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Has the Green Grant Program Had an Impact on Conservation in Brazil?

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Abstract:

This study evaluates the effect of Green Grant program (*Programa Bolsa Verde*) on conservation outcomes in Brazil using data from a survey with beneficiaries and non-beneficiaries. No evidence of impact on *logging* was found across the treated samples and groups, as well as considering the different biomes. Therefore, the results do not suggest that the longer beneficiaries are exposed to the program, the more effective it is for reducing *Logging* was identified. Concerning other outcome variables, this investigation identified statistically significant effects of Green Grant on *Awareness of Territory Statute* and purchase of *New Tools*. The results reveal that a larger number of recipients are aware of land regulations and that they have a higher probability of acquiring new tools and equipment for production activities than non-recipients. The estimations were performed with both Ordinary Least Squares (OLS) regressions and Propensity Score Matching (PSM).

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Contents

List of Abbreviations

FLONA	National Forests
ICMBio	Chico Mendes Institute of Biodiversity
INCRA	National Institute of Settlement and Land Reform
MMA	Ministry of Environment
PA	Conventional Settlements
PA`s	Protected Areas
PAE	Environmentally Sustainable Agroextractive Settlements
PDS	Sustainable Development Settlements
Resex	Multiuse Extractive Conservation Units
Resex Marine	Marine Extractive Conservation Units
SPU	Secretariat of Heritage of the Union

1. Introduction

Rain forests comprise a considerable proportion of the world`s genetic stock. They also provide environmental services – e.g. carbon sequestration, supply of natural resources and repository of biodiversity - that affect both the global biosphere and climate (Albagli, 2010).

Among tropical forests, the iconic Amazon region stands out for its superlative figures. Covering around 7.8 million km^2, the forest is scattered across nine South-American nations and harbors the world`s largest hydrographic basin (MMA, 2008).

Brazil holds roughly 60 % of the forest area. It is estimated that Brazilian Amazon shelters 1/3 of the planet`s genetic stock, 60,000 species of plants - of which, 2,500 species of trees -, and 2.5 million varieties of arthropods, such as insects, spiders and others. Moreover, 2,000 species of fish and 300 classes of mammals are found in the region (Albagli, 2010).

Until the 1960`s, Brazilian Amazon had experienced no significant environmental conservation threats. According to some accounts, the region had lost only 1% of its original forest coverage, after going through two economic rubber cycles, which involved expressive migration flows (Ferreira & Salati, 2005). However, in the subsequent decades, the scenario changed significantly. During the twenty-one years of military dictatorship (1964-1985), a large forest area have been devastated, amounting to 10% the total vegetation coverage loss in mid-1980's (Prates & Bacha, 2011).

The re-democratization period that followed the illegal military term did not modify the situation significantly. In the late 80`s and during the 90`s, another 280,000 km^2 of forest loss have been added. Besides, the rate of deforestation intensified in the early 2000`s, reaching 670,000 km^2 (15%) of total forest area destructed in 2004 (MMA, 2013).

Although the level of annual deforestation have decreased since then, it is currently estimated that around 18% of the original vegetation of the Brazilian Amazon have been clear-cut, amounting to 748,000 km^2 of devastated area (MMA, 2013).

The intensification of the deforestation process was accompanied by the emergency of the ecological movement in the country and abroad in the 1980's. The movement acquired political relevance and managed to include its agenda in the policymaking arenas of Brazil. Among the achievements, it is noteworthy the creation of Protected Areas (PA`s),

the demarcation of indigenous territories (TI)[1] and the implementation of conservation programs.

Nowadays, Brazilian Amazon is a territory under dispute, holding a significant population of 25 million inhabitants, where agribusiness and industries of large-scale natural resources extraction cohabits and competes for land and forest assets with local traditional communities (Menezes, 2012).

Considering the conservation instruments that have been implemented in Brazil, Green Grant Program[2] stands out for combining environmental preservation with improving the livelihoods of families/individuals in situation of extreme poverty.

