conservatively estimated, with individual serial number and transparently listed in a central database. It is currently in its version 3.0 since February/2014.

Currently, there are 15 scopes of eligible activities to be performed within the ACR. To develop forest carbon credits projects, you must use the scope 14, Agriculture, Forestry, Land Use.

The ACR Forest Carbon Project Standard, v 2.1 (2010) establishes the requirements for afforestation and reforestation (A/R), improved forest management (IFM), and reducing emissions from deforestation and degradation (REDD) within the scope 14.

- ✓ **REDD**: Reducing Emissions from Deforestation and Degradation

Valuation of the standing forest, corresponding to the reduction of GHG emissions by reducing or avoiding deforestation and forest degradation, as long as it is in areas with demonstrable risk of possible changes in land use, where forest biomass will be lost. REDD can be separated into two types of projects.

The first encompasses activities that reduce or avoid planned and legally authorized deforestation to occur. The second type is for activities that reduce or avoid unplanned or illegal deforestation and/or degradation.

- ✓ **IFM**: Improved Forest Management

Projects in this category include activities that enhance the practices employed in sustainable forest management and thus increase and retain carbon storage in managed forests.

An essential condition for IFM projects is that the forest after cutting continues to match the definition of forest, both before and after implementation of the proposed improvements. In addition, the project area must have been designated, sanctioned or approved to conduct forest management by a national or local regulatory agency.

✓ **A/R**: Afforestation and Reforestation

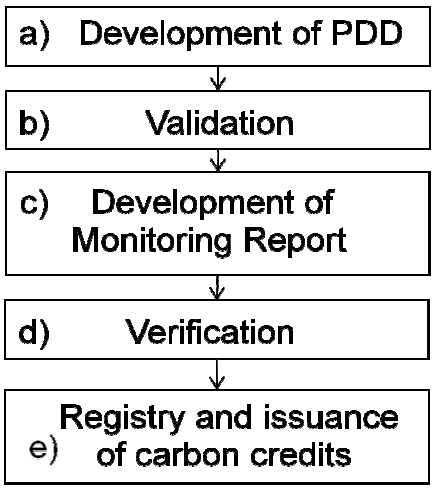
Addresses, this time, activities that restore forest cover through planting, seeding and / or natural regeneration with human assistance. In this mode there are projects involving afforestation and reforestation in non-forested areas, as long that it was not present before the start of project implementation, coverage by native ecosystems for 10 years prior to project implementation.

4.2.1 ACR requirements for the development of REDD+ projects

Figure 8 below shows the cycle of the carbon project within the ACR. The first step is to prepare the Project Design Document (PDD), containing a description of the project, the duration (lifetime) and the crediting period, the baseline conditions, analysis of additionality, monitoring plan, the amount of estimated emissions reduction, among other information. The next step is the validation of the project, which must be carried out by a third-party company, accredited by the ACR. The validation has the objective of auditing the carbon project.

The Monitoring Report should be conducted in order to obtain carbon credits, indicating the amount of emission reduction achieved by the project in a given period of time. This report must be verified by a third-party company with the purpose of auditing the monitoring report. Finally, each verified carbon credit receives a serial number and it should be issued in a registry system.

Figure 8. Project cycle



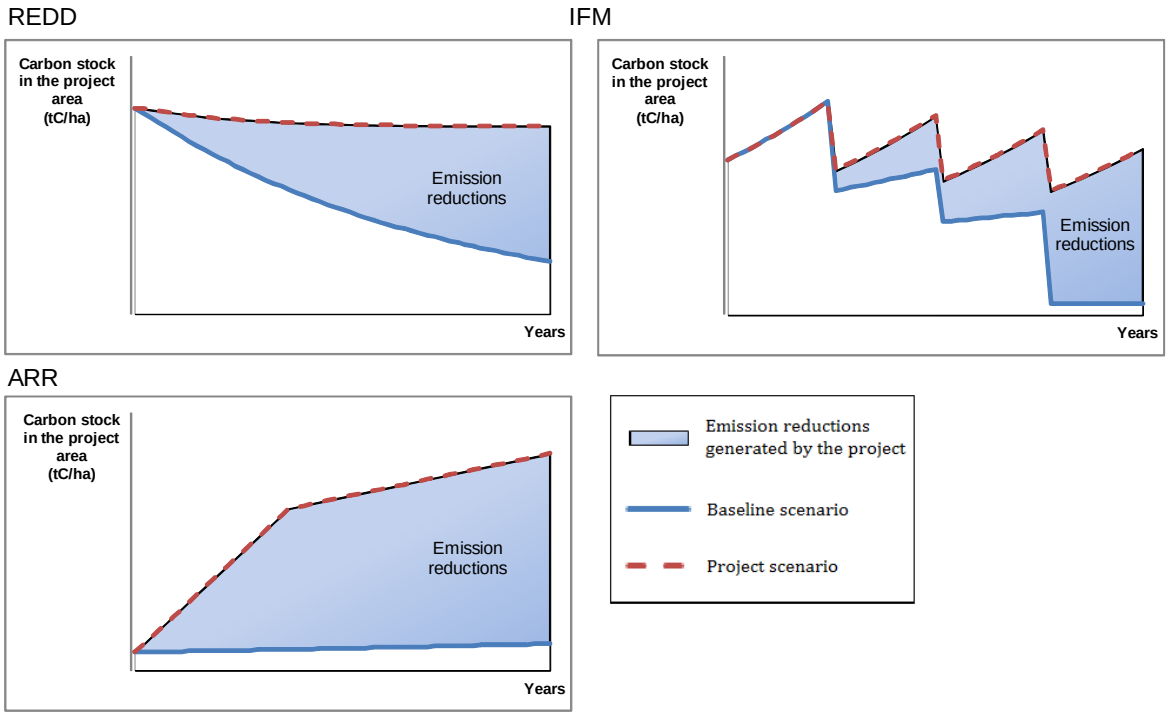
The next topics present the requirements for the development of REDD+ projects following the ACR Standard, in accordance with the Forest Carbon Project Standard, v 2.1 (2010), and The American Carbon Registry Standard, v.3.0 (2014).

4.2.1.1 Baseline for the development of REDD+ projects

The project baseline scenario is a long-term projection of the forest management practices or activities that would occur, or the absence thereof, within the project's physical boundaries in the absence of the project. The baseline is a counterfactual scenario that depicts the likely stream of emissions or removals expected to occur if the Project Proponent does not implement the project. Change in carbon stocks or emissions of GHGs over time relative to the baseline is the basis for a project's Net Emission Reductions – the difference between emissions and removals in the project scenario vs. emissions and removals in the baseline scenario, less any deductions for leakage. Figure 9 below illustrates the comparison between the project scenarios (dashed line) and baseline scenario (solid line) for REDD, IFM and A/R projects. The area formed between the two lines is exactly the emission reductions generated by each type of project.

This step includes the comparison of different likely scenarios to occur in the absence of the project. The most likely to succeed must be adopted as the baseline, given the history of the region and the analysis of the drivers of deforestation. Moreover, this is also the basis for the analysis of the additionality, described below.

Figure 9. Comparison between the project scenarios (dashed line) and baseline scenario (solid line) for REDD, IFM and A/R projects



In addition, after choosing the most appropriate baseline scenario, it is possible to select the applicable methodology for the project. It is the methodology that establishes the rules for measuring and accounting for GHG specific project types and circumstances.

4.2.1.2 Eligibility requirements for REDD+ projects

ACR accepts projects on all land ownership types – private, public (municipal, county, state, federal, or other), and Tribal – provided the Project Proponent demonstrates that the land is eligible, documents clear land title and offsets title, the offsets contract is enforceable, and the project activity is additional and meets all other requirements of the ACR, including baseline definition. Projects on public lands, like any other project, shall demonstrate that the activity is not required by regulations and meets other additionality criteria.

Project Proponents shall provide documented evidence that no project areas have been cleared of trees within the ten (10) years prior to the project start date, i.e., when the project started.

AFOLU projects with a Start Date of 01 January, 2000 or later are eligible for registration in the ACR Standard. Moreover, projects whose Start Date is more than two years prior to the date of listing must provide documentation that GHG mitigation was an objective as of the Start Date. This documentation must provide evidence, based official, legal or other corporate documentation that was available to third parties at or prior to the Start Date of the Project Activity, that GHG mitigation and/or the sale or retirement of carbon credits was considered in the decision to proceed with the Project Activity.

All A/R projects shall have a Crediting Period of forty (40) years and all REDD projects shall have a Crediting Period of ten (10) years. The shorter Crediting Period for these activities is necessary due to potentially more rapid change in baseline conditions. ACR does not limit the allowed number of renewals.

4.2.1.3 Additionality

A key step for all REDD+ projects is to demonstrate additionality, i.e., prove that they are additional to what would have occurred in the baseline or other business as usual scenario. In other words, it should be demonstrated that the REDD+ project would not be feasible in the absence of financial resources from the carbon credits revenues generated by the project.

Every project shall use either an ACR-approved performance standard and pass a regulatory surplus test, or pass a three-pronged test of additionality in which the project must: 1) exceed regulatory/legal requirements; 2) go beyond common practice; and 3) overcome at least one of three implementation barriers: institutional, financial or technical. If these three steps are met, the project is considered additional, thus having the potential to be developed in ACR.

It is important to note that, according to the Brazilian Forest Code (Law 12,651 / 2012), the maintenance activities of the Permanent Preservation Areas, Legal Reserve and restricted use areas are eligible for any payments or incentives for environmental services, configuring additionality for any national or international markets of GHG emission reductions.

4.2.1.4 Precision and the uncertainty deduction

The Project Proponent should reduce, as far as is practical, uncertainties related to the quantification of GHG emission reductions or removal enhancements.

ACR requires that the 90% statistical confidence interval of sampling be no more than 10% of the mean estimated amount of emission reduction/removal. If the Project Proponent cannot meet the targeted ±10% of the mean at 90% confidence, then the reportable amount shall be the mean minus the lower bound of the 90% confidence interval, applied to the final calculation of emission reductions/removal enhancements. The precision target is applied across the project, not within particular carbon pools or strata.

4.2.1.5 Permanence

Permanence refers to the longevity of an emissions reduction/removal and the risk of reversal, i.e. the risk that atmospheric benefit will not be permanent. Fire, disease, pests, and other natural disturbances may cause unintentional reversals. Forest offsets are inherently at some risk of reversal, but this risk can be assessed and mitigated and the offsets thus made fungible with other offsets and allowances.

Project Proponents shall assess general and project-specific risk factors using an ACR-approved risk assessment tool. Project Proponents shall mitigate reversal risk by contributing carbon credits from the project itself to the ACR buffer pool.

To assess the risk of reversal, Project Proponents shall conduct a risk assessment addressing both general and project-specific risk factors. General risk factors include risks such as financial failure, technical failure, management failure, rising land opportunity costs, regulatory and social instability, and natural disturbances. Project-specific risk factors vary by project type. Project Proponents shall conduct their risk assessment using the ACR Tool for Risk Analysis and Buffer Determination. Only until the release of this tool, Project Proponents shall use the most updated version of the VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination.

The Project Proponent shall conduct this risk assessment and propose a corresponding buffer contribution (if applicable). The risk assessment, overall risk category, and proposed buffer contribution shall be included in the GHG Project Plan. ACR evaluates the proposed overall risk category and corresponding buffer contribution (if applicable). The verifier evaluates whether the risk assessment has been conducted correctly.

ACR requires Project Proponents to commit to a Minimum Project Term of forty (40) years for project continuance, monitoring and verification.

4.2.1.6 Leakage

Leakage is the displacement of GHG emissions from the project's physical boundaries to locations outside of the project's boundaries as a result of the project action. Leakage includes both activity-shifting and market effects. The specific types of leakage that must be accounted for and mitigated depend on the project type and design of the activity.

Project Proponents shall assess, account for, and mitigate certain types of leakage. Project Proponents shall deduct leakage that significantly reduces the GHG emissions reduction and/or removal benefit of a project.

4.2.1.7 Social and Environmental Impacts

Projects have the potential to generate both positive and negative community and environmental impacts. ACR requires community and environmental impacts to be net positive overall. Project Proponents shall document a mitigation plan for any foreseen negative community or environmental impacts, and shall disclose any negative environmental or community impacts or claims (by community members only, not external stakeholders) of negative environmental and community impacts.

ACR requires community and environmental impact assessment, and provides tools that may be used to assist in that assessment, but does not mandate a particular process or tool be used. Therefore, in order to analyze the ongoing sustainability of the project and demonstrate the positive impacts from its activities, it is recommended to use the an additional Standard from the ACR, such as the CCB Standards or SOCIALCARBON.