Green Grant is a cash transfer program conditional on recipients` compliance with environmental obligations. It provides a monetary incentive for inhabitants of Protected Areas (PA`s) to perform environmentally sustainable activities and preserve natural resources (Decree n° 7572, 2011).

The aim of this study is to evaluate the impact of Green Grant on environmental conservation in Brazil. Although the prominence of the Amazon area, where the program was started and in which more than 75% of beneficiaries are located (MMA, 2018a), families/individuals from almost all regions of the country are currently Green Grant beneficiaries. Hence, this investigation will consider the whole set of biomes[3] and territories participating in the program.

The effect of Green Grant is assessed through three outcomes of interest: *logging*, *Awareness of Territory Statute* and *New Tools*. The first variable is the main environmental outcome. It shows whether logging was performed in the territory. *Awareness of the statute*, in turn, indicates if respondents knew about the existence of territorial rules that regulates the use of natural resources. Finally, *New Tools* is a variable more associated to the livelihoods of beneficiaries than to conservation ends. It reflects potential increases in production and incomes due to improvements in working conditions.

[1] According to Filho (2014), currently 43% of the Brazilian legal Amazon area correspond to Indigenous Territories and Conservation Units

[2] The denonimation Green Grant program was freely translated from the original Portuguese name *Programa Bolsa Verde*

[3] Biome is a set of plants and animals that share common features associated to the climate they live in (MMA, 2018). The Appendix illustrates Brazilian Biomes

This paper uses data from a household survey carried out in 2015 by Rural Federal University of Rio de Janeiro - UFRRJ, FAPUR and International Conservation - CI Brasil. The dataset comprises a representative sample of both Green Grant beneficiaries and non-beneficiaries. Thus, the causal effects of Green Grant on the variables of interest can be estimated with the survey dataset, using standard impact evaluation methods.

This research is structured in seven sections, including this introduction. Section 2 describes the Green Grant Program, its main features and the context of implementation. Section 3 is on the literature review. Section 4 characterizes the data and the outcome variables of interest. Section 5 discusses the empirical strategy employed. Section 6 presents and analyzes the main results. Finally, section 7 contains the conclusion of the study.

2. Green Grant

The Green Grant Program was first implemented in October 2011 with the purpose of stimulating environmental conservation and fighting poverty in areas holding relevant natural resources (Cabral et al., 2014). At the beginning, only locations within the Amazon Biome were included. However, after the first semester of 2012, it was enlarged to other regions of the country (MMA, 2018a).

Green Grant is a conditional cash transfer program that brings together environmental conservation and poverty alleviation. It makes quarterly payments of fixed amount - around U$ 100.00[4] - to individuals/families in extreme poverty situation[5]. In exchange, recipients should comply with the environmental rules applied to the territories where they live. Currently, the program is benefiting 47.7 thousand families/individuals, with a budget of almost € 15 million (MMA, 2018a).

Like a Payment for Environmental Services (PES) scheme, Green Grant provides a mechanism to compensate the ones who bear the costs of environmental conservation, by allowing them to internalize some of its benefits via cash transfer. However, the program is not only intended to induce forest preservation. It also addresses poverty alleviation, as

[4] The program pays R$ 300 every three months. It is equivalent to U$ 100.00, considering the approximate exchange rate of 3 Reals to 1U$.
[5] Extreme poverty is defined as a per capita income below the approximate value of U$ 1.25 a day, which is in line with the methodology used by most multilateral organizations (MDS, 2014).

the target public consists of individuals/families who live with a per capita income below the poverty line (Decree n° 7572, 2011).

Green Grant has entrance requirements for both families/individuals and territories. In order to be eligible, they have to live or perform sustainable activities in Protected Areas[6] (PA`s) selected by the program. Moreover, their income per capita must be below the extreme poverty line and they should already be recipients of *Family Grant*.

Family Grant is one of the biggest conditional cash transfer programs in the world. It has contributed to taking 36 million people out of the poverty condition in the country since 2003, when it was first implemented (Costa & Falcão, 2014).

Family Grant criterion was included for operational reasons. In order to allow immediate access to Green Grant cash transfers, families were authorized to use the same bank card they were handling for withdrawing *Family Grant* deposits. Besides, printing new bank cards and delivering it would be costly and demand a sizable logistic effort.

Once fulfilling the eligibility criterions, beneficiaries had to sign an agreement term, compromising to carry out environmentally sustainable activities (Decree n° 7572, 2011).

The territories in which Green Grant was implemented, in turn, were selected and qualified for the program after meeting a few requirements. They had to exhibit forest coverage compatible to the Brazilian environmental legislation, as well as possess a document called *Management Instrument*[7] (MMA, 2018a). The *Instrument* consists on the territory statute. It describes the rights and duties of families/individuals concerning natural resources management, environmental conservation, the list of production activities allowed within the area, among others (MMA, 2018a).

Green Grant was designed on the idea that environmental conservation and poverty alleviation should be addressed together. Not in the sense that e.g. poverty alleviation is a pre-requisite to achieve environmental preservation, because the lack of economic alternatives drives the poor to overexploiting natural resources, according to one of the typologies proposed by Adam et al. (2012). Instead, poverty reduction and natural resources conservation should be brought together to create a feedback loop. Hence, the sustainable use of natural resources is a condition for addressing poverty, since the

[6] Appendix describes Protected Areas included in Green Grant Program
[7] *Management Instrument* was freely translated from the original term in Portuguese "*Instrumento de Gestão*"

livelihoods of the poor depend on the ecosystem services and living species (Adam et al., 2012). Likewise, reducing poverty is a necessary action for achieving sustainable development, as stated in the final document of the United Nations Conference on Sustainable Development - Rio +20 (Cabral et al., 2014).

Another noticeable feature of Green Grant is the profile of recipients. As inhabitants and/or users of Protected Areas, they belong to the so-called Traditional Communities and Peoples or just Forest Peoples. Artisanal fishermen, rubber tappers, forest pickers and riverside settlers belong to the traditional communities and are also Green Grant beneficiaries[8] (MMA, 2018a).

Traditional communities are descendants of different generations of Amazonian settlers who came to the region in one of the many migration flows that occurred since the end of the 19th century. They have acquired and passed through generations the knowledge and skills on conservation and sustainable use of natural resources, which are now considered an essential component for environmental preservation in the forest (MMA, 2018a).

2.1. Background: a brief history of the Brazilian Amazon occupation

The expansion of the Portuguese territory in the Americas during the 17th and 18th centuries is considered the first stage of the Amazonian transformation. The occupation of the forest took place along the biggest river banks and was based in military and colonial settlements, as well as Christian missions (Ferreira & Salati, 2005).

Then, the second systematic occupation occurred during the first rubber economic boom (1890-1912). In this period, the region witnessed an intense flow of migrants, coming mostly from the Northeast region of Brazil (Prates & Bacha, 2011). Their labor force was needed for increasing rubber production through the process called rubber tapping in *seringueira* trees.

The decline of the first rubber boom in the Amazon was triggered by international competition. Seeds collected in the Brazilian rain forest were smuggled out of the country. They were later used to forge production in British colonies of Southeast Asia (Viana, 2013).

[8] Indigenous are not recipients of Green Grant, although they are part of the forest peoples

The rubber prosperity in the Amazon resurged during the II world war. Due to the Japanese blockade of Pacific shipment routes, the supplies from Southeast Asia to western allies were interrupted (Viana, 2013).

Under these circumstances, Amazonian rubber production became economically feasible once again. Similarly to the first rubber economic cycle, workers mainly from Northeast states were encouraged to move to the rain forest and join the rubber tappers' "army", in a reference to the war efforts of the allies. The emigration incentives were also a way to reduce social conflicts in that region, which was undergoing another drought period (Neves, 2001). The second rubber boom came to an end when the Pacific naval routes were reestablished after the war.