4.2.1.8 Monitoring

The monitoring will measure, through fieldwork and satellite images, carbon stocks in forest (or the area to be reforested) on each carbon stock included in the project, as well as changes in these stocks.

Usually with the assistance of sampling, measurements of height and diameter at breast height (DBH) of the trees are performed to determine the above-ground live biomass. The collection and analysis of soil, litter and dead wood will provide carbon values in these other stocks, while the belowground biomass is usually calculated using equations or a ratio with the living above ground biomass.

On the other hand, the step of tracking the changes in the land use and forest cover is performed through analysis of satellite images of different points in time, making possible to observe the changes in each forest physiognomy. Some more advanced remote sensing technologies can also help in the measurement of carbon stocks, thereby reducing the fieldwork.

4.2.2 REDD+ Methodologies approved by ACR

Until 25/October/2014, the ACR had 3 approved methodologies for developing REDD+ projects in other countries except the United States.

The ACR generally accepts methodologies and tools approved by the Clean Development Mechanism (CDM). However, the project proponents wishing to use a CDM methodology must first perform a consultation to the ACR for a review of its applicability conditions.

4.2.2.1 Approved methodologies for the development of A/R projects

- ✓ *Afforestation and Reforestation of Degraded Lands*

This methodology is a revision of CDM Methodology AR-ACM0001.

This methodology is applicable to projects conducting afforestation and reforestation (A/R) on lands that are expected to remain degraded or continue to degrade in the absence of the project.

In addition, if at least a part of the project activity is implemented on organic soils, drainage of these soils is not allowed and not more than 10% of their area may be disturbed as result of soil preparation for planting.

Other applicability conditions are that the land does not fall into wetland category, litter shall remain on site and not be removed in the project activity, and ploughing/ripping/scarification is limited to the first five years from the year of initial site preparation and shall not be repeated within a period of 20 years.

4.2.2.2 Approved methodologies for the development of REDD projects

- ✓ *REDD Methodology Modules*

The REDD Modules are applicable to projects reducing emissions from planned deforestation, unplanned deforestation, and degradation through non-renewable fuel wood collection and charcoal production. The modular approach is an effort to streamline methodology development and use. Rather than developing unique methodologies on a project-by-project basis, each aspect of the project from baseline setting to measurement, monitoring and leakage is treated

in a discrete and independent module. Individual modules that are applicable to a specific project's circumstances can then be selected to create an overall methodology for the project.

The REDD Modules may be used on their own for project-level REDD activities, or alternately combined with ACR's Nested REDD+ Standard to register project-level activities nested within a jurisdictional accounting framework. In the latter case the REDD Modules would be used to account for methodological components not addressed by the jurisdictional accounting framework.

There are 3 different modules for the determination of baseline, 4 for leakage, 1 for monitoring, 2 miscellaneous modules and 4 tools.

- ✓ *Reducing Emissions from Deforestation and Degradation (REDD) – Avoiding Planned Deforestation*

This REDD-APD methodology is applicable only to the REDD sub-category Avoiding Planned Deforestation (APD). Thus, the intention of performing the deforestation shall be properly documented, making it possible to identify those responsible for the forest suppression. In this type of project, it is already known the size of the area that would be cleared and the volume of wood that would be explored, and from this figures, the amount of emission reductions to be generated by the forest conservation project (REDD) can be calculated.

4.2.3 Jurisdictional REDD+ and Nested Systems

The ACR Nested REDD+ Standard, v1.0 (2012) provides the requirements for registration of REDD+ activities at a project level, following the baseline requirements, assessment of leakage, monitoring, and other technical requirements at the jurisdictional level, provided they meet certain minimum criteria. The ACR Nested REDD+ Standard also defines the requirements for social and environmental safeguards for REDD+ projects registration.

"Jurisdiction" is defined as any politically defined region delineated for purposes of measuring carbon stocks, deforestation rates and reduction of GHG emissions through REDD+ activities. A jurisdiction may be a national or sub-national (nation, state, province, district, etc.) political entity, although other ways of defining jurisdictional boundaries are also possible.

A “nested” REDD+ project is one that is accounted and monitored in reference to the jurisdictional accounting framework (baseline, leakage assessment, monitoring requirements, etc)

in which the project takes place. This can be beneficial in reducing costs because it allows to use the baseline and other requirements developed by jurisdiction rather than having to develop them at the project level. Meanwhile, the creation of such structures can help jurisdictions to attract private capital for REDD+.

To make sure that nested REDD+ projects registered in ACR meet the same standards as non-nested projects, it is important to establish the jurisdictional criteria for baselines, evaluations of leakage, monitoring and non-permanence risk mitigation. The ACR Nested REDD+ Standard establishes minimum criteria that must be met for a nested project under this ACR registry. In addition, this standard specifies how the differences between project level and jurisdictional level can be reconciled.

Thus, this initiative makes possible that isolated REDD+ projects nest themselves, i.e., to integrate at a jurisdictional level, allowing greater alignment with national policies and legislation. It is also possible to connect these independent projects with a national goal of reducing GHG emissions, thus providing a significant potential for climate change mitigation by the forestry sector.

The intent is to reduce approaches uncertainties, ensuring that all projects and other REDD+ activities in a given jurisdiction are developed using consistent baselines in accordance with policies and national and/or subnational programs, aimed at reducing the emissions. In addition, this program will promote the leakage risks minimization by monitoring emissions in the entire jurisdiction area, increasing, in this way, the global confidence in REDD+ projects.

Another purpose of this system is to ensure that the emission reductions generated by a project gains scale to a jurisdictional level, whether national or subnational. Thus, these carbon credits can be accounted into a national registry system, which in turn will promote a fair distribution of benefits among project participants, also minimizing the risk of double counting.

4.3 Implementation of the REDD+ mechanisms in the State of Tocantins according to the ACR requirements

4.3.1 Reducing Emissions from Deforestation and Degradation (REDD)

Mainly due to the socioeconomic pressure, deforestation in Brazil has not followed any effective planning. Given these conditions, the type of REDD project that suits to be the best

scenario in Tocantins is one that reduces or avoids unplanned illegal deforestation and/or degradation.

One method to estimate the carbon credits generation from such project in determined area would be to calculate the annual rate of deforestation in the region where it is located. Thus, it is possible to determine the area that would be deforested annually in the absence of a REDD project, which is equivalent to the baseline. Based on the forest carbon stock, it is possible to estimate the amount of tons of CO2e (tCO2e) that avoid to be emitted into the atmosphere per year.

The equation for estimating the GHG emissions reductions by REDD in each biome is presented below:

$$RE_{REDD} = (ELB_{REDD} - EP_{REDD} - Leakage) \times (1 - Buffer) \quad (1)$$

Where,

RE_{REDD}: estimated GHG emissions reductions by REDD, in tCO_2e;

ELB_{REDD}: estimate of GHG emissions in the baseline, in the absence of the REDD project, in tCO_2e;

EP_{REDD}: estimate of GHG emissions caused by the REDD project, in tCO_2e;

Leakage: estimated as 10% from project's emissions reduction, in tCO_2e;

Buffer: evaluation of non-permanence risk, estimated in 25% for this work.

In 40 years, the GHG emissions in the baseline (in the absence of the REDD mechanism) in each biome (ELB_{REDD}) are estimated as follows:

$$ELB_{REDD} = \left[Area_{REDD} \times Annual\ deforestation\ rate \times Forest\ carbon\ stock \times \left(\frac{44}{12}\right) \times t\right] \quad (2)$$

Where,

$Area_{REDD}$: eligible area of each biome with potential for developing REDD projects, in hectares;

Annual deforestation rate: average deforestation rates between 2002 and 2010 in the Cerrado and Amazon biomes, in % per year, according to MMA (2012) and MCTI (2013);

Forest carbon stock: average forest carbon stocks of each biome formations, in tC/ha, according to MCTI (2010);

$\frac{44}{12}$: proportion between the molecular weights of CO_2 and C;

t: project lifetime, in this case, 40 years.

The area with potential for REDD development was estimated as follows:

$$Area_{REDD} = (Registered\ area) \times (Forest\ occurence\ in\ the\ biome) \quad (3)$$

Where,

Registered area: area registered through the questionnaires in each biome, in hectares;

Forest occurrence in the biome: percentages of the vegetation cover of each biome that presents forest characteristics, in %, according to MMA (2012).

The percentage of the biome vegetation cover that presents forest characteristics is necessary due to the fact that REDD projects can only be developed in areas with forest physiognomy (ACR, 2010).

For the project scenario, it was conservatively estimated that even with the REDD project, a low deforestation in the area would still occur, rated as 5% of the annual deforestation rate at the baseline. Thus, GHG emissions caused by the REDD project in each biome (EP_{REDD}) were calculated as follows:

$$EP_{REDD} = \left[Area_{REDD} \times Annual\ deforestation\ rate\ with\ the\ REDD\ project \times Forest\ carbon\ stock \times \left(\frac{44}{12}\right) \times t\right] \quad (4)$$

Where,

Annual deforestation rate with the REDD project: deforestation rate in the REDD project scenario, estimated as 5% of the baseline deforestation rate, in % per year.

4.3.2 Afforestation and Reforestation (A/R)

According to ACR (2010), to be eligible, A/R projects should be developed in non-forested areas, provided that they were forests in the past and have been deforested for more than 10 years prior to planting.

Thus, in this estimate, the application of this mechanism in Brazil was restricted to the restoration of degraded areas in registered properties where the owner wants or must perform the reforestation. However, there were disregarded areas that were cleared after 2000, and only include those which, even before this year, had already been defined as a forest.

Through the trees growth rate used in the A/R project, depending on the biome, age and height, you can calculate the increase in carbon stocks in the project area, and thus estimate the

CO_2 sequestration from the atmosphere. This value is then compared to what would happen in the absence of the A/R project, thus obtaining the emission reductions generated by the planting.

The equation for the estimation of the GHG emission reductions generated by A/R follows:

$$RE_{ARR} = \left(RP_{A/R} - RLB_{ARR} - Leakage\right) \times (1 - Buffer) \quad (5)$$

Where,

$RE_{A/R}$: estimate of GHG emission reductions generated by A/R, in tCO_2e;

$RP_{A/R}$: estimate of GHG removals caused by A/R project, in tCO_2e;

$RLB_{A/R}$: estimate of GHG removals in the baseline scenario (in the absence of the A/R mechanism), in tCO_2e;

Leakage: estimated as 10% of the emission reductions generated by the project, in tCO_2e;

Buffer: evaluation of non-permanence risk, estimated in 25% for this work.

The GHG removals by A/R projects ($RP_{A/R}$), during the 40 years project lifetime, are estimated as follows:

$$RP_{ARR} = \left\{\left[\left(Area_{A/R} \times MAI_{\leq 20} \times Period_{20} \times CF \times \left(\frac{44}{12}\right)\right) + \left(Area_{A/R} \times MAI_{>20} \times Period20 \times CF \times 4412 \times 1 + R\right)\right.\right. \quad (6)$$

Where,

$Area_{ARR}$: eligible area with potential for developing A/R projects, in hectares;

$MAI_{\leq 20}$: mean annual increment in the biome, for age classes ≤ 20 years, in tdm/ha.year, as according to IPCC (2003);

$MAI_{>20}$: mean annual increment in the biome, for age classes > 20 years, in tdm/ha.year, as according to IPCC (2003);

$Period_{20}$: 20 years period;

CF: carbon fraction in dry biomass, estimated as 0.5 tC/tdm, according to IPCC (2003);

$\frac{44}{12}$: proportion between the molecular weights of CO_2 and C;

R: biomass proportion between below ground/above ground biomass, SFB (2014).

The multiplication by the percentage of the biome that presents forest characteristics is necessary due to the fact that A/R projects cannot be developed in ecosystems that were not forest in the past.

$$Area_{A/R} = (A/R\ Registered\ area) \times (Forest\ occurence\ in\ the\ biome) \quad (7)$$

Em que,

A/R Registered area: non forested area in each biome, eligible for A/R projects, registered through the applied questionnaires, in hectares;

Forest occurrence in the biome: percentages of the vegetation cover of each biome that presents forest characteristics, in %, according to MMA (2012).

It was considered that, in the baseline scenario, degraded pastures would have a low forest recovery because they would be abandoned. The GHG removals estimate in the baseline ($RLB_{A/R}$) would be around 20% of which would occur in the project scenario, as the following equation:

$$RLB_{A/R} = RP_{A/R} \times 0.2 \quad (8)$$

Thus, the GHG removals at baseline ($RLB_{A/R}$) was subsequently subtracted from the total credits generated by A/R projects.