During the military dictatorship (1964-1985), migration flows to the region were once again stimulated. Under the motto "integrate to not hand it over", the militaries invested in infrastructure projects, mainly in large paved roads, and promoted fiscal incentives for activities such as cattle farming projects, natural resources extraction and colonization settlements.

The slogan summarized the intention of the central government to increase the Amazon GDP and connect its economy to the national market as a means to ensure sovereignty over the region.

The consequences of such strategy that prioritized short-term gains over any sustainability principle were ruinous. At the end of the dictatorship period, the Amazon had lost 10% of its original coverage (Prates & Bacha, 2011).

However, one of the most questionable aspects was the failure to recognize the demands and needs of local inhabitants. The multicultural universe of indigenous tribes, rubber tappers, forest pickers, riverside groups, quilombolas[9] were never taken into consideration by the militaries.

The end of the military term, however, did not reverse the deforestation process. Although some important results have been achieved recently[10], the expansion of the agriculture frontier, as well as large-scale extraction activities never ceased.

[9] Descendants of slaves

[10] The annual deforestation rate fell from 27,000 km^2 in 2004 to around 4,000-6,000 in the subsequent years.

From mid-1980 to the present day, around 400,000 km^2 of deforested area were added, making up to 18% of total forest coverage loss, or approximately 750,000 km^2.

Paralleled to the deforestation process, the Amazonian traditional groups developed their own strategies in response to the threats posed by cattle ranchers. During the late-80`s and throughout the 90`s, the movement accomplished important results, such as the creation of the first Multiuse Extractive Conservation Unit (Resex), the demarcation of Indigenous Territories (TI) and implementation of conservation programs.

As stated before, in the current days, Brazilian Amazon is a territory under dispute, reflecting the dilemmas of economic development and environmental conservation. Large-scale extractive industries and agribusiness cohabits and competes with traditional groups and sustainable methods of forest management (Menezes, 2012).

It is in this context that Green Grant was implemented, combining environmental preservation with social goals.

3. Literature Review

There are few studies assessing the impact of Green Grant on conservation. Most investigations have addressed aspects related to the implementation design, institutional arrangements, activism of the intermediary-level bureaucracy and perspectives for reaching the program`s goals (Abbers, 2013; Coutinho, 2014; MDS, 2016; Viana, 2013).

Considering the effect of Green Grant on the environment, the most comprehensive publications are the annual Sample Monitoring Reports (MMA, 2018b). These reports present an extensive list of indicators and variables constructed out of the data collected through surveys with beneficiaries and non-beneficiaries of the program.

The Reports compare treated and non-treated groups on variables and indicators taking into consideration the biomes, institution in charge and category of the territory where respondents are settled (MMA, 2018b).

Moreover, the documents compose a comprehensive profile of beneficiaries, through variables on socioeconomic status, sanitation conditions, income, attitude towards conservation, and others. Furthermore, it raises issues concerning the strategies of implementation and management of the program and recommends improvement measures (MMA, 2018b).

As the main data source used in this study, the survey dataset - on which the Monitoring Reports were based - will be described in the next section, as well as the variables of interest of this investigation, which were also chosen among the survey indicators.

Regarding the findings of the studies on Green Grant, I highlight two fundamental aspects on which they have come to similar conclusions: the lack of information about the program, considering both beneficiaries and local managers of the areas, and the need for complementary programs, e.g. technical assistance on agroforestry, in order to increase families` incomes and sustainable production (Pires, 2016; MMA, 2018b).

The absence of understanding about Green Grant is revealed in the studies. Many beneficiaries could not associate the transfer to conservation purposes (Pires, 2016; MMA, 2018b). Others said to have never been visited or received guidance on the program.

In addition to that, recipients agree that the transfer is very helpful, particularly in periods of lower production output, or when forest commodity prices oscillate downwards. However, governmental policies to foster agroforestry and environmentally-friendly production techniques are needed, according to families (Pires, 2016; MMA, 2018b).

Concerning impact evaluation studies on conservation measures, a recent body of publications have casted doubt on their empirical findings. Miteva et al. (2012) challenges the accuracy of methods, data and theories employed in those works and calls for a new generation of impact evaluation investigations, using rigorous econometric methods.

Impact evaluation literature usually employ two methods of comparison. One is to perform *with* and *without* comparisons; that is, confronting areas exposed with the ones not included in the intervention. The other method is to carry out *before* and *after* comparisons in the same territory (Miteva et al., 2012).

In order to obtain unbiased estimates of the causal effects using these methods, a few assumptions should be valid. For the *with* and *without* design, it is assumed that areas would be similar on the characteristics correlated to the outcomes, if the intervention were not to take place. In addition, there must be no spillover effects from the treated areas to the non-treated ones (Miteva et al., 2012).

Regarding the *before* and *after* design, it is presumed that the outcome variables would remain the same before and after the intervention – or that "the past perfectly represents the future" (Ferraro and Pattanayak, 2006).

However, if those assumptions break down, the estimations will be biased and no longer reflect the causal effect of the conservation interventions.

According to Miteva et al. (2012), Protected Areas (PA's) are the most evaluated instrument of conservation. Even though, the evidence gathered by the few rigorous studies is considerably limited as to allow for meaningful conclusions about the effect of PA's on deforestation (Miteva et al, 2012).

The same verdict applies to the research on Payment for Environmental Services (PES), decentralization measures and ICDP, whose set of studies are even weaker than those on PA's (Miteva et al., 2012).

Hayes and Ostrom (2005), on the other hand, state that a successful forest conservation policy in the context of PA's is the result of multiple factors, such as "biophysical features, financial and human resource support and mechanisms for conflict resolution". The authors also found that stronger local-level institutions and higher forest user autonomy in decision-making contribute to forest protection. Lastly, they reject the idea, or myth, that the Protected Area model is the only instrument able to maintain forest cover.

Likewise, other studies also found that forest conservation in Protected Areas is a function of many variables and exhibits heterogeneous results. It depends on baseline poverty, distance to cities and the slope of the territory (Miteva et al., 2012).

The contribution of this study is to assess the impact on environmental conservation of an innovative public policy implemented in a country that hosts major biodiversity stocks, using a robust estimation method. Moreover, this evaluation may indicate opportunities for efficiency improvements, outlining contexts in which the program may be more effective, as well as others where it needs redesigning.

4. Data

This section describes the data sources used in this impact evaluation study. Descriptive statistics for the outcome variables, the treatment and the control covariates are presented. This section also details how the treatment groups were conceived.

The main data set used in this study consist on the survey carried out in 2015 by UFRRJ[11] with Green Grant beneficiaries. The inquiry was designed to reflect a representative sample of recipients and territories included in the program. In addition, it contains data on control groups living in the same areas as those of beneficiaries, which is highly recommended in impact evaluation studies. The purpose was to ensure a balanced and comparable sample of treated and non-treated individuals and to facilitate controlling for territory-specific unobserved characteristics (MMA, 2018b).

The survey comprises a comprehensive questionnaire, divided in five blocks, addressing topics such as socioeconomic status, income and production, infrastructure, sanitation conditions, social organization, among others (MMA, 2018b).

4.1. *Outcome variables: Logging*

Although logging activities are permitted in Multiuse Protected Areas (PA's) in Brazil (as long as they are performed according to the territory statute), it is expected that Green Grant have had an impact on wood extraction practices in those territories. The hypothesis is the following: by imposing environmental conditions on beneficiaries, the program has contributed to reducing their logging.

The amount and volume of wood extraction legally permitted varies according to a number of elements: the biome in which the protected area is located, the category of the territory, the main economic activities performed and others.

Because of the large number of PA's participating in the program, it is not feasible to examine the rules and norms concerning logging defined for every territory.