4.4 Social Carbon Methodology

The term "Social Carbon" was created in 2000 by Ecologica Institute. There was a need for the elaboration of a tool that could assess the contribution from the Carbon Sequestration Project in the surrounding of the Bananal Island, located in Tocantins, promoted by the same Institute. Ecologica Institute (EI) is a nonprofit, independent organization, and has the mission of reducing the effects of climate change through scientific research, environmental protection, and the establishment and support of sustainable development programs with local communities (REZENDE; MERLIN, 2009).

The Bananal Island project development originated the Social Carbon methodology based on the Sustainable Livelihood Approach (SCOONES, 1972). According to Rezende and Merlin (2009), the methodology consists of basic guidelines centered on the point of view of communities and a conceptual framework that provides an overview of the situation.

The purpose of this methodology is to monitor the social, environmental and economic performance of the project, to encourage the active participation of the affected communities in the project development, to solve problems and to pursue the sustainability.

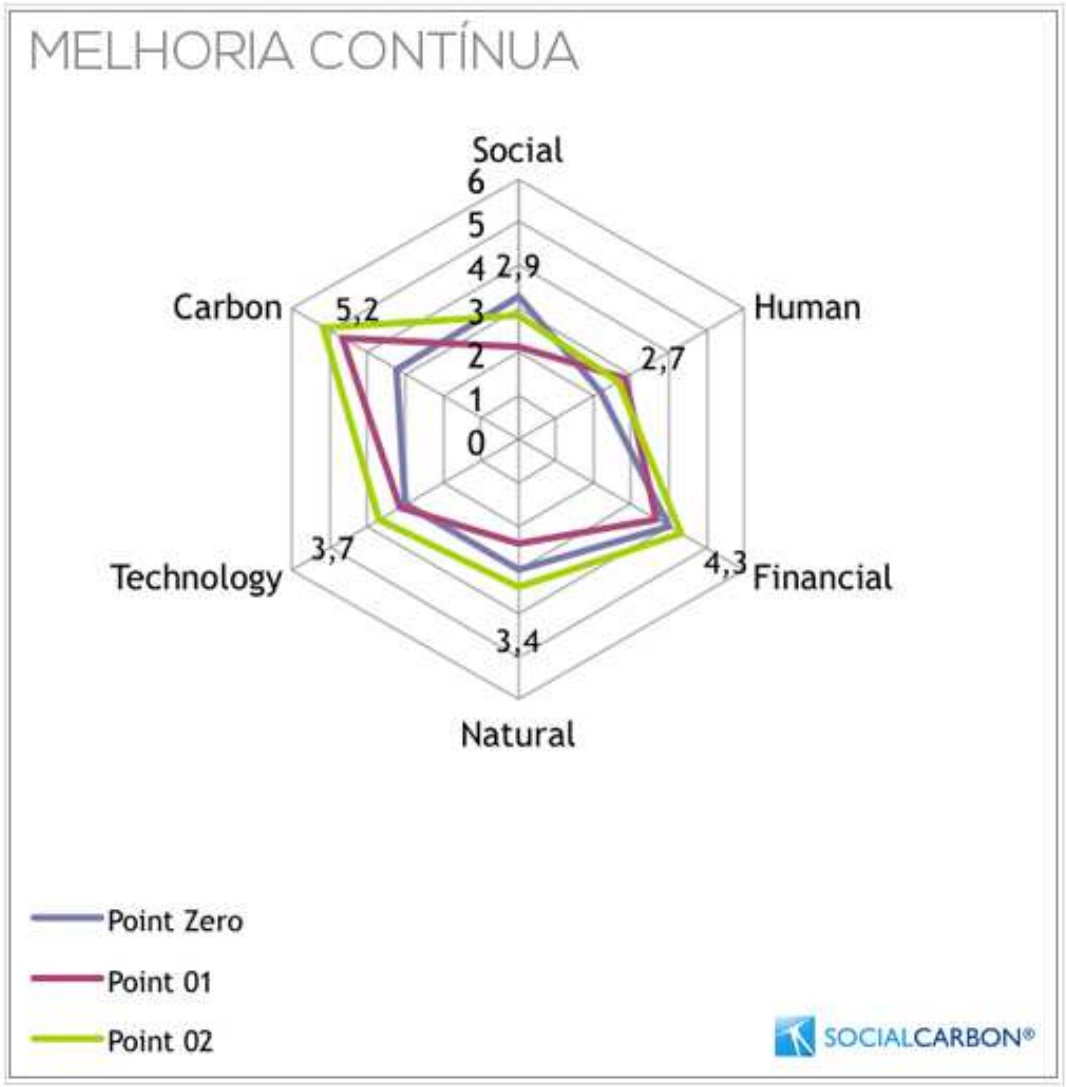
The methodology holistically evaluates the performance of social, human, financial, natural, biodiversity and carbon resources that aim to monitor the sustainability of a project or community. These resources are defined as:

- ✓ Social Resource: Working networks, social duties, social relationships, affiliations, and associations.
- ✓ Human Resource: Measurable skills, knowledge, professional qualifications and health and welfare.
- ✓ Financial Resource: Basic capital in the form of cash, credit/debit and other economic goods which are available or may become available.
- ✓ Natural Resource: The stock of natural resources (soil, water, air, etc.) and environmental services (soil protection, maintenance of hydrological cycles, pollution
- ✓ sinks, pest control, pollination, etc.), from which resources for livelihoods are derived.
- ✓ Biodiversity Resource: The combination of species, ecosystems and genes that form biological diversity. Relevant aspects of this component are: the integrity of natural communities, the way people use and interact with biodiversity, the degree of conservation, pressures and threats imposed on native species, and the existence of high-priority areas for conservation.
- ✓ Carbon Resource: The type of carbon project developed, encompassing the methodologies utilized and project performance.

Social Carbon's resources are considered necessary to achieve a "sustainable livelihood" in a particular project or community. The methodology uses the definition of "sustainable livelihoods" as the integration of equity, capacity and sustainability. In this, equity is the distribution of income more equally; capacity is related to what the individual is able to do with the skills that he has and how to make use of opportunities; and sustainability is based on the classical definition of the Brundtland Report (1991, p.9), "that meets the needs of the present without compromising the ability of future generations to meet their own needs".

As a visual representation, the SCM uses a hexagon containing information on the project performance. As can be seen in Figure 10 below, each point of the hexagon corresponds to the performance of a resource. The hexagon has a scale from zero to six, where the center is the minimal access to resources and the point is the maximum access. The analysis of the hexagon should be done holistically because the review of independent resources is not enough.

Figure 10. Social Carbon Hexagon



Source: Social Carbon

One of the challenges that SCM faces is to establish indicators for each of the above mentioned resources, thus the benefits and impacts of a carbon project activities can be evaluated, identifying the specific contributions of the project to communities.

4.4.1 Development of Social Carbon indicators

According to Rezende and Merlin (2003), the SCM was created with the goal of ensuring that projects aiming to reduce GHG emissions can make a contribution to sustainable development, through a method of evaluation and measurement of the benefits achieved by the

communities involved in the projects and ensure that the environmental services provided by communities are appropriately evaluated.

The methodology is based on six features: Social Human, Financial, Natural, Biodiversity, and Carbon. Each resource must provide adequate indicators for each subject. The number of indicators varies depending on the project needs, although the SOCIALCARBON Standard recommends at least three and maximum of ten indicators to each of the six resources.

For the development of the indicators, SOCIALCARBON Standard provides a guide called "Template and Guidance for Submission of New SOCIALCARBON® Indicators" (SOCIALCARBON STANDARD, 2013).

The methodological steps are:

- ✓ Listing of the main aspects and consequences related to the implementation of the project.
- ✓ Listing the potential stakeholders, either directly and indirectly affected by the project activities.
- ✓ Listing of main constraints (risks) for the project's development.
- ✓ Based on the above data, relevant indicators to be monitored throughout the life cycle of the project can be identified, distributed in six resources used by the methodology. Then the indicators obtain points ranging from the worst situation, scenario one, to the best situation, scenario six. Table 7 below shows how the classification of the scenarios is conducted.

Table 7. Scenario Classification (SOCIALCARBON STANDARD, 2013)

Points	Classification	Characteristics
1 e 2	Critical	Irregularities; high environmental risk; significant level of environmental and social degradation; or situation of extreme difficulty, which significantly compromises the life quality of the population.
3 e 4	Satisfatory	Meets all legal requirements relating to their activities; exceeds by adopting best practices and voluntary actions in some cases; or life quality reaches a minimum acceptable standard, but requires improvement.
5 e 6	Sustainable	Beyond the legal obligations and/or market common practices, the project adopts the best possible practices for the sector; or communities reached a sustainable livelihood with adequate access to materials and social goods, are able to recover independently from stressful situations, and are not causing the deterioration of key environmental resources through their activities.

4.4.2 Social Carbon indicators applied to REDD projects in the State of Tocantins

The Social Carbon methodology can be applied to different types of projects, from small projects focused on income generation for local communities, to large companies such as hydropower.

It is important to note that forestry projects have many particular aspects due to various aspects, such as the various types of forest formations, the communities living in the area and around the project location, scale of the project, among others.

Therefore, the Social Carbon Methodology can be applicable to different projects scales, being flexible on the adaptation of indicators to different local realities. This way, the SCM turns to be a good tool for evaluating and measuring the co-benefits generated by REDD+ projects.

Based on the local reality of Tocantins, the most applicable indicators were selected, which will assess the impacts of the development of a REDD+ project in the State of Tocantins.

Table 8. List of potential social, economic and environmental impacts by a REDD project

Activity	Aspect	Impact	Effect	
			Beneficial	Adverse
REDD: Carbon credit project	Conservation of the Cerrado biome	Greenhouse Gas Emissions Reductions	X	
REDD: Carbon credit project	Conservation of the Cerrado biome	Monitoring and supervision to avoid deforestation of forest within the project area	X	
REDD: Carbon credit project	Conservation of the Cerrado biome	Conflict management with communities in the project area, due to banning of timber product extraction		X
REDD: Carbon credit project	Empowerment	Increased independence of the communities in the project area	X	
REDD: Carbon credit project	Application of the Social Carbon methodology	Encouragement and investment in research on social, economic and environmental aspects in the project region.	X	

Table 9. List of the main stakeholders affected by the project

Stakeholders	Brief description of how the project affects the stakeholders mentioned
Communities living inside and surrounding the project area	Potential improvement of living conditions, including food production and gathering, water availability, employment, energy availability and education. Potential limiting/ prohibition of access to timber, firewood, Non Timber Forest Products (NTFPs), extraction of food products and limiting/ prohibition of further deforestation for agriculture or living areas.
Project area Municipalities	Involvement in legal issues involving: opposition of community to prohibition of timber or firewood harvesting; questions of land tenure involving residents
Environmental Agency(ies) of Project Municipality(ies)	Collaboration with project proponents in terms of communication and logistics, for example providing space for stakeholder consultations, keeping of minutes of meeting.
Agriculture Agency(ies) of Project Municipality(ies)	Potential collaboration with environmental/ agronomy programs.

Table 10. List of significant risks for the project

Activity	Aspect	Risk	Comments/observation
REDD: Carbon credit project	Uncertainties relating to standing forest in the future	Non permanence of carbon: Time which carbon will remain stocked in live biomass, without being emitted into the atmosphere. Due to the uncertainties relating to what will happen to the forest in future, there is a risk of non-permanence of forest carbon	Monitored by the Carbon resource: - Buffer reduction

Table 11. List of the potential indicators for the social resource

Indicator	Description
Extent of community education/training and alternative income sources	Evaluates whether the community education/training and alternative income sources implemented by the carbon project extend to the entire project area and, preferably, covering the leakage management area as well
Social research	Examines level of research into social, demographic and economic aspects of communities in the project. Relevant research for the project includes: - Community satisfaction survey: gauging opinions of the all projects affecting them; - Education levels among the youth and the community; - Economic research such as levels of income, means of subsistence; - Communities' views of their own needs; - Demographic research: numbers of people and profiles.
Social satisfaction	Evaluates the communities' satisfaction relating to the carbon project. Also evaluates the existence of some kind of community satisfaction survey, which can be conducted through local research, or stakeholders' consultation, among other means
Associations and cooperatives	Evaluates whether communities residing in the project area are involved in associations or cooperatives. - Association: Group of two or more people who organize themselves to defend their common interests, without financial ends and existing as a legal entity. - Cooperative: Organization consisting of at least twenty private individuals acting cooperatively and mutually assisting each other, with democratic, participatory management, with common economic and social goals, of which the legal and doctrinal aspects are independent of those of other organizations and societies

Table 12. List of the potential indicators for the human resource

Indicator	Description
Community education and training	Evaluates the relevant education and training programs related to the project, including additional programs to the stakeholders and broader community. The following major areas are considered: - Training: technical; IT and digital; courses, etc. - Education: basic and supplementary, environmental awareness-raising, etc.
Health	Evaluates the presence of initiatives and campaigns relating to community health, as well as access and communication with hospitals in neighboring cities
Leisure, culture and sport	Evaluates the presence of projects involving leisure, health and sport within the carbon project area, which benefit the community
Equipment and infrastructure	Evaluates the project proponent's investment and encouragement relating to equipment and infrastructure (sanitation, household, electricity, transport, among others) for the community's benefit.