Therefore, as the investigation cannot use a single baseline compatible to all areas, I have assumed that the less logging is performed, the better it is for environmental conservation. That is, decreasing logging is always beneficial for the environment, even if families and

[11] UFRRJ stands for Rural Federal University of Rio de Janeiro. The institution was hired by the Federal Ministry of Environment to design and implement the survey

individuals - both beneficiaries and controls - are complying with the territory statute when it comes to this activity.

In the survey, respondents were asked whether they carry out logging; and how it is performed. Most individuals who said to undertake logging described that they pick wood from the ground, collect dead branches or recycle wood pieces from old fences and other unused objects (MMA, 2018b).

The table below presents descriptive statistics of *Logging* for the whole sample of treated and control individuals. It also reports the statistics for other treatment variables, that is, alternative subgroups of beneficiaries, formed according to the number of years they have been receiving the Green Grant transfer. For example, the variable *Treatment – more than 3 years* refers to beneficiaries who have been in the program for more than three years.

These treatment variables were created to test the other hypothesis of this study: the longer beneficiaries are exposed to the program, the stronger is its effect on the outcome variables. The reason is that environmental constrains and behavioral change are gradually assimilated by recipients. Therefore, the impact of the program should be increasing with the period of treatment.

The treated observations were grouped according to the following strategy: besides the whole sample of beneficiaries, the other treatment variables consist on households who have been treated less than one year (*Treatment - less than 1 year*); beneficiaries who have been in the program more than one year, but less than two (*Treatment - more than 1 year and less than 2*); the group of recipients who have been receiving the Green Grant`s transfer more than two years, but less than three (*Treatment - more than 2 years and less than 3*); and, finally, households who have been more than 3 years in the program (*Treatment – more than 3 years*).

The impact of the program on these groups of beneficiaries will also be tested for the other variables of interest.

Table 1 – Descriptive statistics of the outcome variable *Logging*, for the control and different treatment groups.

Outcome variable: ***Logging***	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Treatment - all sample	1,094	.865	.342	0	1
Treatment - less than 1 year	159	.893	.310	0	1
Treatment - more than 1 year and less than 2	275	.873	.334	0	1
Treatment - more than 2 years and less than 3	228	.895	.308	0	1
Treatment – more than 3 years	432	.833	.373	0	1
Control	1,094	.858	.349	0	1

According to Table 1, the percentage of respondents who undertake logging varies from 83.3% to 89.3% in the treatment variables. Considering the controls, as much as 85% of individuals said to perform logging activities.

One interesting aspect pictured on the table is that only beneficiaries who have been in the program longer - more than three years - reported a lower level of logging than non-treated. 83.3% of this subset of recipients engage in such activities, against 85.8% of the controls.

Regarding the covariates in the regression model, I have used indicators for socieconomic status and household conditions of the family unit, as well as dummies for territory class, biome and institution in charge of the PA.

Income consist on the total per capita revenues obtained by the family in production and other sources, such as pensions and wages. Benefits from cash transfer programs were excluded, since they soften the differences between families` incomes. The values are expressed in Euros.

Union Member indicates whether the individual or head of the family is associated to a forest union or an association alike.

Family Grant is a categorical variable that takes the value of "1" if the family is beneficiary of the country`s largest conditional cash tranfer program.

Elementary and *High School Enrollment* shows the proportion of children and teenagers from 6 to 14 and 15 to 17, respectively, enrolled in education institutions. *Primary*, *HighSchool* and *Under Graduation* are binary variables that indicate whether at least half of the adult members within a household have achieved that education level.

Location Inside is a dummy for location of the household: "1" if located inside the protected area and "0" otherwise; whereas *Energy* expresses whether the household access this commodity.

Finnaly, *Water supply - Network system* indicates households supplied by network systems and *Sewage Network* shows the proportion of households whose sewage is discarded into the network system.

The table below reports descriptive statistics of the socioeconomic variables mentioned above, comparing the mean values of treated and control observations. The last colunm presents the statistical significance of the differences between the two groups. There are 1,094 observations for each group.