Table 13. List of the potential indicators for the financial resource

Indicator	Description
Alternative income sources	Evaluates whether the project created alternative sources of income generation for the communities living within the project area
Employment opportunities	Direct employment offered by the project: number of people employed in activities related to project (e.g. supervisors and trainers) and provision of official documentation employment (informal and formally documented)
Securing of funds	Evaluates the project proponent' participation in requests for proposals/ programs for securing funds. Also monitors whether project participants were successful, and whether the funds raised are creating activities for communities resident in the project area
Carbon credit Investments	Evaluates whether proceeds from the sale of carbon credits was invested in the carbon project improvements or activities that benefit the local community

Table 14. List of the potential indicators for the natural resource

Indicator	Description
Monitoring Methods	Measures the progression of project's monitoring methods, including for example: high-resolution GIS capable of detecting degradation; employment of guards/supervisors; presence of guard towers within project area
Efficiency of project in countering agents of deforestation/ degradation	Measures the project's ability to reduce deforestation and degradation within the project area over the monitoring period
Non-timber forest products (NTFPs)	Evaluates the sustainable use of natural resources by communities in the project area for income generation. "NTFPs are biological resources or products from flora – which are not wood – obtained from forests for subsistence or for trade." (SFB, 2013). Sustainable practices are taken to include the following: - Low-impact practices; - Exploitation/ collection practices of each NTFP which are compatible with their productivity levels without affecting their regeneration and/or conservation of each utilized species.

Table 15. List of the potential indicators for the biodiversity resource

Indicator	Description
Biodiversity research	Evaluates the existence of partnerships with universities and environmental bodies, among others, which contribute to/encourage research on biodiversity in the project area
Biodiversity conservation	Evaluates the existence of biodiversity conservation activities in the project area. e.g.: recovery of degraded areas, planting of native trees, environmental education, partnerships, among others
Tree nursery and maintenance of planted trees	Evaluates the presence of a tree nursery, used for tree production in the project area

Table 16. List of the potential indicators for the carbon resource

Indicator	Description
Project Performance	Evaluates project performance in relation to verified emissions reductions. Project performance = Units verified in the Monitoring Report corresponding to the SCR period/ Estimate of emissions reductions in the VCS PD.
Buffer reduction	Measures the progression of the buffer in the current monitoring period compared to the previous monitoring period, or compared to the VCS PD if current SCR period is Point 0.
Stakeholder consultation	Evaluates the stakeholder consultation

5. RESULTS

This section presents the results of the compilation of all questionnaires that were applied during the data collection in rural properties in the state of Tocantins. A total of 76 questionnaires were applied, including questions about the profile of the properties and the feasibility for conducting REDD+ projects, in particular, A/R (afforestation and reforestation) and REDD (reducing emissions from deforestation and forest degradation) projects.

It is important to note that the results of the questionnaires are limited by certain factors. Thus, there are still significant challenges in understanding some important issues that affect the feasibility of developing REDD+ projects in the State of Tocantins, such as specific analyzes for the region of each property interviewed regarding the carbon stock of each forest vegetation type and the rate of deforestation observed in the last 10-15 years.

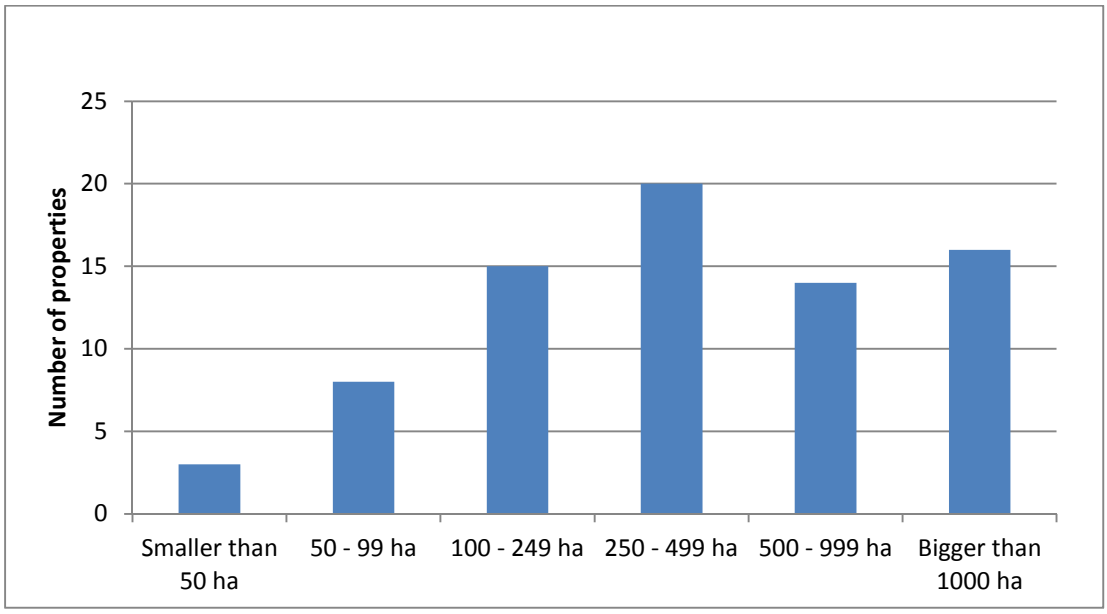
In the topics below, there will only be addressed the data and characteristics of the Amazon and Cerrado biome, due to the majority of Tocantins's area is within these biomes.

5.1 Analysis of surveyed farms in the State of Tocantins

The 76 farms surveyed by this study totalize an area of almost 55 thousand hectares, representing around 0.20% of the area of the State of Tocantins. The biggest surveyed property has more than 8 thousand hectares, while the smallest has 22 hectares.

The average size of properties surveyed by this study was 720 ha. However, the majority (26%) of these areas is within the size range from 250 to 499 ha, as shown in Figure 11 below. Moreover, almost 20% of the surveyed properties have an area superior to 1.000 ha.

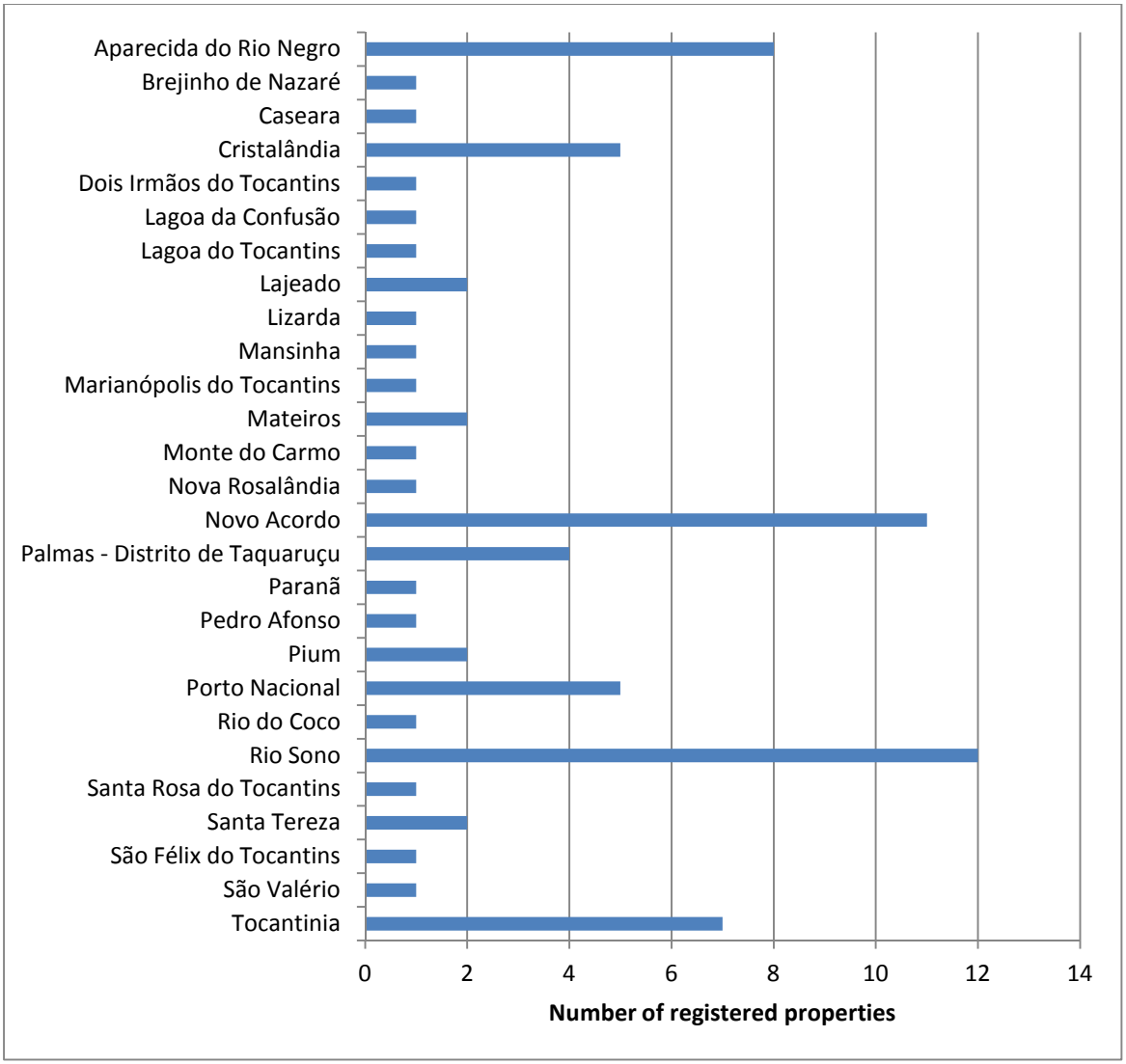
Figure 11. Classification of surveyed properties by size, in hectares



The registered properties are located in 27 different municipalities of the State, thus reaching about 20% representativeness of a total of 139 municipalities in Tocantins. The largest portion of these properties are located in the municipalities of Rio Sono, Novo Acordo and Aparecida do Rio Negro, corresponding to almost 40% of all municipalities included in this study.

The Figure 12 below shows the distribution of the surveyed properties by municipality.

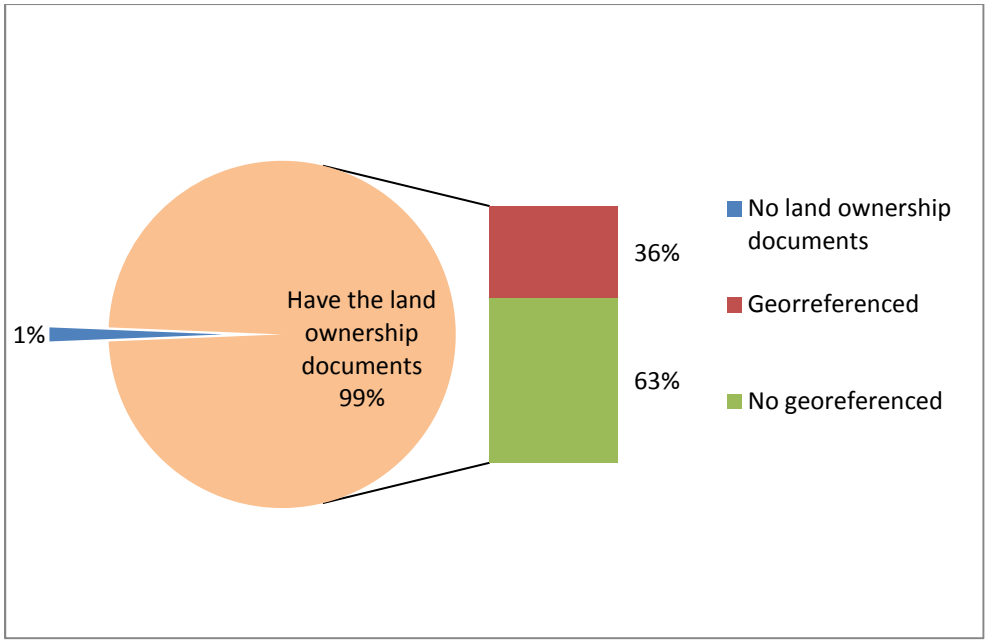
Figure 12. Number of surveyed properties in the State of Tocantins, per municipality



Overall, the interviewed properties have the required legal documentation and are in order with the land title. Only one of them did not have the legal documentation. However, it could be observed that only 36% of surveyed farms are georeferenced, and only two (2.5%) of them had the Rural Environmental Registry (CAR). Most properties haven't been georeferenced yet. Figure 13 below illustrates the ownership status of the surveyed properties.