Most covariates show statistically significant differences between treated and non-treated individuals, which points out to the importance of controlling for such variables in the estimation model.

The mean value of *Income* revenues are higher among non-treated individuals in comparison to treated ones, corresponding to € 28.55 and € 23.63, respectively. The difference is statistically significant at 99% level. This result is probably a consequence of Green Grant`s income threshold, which prevent higher income families from becoming recipients of the program.

The proportion of *Union membership* and of *Family Grant* recipents is larger in the treated group. The higher percentage is expected given that *Family Grant* is one of the entrance criterions to Green Grant, while unionization may increase the chances of accessing governmental programs available in protected areas. These two variables will be further discusssed on section 5.1.

Regarding educational covariates, school enrollment of children and teenagers is greater among Green Grant beneficiaries, what may be reflecting the effect of *Family Grant*. This conditional cash tranfer program demands a minimun level of school attendance for children of beneficiary families.

As for schooling levels, non-treated households have a higher proportion of adult members with primary, high school and under graduation degrees: 25%, 21% and 1.2%, respectively, against 22%, 14% and 0.7% among treated individuals.

When it comes to household conditions, the only statistically significant differences between the groups is related to *energy supply* and *Sewage network*. For both variables, the proportion is larger among beneficiaries than controls. 91% of Green Grant recipients have access to energy, whereas 85.3% of non-treated individuals are supplied with this commodity.

Unlike energy, the percentage of households connected to the sewage network is significantly low for both groups: only 1.4% of Green Grant recipients are linked to the network while 0.6% of households in the control group have such facility.

Table 2 - Descriptive statistics of covariates on Socioeconomic Status and Household Characteristics, comparing treated and control groups.

Variable	Mean treated	Mean non-treated	Diff
Socioeconomic Status			
Income per month (in €)	23.631	28.547	-4.912***
Union Member (dummy)	.855	.754	0.101***
Family Grant (dummy)	.942	.856	.087***
Elementary School Enrollment (%)	72.223	52.977	14.246***
High School Enrollment (%)	39.595	23.035	16.560***
Primary School (dummy)	.227	.251	-0.025
High School (dummy)	.149	.217	-0.068***
Under Graduation (dummy)	.007	.012	-0.006
Household Characteristics			
Location Inside (dummy)	.963	.965	-0.003
Energy (dummy)	.910	.853	0.058***
Water Supply - Network System (dummy)	.187	.171	0.017
Sewage Network (dummy)	.014	.006	0.008**

*** p<0.01, ** p<0.05, * p<0.1

Considering the control variables for territory classes, governmental institutions (in charge of the protected areas) and the ecosystems in which they are located, the folllowing table presents their descriptive statistics. All covariates are categorical.

In order to create a control group as similar as possible to the treated one, the survey collected an equal number of reated and untreated observations for each covariate in Table 3. Consider, for instance, the dummy variable for Amazon biome. According to the table, 64,6% of the total survey observations (2,188) are located in the Amazon biome, which means that both treated and control groups have 64,4% of observations from that biome.

Therefore, there is no need to break down the observations by recipients and non-recipients.

Brazilian biomes are identified as *Amazon*, comprising the tropical rain forest region; Savannah, an area with scrub forests; *Caatinga*, the only exclusive Brazilian biome, consisting of an arid climate that undergoes frequent droughts; *Atlantic Forest*, which is to the most devasted biome in the country, characterized by dense forest and large variaties of plants and animals; and, lastly, *Coastal Marine* stands for the ecosystems found on the coastal area of the country[12] (MMA, 2018c).

Regarding the institutions and territory classes[13], *ICMBio* is the governmental agency in charge of Extractive Conservation Units (*Resex*), Marine Extractive Conservation Units (*Resex Marine*), National Forests (*Flona*) and Sustainable Development Reserves (*RDS*). These multiuse protected areas combine conservation with sustainable handling of natural resources by tradicional communities.