Through georeferencing it is possible to delimit the boundaries of a forest carbon credit project, being an essential condition to ensure the ownership of the property (land tenure).

Figure 13. Land tenure of the surveyed properties



From the total surveyed area in the analyzed properties, 43% is covered by native vegetation (approximately 23,500 hectares), while 57% have other land uses. The vast majority of these properties are located within the Cerrado biome, corresponding to 97% of the remaining native vegetation on the surveyed properties. Figures 14 and 15 below illustrate the land use and the biomes in the analyzed properties, respectively.

Figure 14. Land use in the surveyed properties

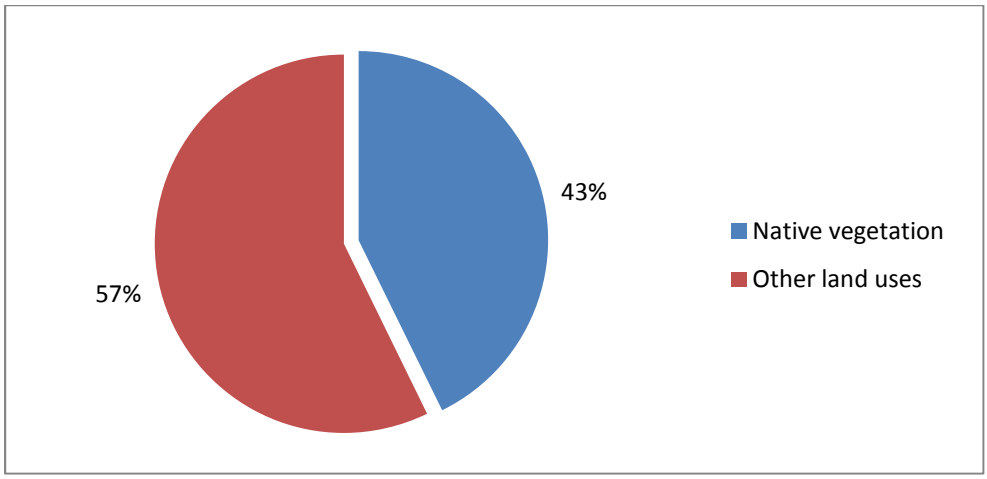
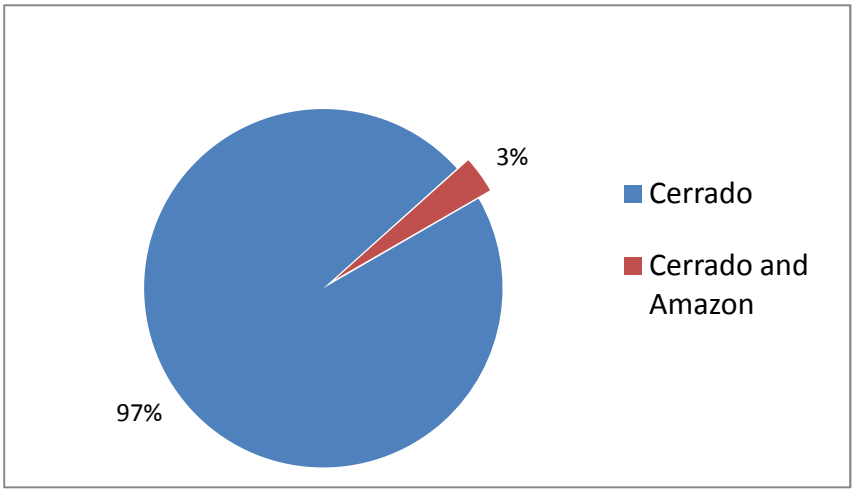
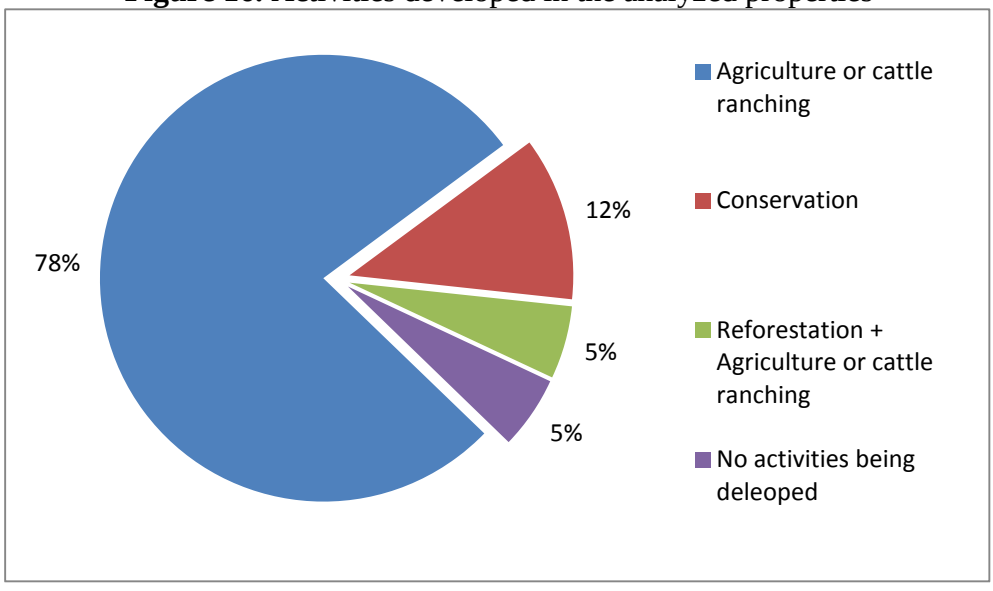


Figure 15. Biomes in the surveyed properties



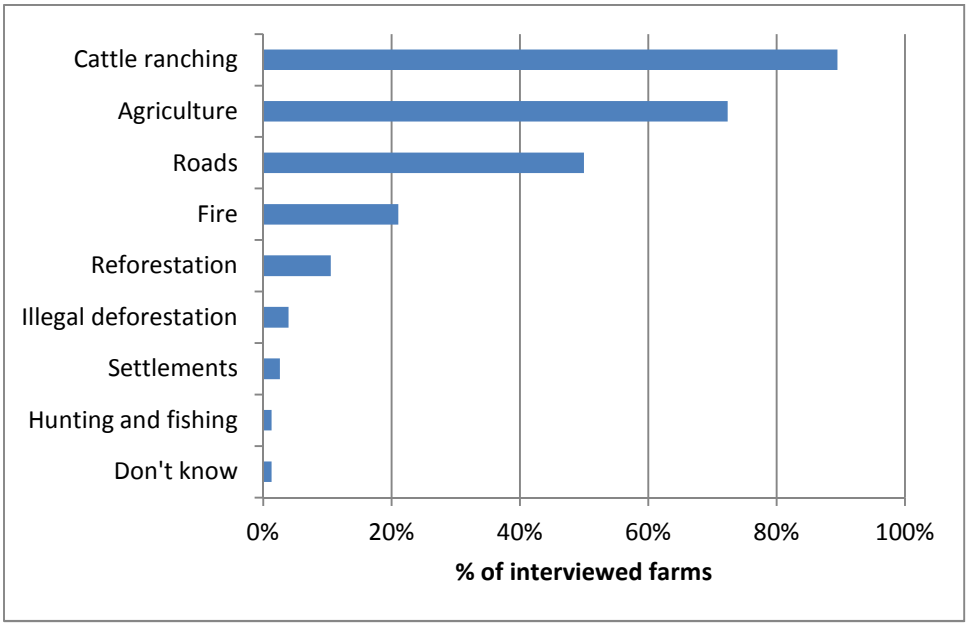
The activities developed in the analyzed properties are basically three: agriculture or cattle ranching, reforestation associated to agriculture or cattle ranching, and conservation. On the other hand, some properties do not currently have activities being developed. Figure 16 below illustrates the scenario of the activities developed in the analyzed properties. It can be observed that 83% of the surveyed properties carry out agricultural/cattle ranching activities, and some of them have reforestation activities, especially the plantation of rubber trees. In addition, approximately 12% of the properties have the conservation profile, which was considered significant. This has probably occurred because some interviews had been conducted with owners of private reserves (RPPNs), and also in properties located in tourist areas of Tocantins (e.g. Taquarussu district in Palmas).

Figure 16. Activities developed in the analyzed properties



Furthermore, when asked about the main agents of deforestation in the region, almost 90% of respondents stated that livestock is the major factor, followed by agriculture (72% of responses), roads (50%) and fire (21%). Other factors that cause deforestation in their regions were also reported, such as the expansion of reforestation with rubber trees, illegal deforestation for firewood collection, settlement and predatory hunting and fishing. This pattern help to illustrate the term called "expansion of the Brazilian agricultural frontier". Tocantins is one of the Brazilian States that are located within this deforestation front. Figure 17 presents the main deforestation drivers and agents, according to respondents.

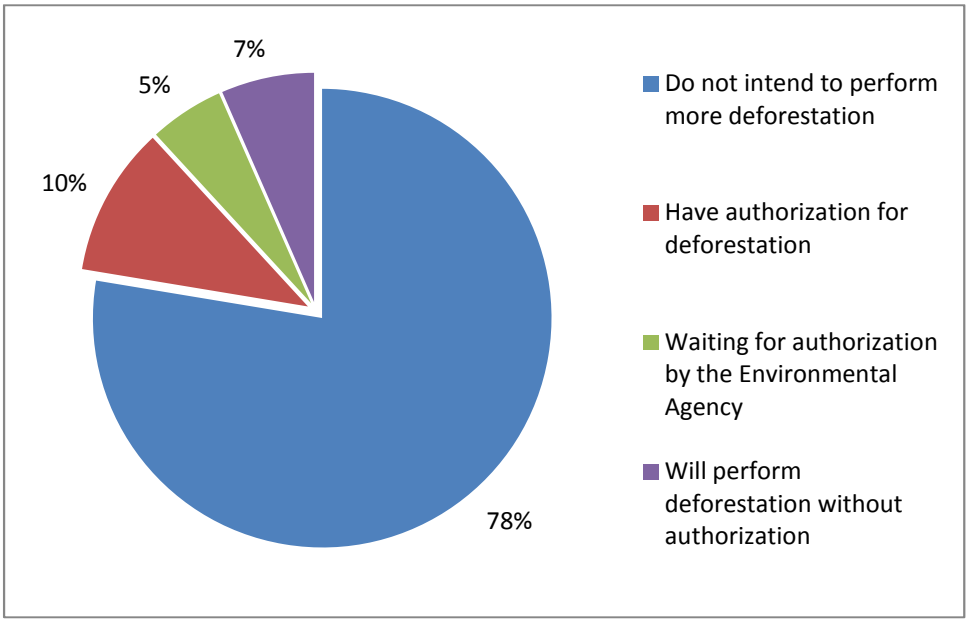
Figure 17. Deforestation drivers and agents in the surveyed region, in % of answers



Regarding the existence of an authorization for deforestation in the analyzed properties, 78% reported that they did not intend to perform more vegetation removal on their property, 10% have permission to perform deforestation, 5% is waiting for approval by the Environmental Agency, and 7% will perform deforestation without permission. Figure 18 below summarizes the information collected about the existence of deforestation authorization in the analyzed properties.

Thus, analyzing the information about the deforestation pattern in the region, it can be observed that mostly occurs in an unplanned way, as only 15% of respondents had authorization for deforestation in their properties.

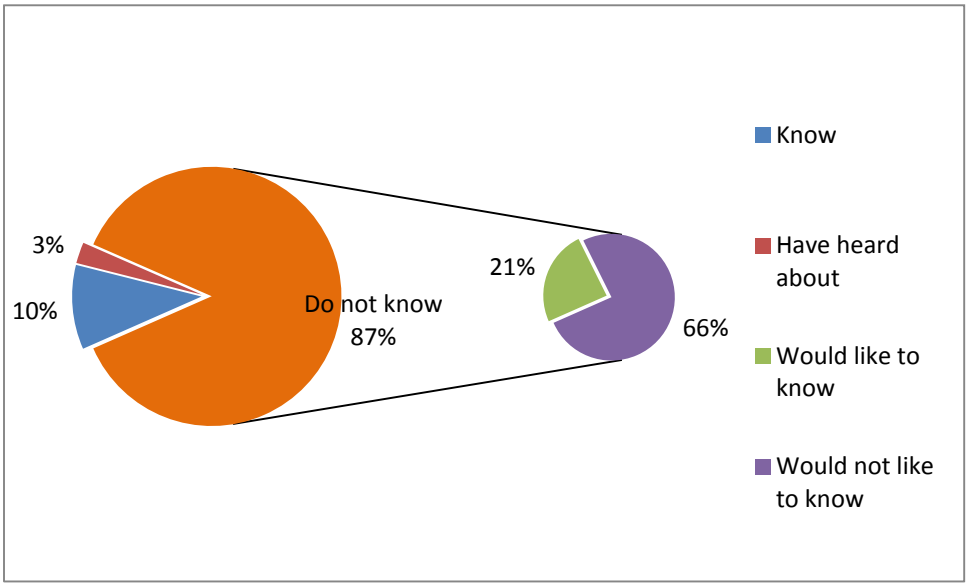
Figure 18. Existence of authorization for deforestation in the analyzed properties



Regarding the knowledge of the respondents about the Environmental Adaptation Program for the Rural Property and Activity - TO-LEGAL, which aims to assist property environmental regularization, inserting them in the CAR system, this research shows great ignorance about this Program by the landowners. Moreover, many of them have no interest in knowing this program, claiming that they are already in compliance with the law. Only 13% of respondents knew or had heard about TO-LEGAL program, while the others (87%) did not know anything about. From this latter, only 21% would like to know about the benefits of the State program. This scenario is best shown in Figure 19 below.

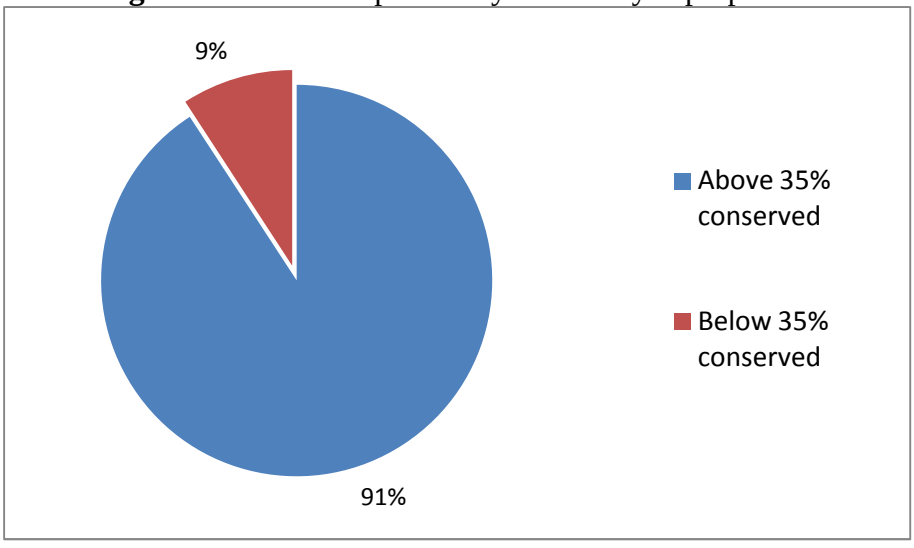
This situation helps to demonstrate the reluctance of landowners in the State of Tocantins regarding changes in legislation and environmental regularization of the rural properties. It also shows the lack of technical assistance and rural extension by the Government, as a greater encouragement and technical support would make farmers to believe in such governmental actions. One of the main ways to counter deforestation in Brazil is the command and control mechanisms, such as the effective monitoring, the compliance with environmental legislation together with a greater State action. However, according to Moutinho et al. (2011), this does not seem effective in most regions of the country due to the lack of control by the Government in comparison with other social goals and economic interests.

Figure 19. Interviewed farmers knowledge about the TO-Legal Program



Generally, the rural properties interviewed comply with the maintenance of the legal reserve areas (LRA). Over 90% of them have the LRA above 35% of his property, thus in accordance with the Forest Code (Law No. 12,651/2012) for properties located in the Cerrado biome within the Legal Amazon. Figure 20 below shows the distribution of surveyed farms regarding the compliance with the maintenance of LRA. Furthermore, as shown previously in the Figure 14, approximately 43% of the properties have native vegetation, which ensures the maintenance of PPA and LRA.

Figure 20. LRA compliance by the surveyed properties



5.2 Analysis of the potential for the development of REDD+ projects

Through the analysis of the data collected through interviews of rural properties in the State of Tocantins, estimates of carbon credits generation through REDD+ could be calculated, according to the ACR requirements. Therefore, the calculations previously presented in this report were utilized, which refers to reforestation (A/R) and forest conservation (REDD) projects.

Based on the 76 properties registered in this survey, 95% (or 72 farms) have eligibility for REDD project development, and 11% (or 8 farms) for A/R projects, according to ACR rules. Furthermore, from the total surveyed properties, 73 farms (or 96% of the total) have eligibility for some REDD+ project, whether REDD or A/R. Table 17 below shows the number of properties with eligibility for the development of forest carbon credits project (REDD+) according to ACR requirements.

Table 17. Eligible properties for REDD+ projects

Project type	Number of properties	% of the total
A/R	8	11%
REDD	72	95%
Total of properties that are eligible for any REDD+ project	**73**	**96%**

Thus, it is possible to observe the high potential for REDD+ projects in the State of Tocantins, especially with regard to forest conservation projects (REDD) for avoided unplanned deforestation. A total of 72 farms have eligibility for REDD projects (of the 73 properties that are eligible for any REDD+ project), particularly with regard to the conservation of the legal reserve and permanent preservation area.

5.2.1 Reducing Emissions from Deforestation and Degradation (REDD)

First, the total eligible area within the surveyed properties with potential for REDD projects development under the ACR in each biome of the State was calculated, as shown in Table 18 below. As described above, only areas that have native forest vegetation and that have not been deforested for over 10 years have been considered.

Table 18. Calculation of the eligible area for REDD in the surveyed properties, separated by the biomes in the State of Tocantins

Biome	Area with native vegetation in the properties (ha)	Biome Forest Occurrence (%)	$Area_{REDD}$ (ha)
Amazon	240	95.03%	228
Cerrado	20,487	60.80%	12,456
Total	20,727		12,684

Then, based on the estimated annual deforestation rate and the forest carbon stock in each biome, GHG emissions were calculated at baseline for REDD (ELB_{REDD}), estimated for a period of 40 years from 2011, as shown in Table 19 below.

Table 19. Calculation of GHG emissions in the baseline scenario for REDD in the surveyed properties, divided in the biomes in the State of Tocantins

Biome	$Area_{REDD}$ (ha)	Annual deforestation rate (%/year)	Forest Carbon Stock (tC/ha)	ELB_{REDD} (tCO_2e)
Amazon	228	0.44%	135.1	19,864
Cerrado	12,456	1.08%	74.0	1,459,093
Total	12,684	0.60%		1,478,957

Then, the estimated GHG emission reductions by REDD (RE_{REDD}) that could be generated by the registered properties with potential application was calculated. As mentioned above, the GHG baseline emissions was deducted by the GHG emissions caused by the REDD projects (EP_{REDD}). This result was then discounted by the leakage (estimated as 10%) and by the buffer (retention of 25% of the emission reductions by REDD projects). These figures are shown in Table 20 below.

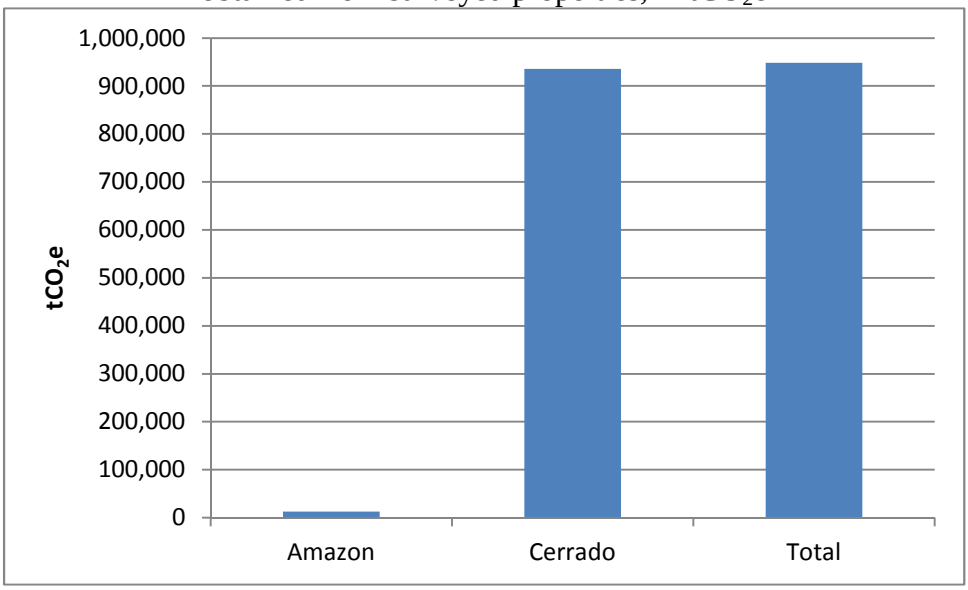
Table 20. Calculation of the estimated GHG emission reductions by REDD in registered properties, divided into the biomes in the State of Tocantins

Biome	ELB_{REDD} (tCO_2e)	EP_{REDD} (tCO_2e)	Leakage (tCO_2e)	*Buffer* (tCO_2e)	RE_{REDD} (tCO_2e)
Amazon	19,864	993	1,887	4,246	12,738
Cerrado	1,459,093	72,955	138,614	311,881	935,643
Total	1,478,957	73,948	140,501	316,127	948,381

Based on the estimates presented in Table 20, it is possible to note that from 2011 to 2050 (40 years), REDD projects on surveyed properties in the State of Tocantins could generate around 1 $MtCO_2e$ of GHG emission reductions.

Figure 21 below shows the distribution of this emission reduction among the biomes existing in the State, estimated through the properties that were surveyed in this study. The Cerrado biome is the one that accounts for the largest share, with around 95% of the total. The Amazon biome accounts for only 5% of the reduction. Thus, it can be inferred that the Cerrado biome has the greatest potential for reducing GHG emissions through REDD in the state of Tocantins.

Figure 21. Distribution of GHG emission reductions through REDD in 40 years, based on the data obtained from surveyed properties, in tCO_2e



According to the survey conducted in this research, the main pressure for deforestation observed by respondents in the State of Tocantins is cattle ranching, and then agriculture.

Tocantins is located in the agricultural frontier expansion region, thus the deforestation in this State tends to be higher than those observed in the biome (Cerrado or Amazon). However, due to the lack of relevant data on the deforestation rate and carbon stock by region of the State, information about the biomes were used, as described previously. The Jurisdictional REDD+ could contribute to the development of projects in Tocantins, as it tends to facilitate the data at the project level, which would probably make the implementation of REDD projects cheaper possible on a small scale level.

5.2.2 Afforestation and Reforestation (A/R)

Based on the analysis conducted in this study regarding the deforested areas in each property that should be reforested to comply with the law, the eligible areas for A/R projects development could be estimated. It is important to note that only areas that presented characteristic of forest vegetation that has been cleared for over 10 years were considered. Table 21 below summarizes the reported data, as well as areas with potential for A/R projects classified by biome.

Table 21. Calculation of the eligible area for A/R project development in the surveyed properties, divided per biome

Biome	Eligible deforested area (ha)	Biome Forest Occurrence (%)	$Area_{A/R}$ (ha)
Amazon	0	95.03%	0
Cerrado	1,200	60.80%	730
Total	1,200	-	730

The estimate of eligible areas for A/R project development in the surveyed properties in the State of Tocantins equals approximately to 730 ha, located exclusively in the Cerrado biome. The surveyed properties in the Amazon did not present deficit of vegetation, so the estimates below consider only properties with potential for A/R in the Cerrado biome.

Then, the GHG removals caused by the A/R (RP_{ARR}) was calculated, estimated for a period of 40 years from 2011, exhibited in the Table 22 below. This estimate considers the mean annual increment (MAI) only for altitudes below 1,000 meters, as more than 93% of the country is located below this altitude range (SCHNEEBERGER; FARAGO, 2003).

Table 22. Calculation of GHG removals by A/R mechanism in the surveyed properties, divided per biome

Biome	$Area_{ARR}$ (ha)	MAI (tdm/ha.year) Altitude < 1.000 m		R Ratio below / above ground biomass	$RP_{A/R}$ (tCO_2e)
		≤ 20 years	> 20 years		
Amazon	0	10	1.9	0.19	0
Cerrado	730	4	1	0.59	212,678
Total	730	-	-	-	212,678

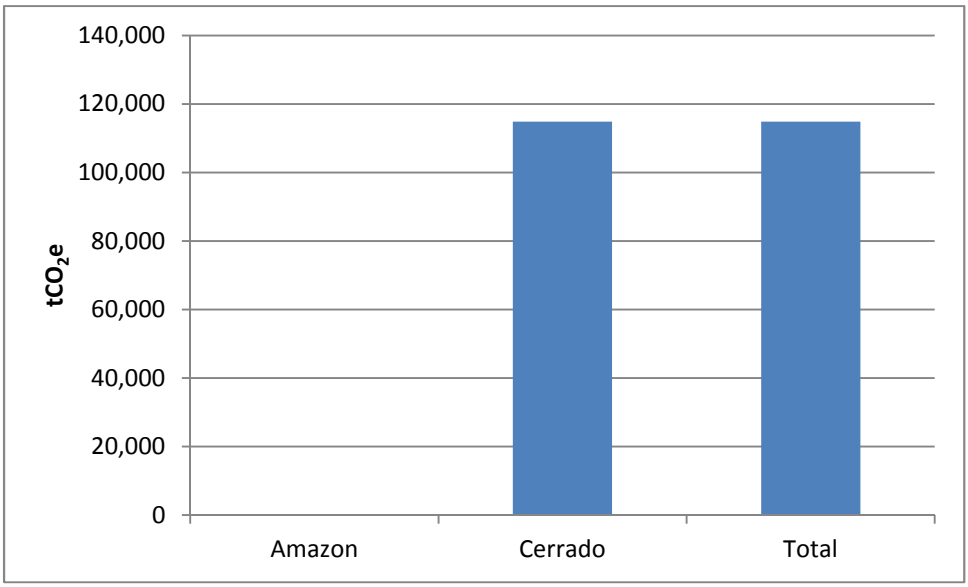
Then, the estimated GHG emission reductions by A/R based on the surveyed eligible properties to develop such projects could be calculated ($RE_{A/R}$). The GHG removals in the project scenario were deducted from the GHG removals that would occur in the baseline ($RLB_{A/R}$), estimated as 20% of the project's removals. Afterwards, the leakage was discounted (estimated as 10%) and finally, the buffer (retention of 25% of the emission reductions generated by A/R project). Table 23 below shows these estimates.

Table 23. Calculation of the estimated GHG emission reductions generated by A/R in the surveyed properties, divided per biome

Biome	$RP_{A/R}$ (tCO_2e)	$RLB_{A/R}$ (tCO_2e)	Leakage (tCO_2e)	*Buffer* (%)	$RE_{A/R}$ (tCO_2e)
Amazon	0	0	0	25%	0
Cerrado	212,678	42,536	17,014	25%	114,846
Total	212,678	42,536	17,014	50%	114,846

Through the results achieved in Table 23, it is estimated that A/R projects in the surveyed properties in the State of Tocantins could sequester around 115,000 tCO_2e at the end of 40 years after its implementation. Figure 22 below shows the distribution of these emission reductions between the Amazon and Cerrado biomes.

Figure 22. Distribution of GHG emission reductions generated by A/R during the 40 years project lifetime, based on the data obtained from surveyed properties, in tCO_2e



Thus, it can be noted that the main potential for the development of reforestation projects in the State of Tocantins is located in the Cerrado biome. In this biome, rural properties should have at least 35% of its property with predominantly native vegetation as legal reserve. Thus, properties that do not meet this minimum requirement may be able to develop an A/R project, provided that the area has been deforested for more than 10 years.

Even though the GHG emission reductions by A/R have not been very significant in this study, due to the fact that over 90% of the surveyed properties comply with the LRA and PPA, A/R projects may be a viable tool to help recovering degraded areas in the State of Tocantins.

5.2.3 Comparison among the REDD+ mechanisms

Comparing the estimate of GHG emission reductions resulted from the possible application of the REDD+ mechanism in the surveyed properties, it is possible to analyze and estimate which of these mechanisms have the greatest potential for application in the State of Tocantins, as well as which biomes have the largest capacity for the development of REDD+ projects.

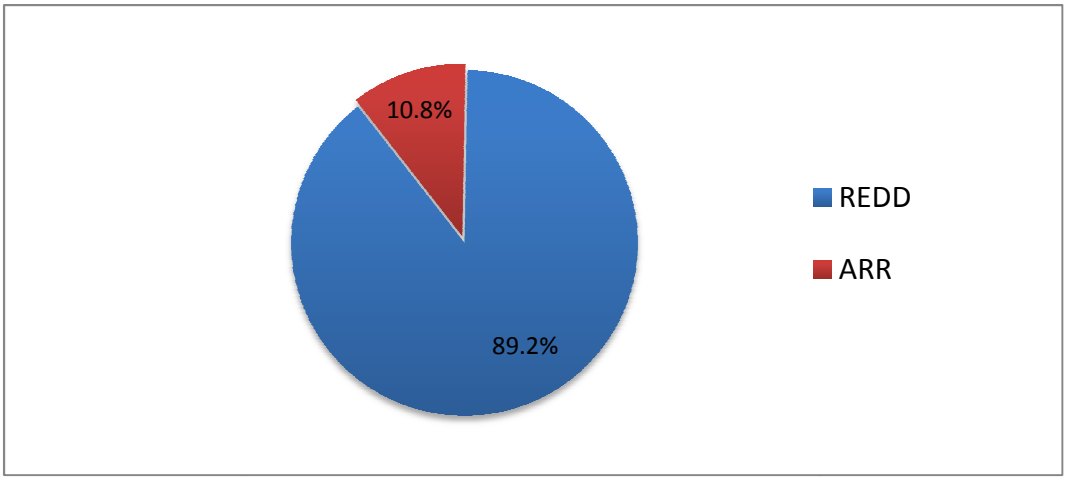
Table 24 below summarizes the estimated generation of carbon credits by each REDD+ mechanism that could be applied in the surveyed properties, considering a 40-year period as from 2011. In addition, it is possible to observe the overall potential for emission reductions through the development of REDD+ projects in these properties, according to ACR requirements.

Table 24. Estimated GHG emission reductions in the surveyed properties generated by REDD+ mechanisms in each biome, in tCO_2e

Biome	REDD	A/R	REDD+
Amazon	12,738	0	12,738
Cerrado	935,643	114,846	1,050,490
Total	948,381	114,846	1,063,227

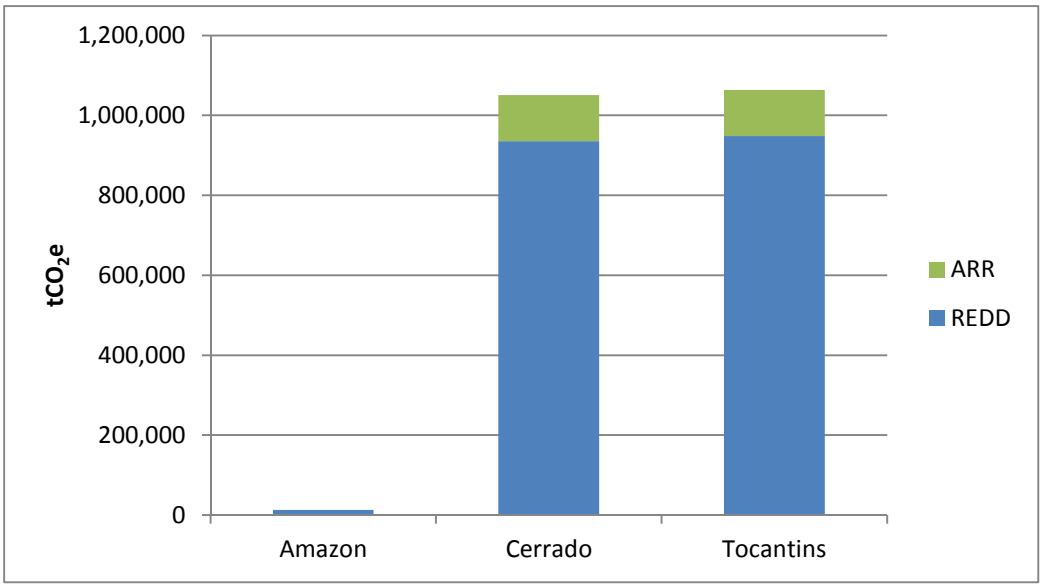
According to Table 24 above, the emission of approximately 1 $MtCO_2e$ could be avoided through the application of REDD+ mechanisms in the surveyed properties in Tocantins, during the proposed period (40 years). Figure 23 below compares the REDD+ mechanism in terms of generation of carbon credits. It is possible to note that REDD projects account for almost 90% of the total emissions reductions that could be generated in the surveyed properties in this study. Then, the A/R projects represent only 10% of the total.

Figure 23. Participation of each REDD+ mechanism in the total of 1 $MtCO_2e$ of emission reductions that could be generated in the surveyed properties in 40 years



In addition, the REDD mechanism (conservation) in the Cerrado biome showed the most significant application in this research, corresponding to the generation of more than half of the total estimated for REDD+. The reason is the significant proportion of forested areas in the State of Tocantins, which unfortunately suffers considerable pressure for deforestation. The Figure 24 below organizes the biomes in the State of Tocantins in terms of generation of carbon credits by the implementation of REDD+ mechanisms in the properties that participated in this study.

Figure 24. Distribution of GHG emission reductions per biome, which could be generated through REDD+ in the surveyed properties, in a 40-years period, in tCO_2e



In addition, according to the Figure 24 above, it is possible to analyze that the surveyed properties present a better condition for the elaboration of forest conservation projects (REDD) in the Cerrado biome, which can generate approximately 90% of the total GHG emission reductions calculated in this research.

5.3 Challenges and difficulties

The approach method utilized to reach producers created a barrier. The technical team of Ecologica Institute and Sustainable Carbon faced some rejection and there was a lack of participation by farm owners. This reflects the current situation about the land-use in the State of Tocantins.

It can be assumed that much of the properties in the State no longer have the minimum vegetation cover required by the Brazilian Forest Law. Moreover, the vast majority has no surplus vegetation area to the mandatory legal reserve area.

Most of these properties that have already been deforested had no license to deforestation and thus, when asked about the implementation of possible environmental projects, such as Payments for Environmental Services (PES) or Reducing Emissions from Deforestation and Degradation (REDD), the farm owners showed some resistance to provide information about their properties.

Several invitations to meetings and discussions on REDD+, workshops and the course on REDD+ were sent to farm owners. However, most of them did not attend any event, and many of these owners had no interest in the proposal due to the peculiarities of their properties.

Another major challenge was to attract institutions and their technicians for the discussion and training about REDD+. Much of the technical staff of these institutions was involved in other activities or basically had no interest in participating of the GCF events in the State.

Due to these difficulties, a greater effort was needed to disseminate the events promoted by the GCF fund in Tocantins. Invitation letters were directly sent to coordinators and directors of institutions in order to require the participation of a greater number of their technicians emphasizing the importance of the addressed issues, and the relevance of the panelists and trainers involved with this project.

It also should be noted the difficulty of communication with farm owners, who mostly reside on their properties where usually there is lack of some urban services, such as phone service and internet, and are also located in remote access regions. These situations required a more direct contact with each owner. The site visit approach, i.e., visit the property and interview the owner, proved to be a difficult approach, but it was required to reach the number of 76 farm owners in this survey.

5.4 Technical potential and political reality for the farm owners to get involved in reducing deforestation in the State of Tocantins

Main activities conducted in the State of Tocantins regarding the reduction in deforestation and implementation of REDD+ projects:

- ✓ 1998 – The State of Tocantins implements the first carbon sequestration project in Brazil, which was developed by Ecologica Institute in the Canguçu research center, in the Bananal Island. Beyond the carbon component, this pilot project helped to create the Social Carbon Methodology, based on indicators addressing social, human, financial, natural, biodiversity, and carbon aspects.
- ✓ 2002-2004 – The Environment Agency of the State of Tocantins and the Ecologica Institute implanted the urban carbon sequestration project in Palmas, aiming to analyze the increase in carbon stocks due to urban tree planting. However, this project was not maintained due to lack of political support and government transition.

- ✓ 2008 – The Genesis REDD Project in the Cerrado biome, which was also implanted by Ecologica Institute, had the objective of preserving the Cerrado biome, by avoiding the deforestation, reforesting degraded areas, and also incentivizing the income generation for local communities. It was not concluded due to problems during the project validation under CCBA.
- ✓ 2008 – The State of Tocantins created the Regional Politics of Climate Changes, Environment Conservation and Sustainable Development (in revision process nowadays).
- ✓ 2009 – The Plan for Prevention and Control of Deforestation (PPCD) in Tocantins was officially implemented, aiming to reduce the illegal deforestation to 0% from 2009 to 2014, to reduce the Amazon deforestation in 80% by 2013 and the Cerrado deforestation in 40% until 2020.
- ✓ 2010 – The Federal University of Tocantins, coordinated by Prof. Glaucia Vieira, developed a research project, the first project of Tocantins to be financed by CNPq, aiming to estimate the above ground biomass, the carbon stock and the quantity of avoided emissions in native forest areas, based mainly on the Pequi and Babaçu species. In addition, this research is analyzing the production of vegetal oil to produce biodiesel and bio oil as an alternative energy source to traditional communities.
- ✓ 2012 – The State of Tocantins has implemented the Politics of Environmental Services and Payments for Environmental Services, as a complement of the previous Regional Politics of Climate Change.
- ✓ 2012 - Decree nº 4.550/2012 – Revision of the Regional Forum about Climate Change and Biodiversity, aiming to add environmental value to the State patrimony.
- ✓ 2013 - The first seminary about REDD+ was carried out by Ecológica Institute in partnership with CiVi.Net in June/2013. This seminary contributed to the exchange of information among technicians from the Governmental Agencies, Environmental Institutions, farm owners, and other stakeholders.
- ✓ 2013 - Partnership between the State of Tocantins and IBOPE Ambiental to the incorporation of the ecosystem assets to the Tocantins patrimony.
- ✓ 2014 – GCF project development in the State of Tocantins, creating a database of 76 rural properties in the State as well as conducting workshops and courses about REDD+ and the carbon market.

- ✓ 2014 - PhD Thesis about the carbon stock in the above ground biomass in the Cerrado stricto senso formation, in the municipality of Palmas, developed by Eliana Pareja – Director of Ecologica Institute.

Thus, it can be noted that several initiatives about REDD+ have been undertaken in the State of Tocantins. There is a great potential for the application of these mechanisms in the State, as demonstrated previously in this study. Tocantins is a relatively young State, and large forested areas are under pressure by the expansion of the Brazilian agricultural frontier.

Therefore, a greater incentive about the forest conservation initiatives from the Government is necessary, such as the creation of a State Law about REDD+, and the creation of a future jurisdictional scheme in the State. Only after implementing those governmental actions, it can be expected that landowners realize the environmental, economic and social advantages of developing REDD+ projects in comparison to cattle ranching and soybeans agriculture, which can only give economic revenues in the short-medium term.

Certainly, REDD+ is not the only solution for the forest conservation and restoration. There should be integration with other command and control actions, such as the territorial and land use planning, the improved environmental monitoring, the creation of protected areas, along with government plans that encourage the protection and sustainable use of forest resources. These actions can enhance the implementation and results of the REDD+ projects.

5.5 Overall results achieved by the project

The GCF activities developed in the State of Tocantins contributed to the following results:

- ✓ 02 workshop about REDD+ and the carbon market;
- ✓ 01 course about REDD+ and the carbon market;
- ✓ 04 formalized institutional partnerships in order to encourage technicians to participate in events and courses to discuss the issues of climate change;
- ✓ 76 surveyed rural properties with satisfactory results, creating a database for REDD+ projects in the State;
- ✓ 75 people participating in the workshop discussions about REDD+. A certificate was delivered to each participant;
- ✓ 19 people participating in the course about REDD+ and the carbon market. A certificate was delivered to each participant;

✓ 01 banner elaborated.

5.6 Recommendations moving forward

The activities carried out by Ecologica Institute and Sustainable Carbon resulted in a better understanding of REDD+ by the stakeholders (students, rural technicians, researchers and farm owners). The Governors' Climate and Forests Task Force provided conditions for expanding this networking, through meetings, circulation of materials about the GCF, workshops and course about REDD+.

It is expected that the information disseminated through the GCF activities will bring benefits, especially among the academic area. Many students from Environmental Engineering were quite interested about this subject.

However, the establishment of a jurisdictional REDD+ program in the State of Tocantins is not the current priority of the Government. Thus, the first step should be the creation of a multidisciplinary working group about the implementation of REDD+ in the State level.

It is also necessary to support the restructure of the legal framework on climate change, and contribute to the creation of a law regarding REDD+ in the State of Tocantins with focus on actions that enhance the sustainable use of the forest.

Another important action to continue with the initiatives developed in the State would be the dissemination of the REDD+ context for the whole society, once it is currently restricted to the academy and NGO projects. Thus, the future activities should seek to achieve results beyond carbon and avoided emissions, as well to promote a sustainable forest economy to justify the implementation of projects together with other productive activities, such as cattle ranching or agriculture.

6. CONCLUSION

The results obtained in this research based on surveying 76 farms in the state of Tocantins, totaling an area of approximately 55,000 hectares (of which 20,000 ha are covered by native vegetation and 1,200 should be recovered), helps to demonstrate the great potential for the development of REDD+ projects in the State.

According to IBGE (2006) the State of Tocantins has approximately 4.5 million hectares of native vegetation in private properties, and nearly 685,000 hectares of degraded land, mostly old pasture areas. Thus, the application of REDD+ mechanisms in the State could contribute to the conservation of the remaining forests and forest restoration in degraded areas, while generating economic benefits for landowners through revenues from carbon credits.

However, the method used to approach the producers (questionnaires) was not the most appropriate, since many landowners refused to answer the survey because they were afraid about data confidentiality, and also because some properties do not have mandatory preservation areas, which in many cases were deforested without authorization.

The survey on rural properties presented in this study aims to meet its primary objective of helping in a better understanding of the issue, seeking to illustrate the development of REDD+ projects using the ACR. This survey intended to identify the main benefits generated by REDD+ mechanisms in order to represent those that could be provided by these projects in the State of Tocantins.

Thus, this research sought to demonstrate that REDD+ mechanisms may be an advantageous option, especially considering the option of forest conservation in the Cerrado biome, through the avoided unplanned deforestation methodology. This was the type of REDD+ project that proved to be more advantageous in this research.

This could be facilitated through the establishment of a jurisdictional system for REDD+ in the State of Tocantins, as well as being in line with the National Policy on Climate Change - PNMC (2009). This strategy would create various levels of state reference for forest formations, carbon stocks, rates of deforestation and degradation, forest management and restoration. Furthermore, they could also provide details of land use change that pressures the forests in each region of the state, in order to facilitate the additionality analysis. Thus, this jurisdictional program tends to encourage and hasten the development of REDD+ projects in the state, in order to conserve forests, reduce emissions and attract revenues from carbon credits. Therefore, through the carbon market, conservation and forest stocks increase efforts in small areas could be valued, especially in isolated areas and/or with a lower risk of deforestation, which otherwise would be financially unfeasible once it does not generates a high amount of carbon credits.

Besides the economic benefits of the revenue from carbon credits, REDD+ mechanisms provide several improvements on the other two aspects of sustainability. In addition to the

maintenance of ecological services, another important environmental benefit provided by the REDD+ mechanism in the State of Tocantins concerns the preservation of an important biodiversity, sorely threatened by deforestation and forest degradation. The development of the proposed projects can therefore act in two major areas: climate change and biodiversity loss. Furthermore, if well planned, it is also possible to generate several results in the social aspect. Communities directly affected by the projects can achieve improvements in their quality of life, income generation and maintenance of cultural traditions.

To ensure that these effects can be assessed, monitored and enhanced, it is recommended the use of an additional standard to ACR, such as the Social Carbon Standard, developed in the State of Tocantins and mentioned in this study.

The methodology developed by the Social Carbon Standard is relevant to monitor the positive and negative externalities of a project through the application of the Social Carbon methodology (SCM). The SCM considers the particularities of the project regarding the characteristics of the area and the socio-environmental attributes associated, which results in the elaboration of specific indicators for the project reality.

The SCM monitors the project throughout its life cycle, and also allows that monitoring can be done through simple variables, enabling low-cost application.

Another observation is that the indicators should be well defined and specific in what they want to evaluate in order to avoid subjectivity, particularly regarding to qualitative indicators.

It is observed that the evaluation of the co-benefits from an emission reduction project is as important as the monitoring of GHG emissions that are no longer emitted into the atmosphere. The Social Carbon Methodology is an effective tool for such assessment.

It is expected that this study can contribute to the monitoring of environmental, social and economic co-benefits resulting from GHG emission reduction projects involving REDD+ in the State of Tocantins, and the suggested indicators can encourage best practices for the development of such REDD+ projects.

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ANNEX I – QUESTIONNAIRE APPLIED TO FARM OWNERS (IN PORTUGUESE)

Pesquisa sobre o potencial de projetos de REDD+ (pagamento por serviços ambientais por meio de créditos de carbono) nas propriedades agropecuárias do Tocantins

IDENTIFICAÇÃO

O correto preenchimento possibilitará a avaliação da viabilidade e do potencial da participação da área indicada para um eventual projeto REDD:

Nome da Fazenda:

Endereço/Município:

Nome do proprietário/administrador:

e-mail:

Telefone:

QUESTIONÁRIO DE INFORMAÇÕES TÉCNICAS

A - DESCRIÇÃO DA PROPRIEDADE

1. Tamanho da propriedade (em hectares);

2. Tamanho da área com floresta nativa (APP, reserva legal e adicional);

3. Tamanho da área que precisa ser recuperada com floresta nativa (em hectares);

4. Quais as atividades desenvolvidas na propriedade? Ex. agricultura, criação de gado, coleta de lenha e outras.

5. Qual o tipo de vegetação na propriedade: Cerrado ou Floresta Amazônica?

B - ELEGIBILIDADE DA TERRA E DESCRIÇÃO DA ÁREA

1. A propriedade possui documentação fundiária regularizada? Está georreferenciada?

2. As áreas que precisam ser reflorestadas estão desmatadas há quantos anos, aproximadamente?

3. As áreas de floresta existentes na propriedade estão conservadas há quantos anos, aproximadamente?

4. Quais são os fatores que exercem pressão sobre as florestas conservadas na região? Ou quais são aqueles que causaram o desmatamento em áreas próximas à do projeto? (Ex.: Fogo, estradas, expansão da fronteira agrícola, pressão imobiliária, abertura de pastagens, invasão, etc);

5. Por favor, forneça uma breve descrição das áreas no entorno de sua propriedade. Quais atividades são desenvolvidas? Existem rodovias/estradas próximas à área da propriedade?

6. Existe alguma autorização para desmatamento na propriedade, porém que ainda não foi realizado? Se sim, autorização para quantos hectares?

7. Já ouviram falar do Projeto de Lei TO-Legal? Tem cadastro no quadro do TO-Legal? Caso negativo, você gostaria de possui? Por quê?

C - INFORMAÇÕES ADICIONAIS

Fotos, mapas, inventário florestal, estudos, documentos ou quaisquer outras informações que forem relevantes para compreensão da área e do projeto e da dinâmica do desmatamento na região.

ANNEX II – SUPPORT LETTER FROM MARY GRADY, DIRECTOR OF BUSINESS DEVELOPMENT, AMERICAN CARBON REGISTRY (ACR)

October 8, 2013

Mr. Stefano Merlin
President
Instituto Ecológica
103 Sul, Rua SO-03, Lt. 38
Palmas, Tocantins, BRASIL
CEP 77.015-016

RE: Support for Instituto Ecológica Proposal to GCF Fund

Dear Mr. Merlin,

The American Carbon Registry (ACR), a nonprofit enterprise of Winrock International, is pleased to provide this letter of support for Instituto Ecológica's proposal to the Governors Forest and Climate Task Force (GCF) fund to work with large scale cattle ranchers in Tocantins, Brazil to demonstrate compatibility of low-emission cattle production and forest management and conservation.

The proposed project includes conducting research on the potential for REDD+ projects on farmlands in Tocantins and then applying the ACR REDD+ Methodologies, ACR Nested REDD+ Standard and SocialCarbon Standards on these farmlands to quantify emissions reduction as well as social and environmental co-benefits. If funded, this first-of-a-kind initiative in Tocantins will contribute to the creation of a nested REDD infrastructure at the state level and serve as a foundation for expansion. We are keen to collaborate with Instituto Ecológica to make the project a success.

As background, ACR was founded in 1996 as the first voluntary offset program in the world, and has over 18 years of experience in the development of rigorous, science-based carbon offset standards and methodologies as well as in carbon offset issuance, serialization and transparent online retirement reporting. In addition to our voluntary carbon market activities, ACR is an approved Offset Project Registry (OPR) and Early Action Offset Program for the California Cap-and-Trade program. As an OPR, ACR works with the regulatory agency in California, the Air Resources Board (ARB), to oversee the registration and issuance of California-eligible Registry Offset Credits developed using ARB's compliance or early action offset protocols. ARB's approval of ACR to help implement the compliance offset program signals that ACR has met stringent regulatory requirements including technical expertise in carbon offset protocols; extensive experience in the oversight of offset project listing, registration, independent verification and issuance; operational know-how in offset registry management; and a solid understanding of the regulation underpinning the compliance offset program.

2121 Crystal Drive, Suite 500
Arlington, Virginia 22202

www.americancarbonregistry.org