INCRA is a governmental institution that manages Environmentally Sustainable Agroextractive Settlements (*PAE*), Sustainable Development Settlements (*PDS*) and Conventional Settlements (*PA*). *PDS* and *PAE* are protected areas similar to the ones managed by *ICMBio*, that is, they are multiuse settlements inhabited by traditional communities, who carry out sustainable activities.

Conventional *PA`s*, on the other hand, consist of settlements oriented to production. They also have to comply with environmental regulations, although preservation issues are not of main concern in these locations.

Finally, *SPU* is a state department responsible for conceding to *Riverside* groups the right to use a small portion of land.

[12] For more details, see Appendix
[13] More details on protected areas included in Green Grant see in Appendix

Table 3 - Descriptive statistics of covariates on biome, territory category and institution, whole sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Biome					
Amazon (dummy)	2,188	.646	.478	0	1
Caatinga (dummy)	2,188	.034	.181	0	1
Savanna (dummy)	2,188	.082	.275	0	1
Coastal Marine (dummy)	2,188	.201	.401	0	1
Atlantic Forest (dummy)	2,188	.037	.190	0	1
Territory Category					
PA (dummy)	2,188	.160	.366	0	1
PAE (dummy)	2,188	.409	.492	0	1
PDS (dummy)	2,188	.022	.147	0	1
RDS (dummy)	2,188	.003	.056	0	1
Resex (dummy)	2,188	.106	.309	0	1
Marine Resex (dummy)	2,188	.201	.401	0	1
Flona (dummy)	2,188	.016	.125	0	1
Riverside (dummy)	2,188	.083	.276	0	1
Institution					
ICMBio (dummy)	2,188	.326	.469	0	1
INCRA (dummy)	2,188	.590	.492	0	1
SPU (dummy)	2,188	.083	.276	0	1

The reason for using dummies to indicate biome, land class and institution in the model is to control for unobserved differences across these variables that could affect the estimation of the impact of Green Grant.

The figures indicate that 64% of respodents are in the *Amazon* biome, whereas only 3.3% of interviews were conducted in *Caatinga* ecosystem. *Coastal Marine* zones hold 20% of the sample, while 8.2% and 3.7% of surveyed individuals are located in *Savanna* and *Atlantic Forest*, respectively.

Table 3 also shows the amount of observations for each territory category. The largest percentage of beneficiaries and non-beneficiaries from the dataset are settled in *PAE`s* (40%). Moreover, 59% of observations are located in the territories managed by *INCRA*.

The list of control variables reported in tables 2 and 3 will be used in the estimation not only for the effect of the program on *Logging*, but also for the other two outcome variables assessed in this study, which are described below.

4.2. Awareness of Territory Statute

The survey asked respondents whether they were aware of the territory statute, which lists and describes the rights and duties within the areas, concerning e.g. the use of natural resources, among other topics.

I have hypothesized that Green Grant has increased awareness of the territory statute and conservation norms among recipients, which advantageous to environmental conservation. Hence, the number of treated individuals who said to be aware of the land rules in the survey should be higher than that of non-treated ones.

As described in section 2, in order to access Green Grant cash transfer, would-be beneficiaries have to sign an agreement term by which they compromise themselves to comply with the territory statute.

Families were asked to sign the documents through different approaches and strategies. Some were visited at their household location. Others attended a community event in which Green Grant subscription process took place.

In either one or the other approach, the process was an opportunity for territory managers to provide guidance on the statute and reinforce its importance for the environmental conservation. Had the community not felt encouraged to learn about the territory regulation before, or regarded it unnecessary for their daily lives, Green Grant seems to provide such an incentive.

One issue concerning survey's data is the accuracy of answers. For some questions, the evidence on whether respondents replied faithfully could only be, if so, marginally inferred by cross-checking the answers to other questionnaire items.

I have assumed that both treated and non-treated individuals understood the aim of the survey and did not feel willing to shape the answers; e.g. responding yes when they actually have no knowledge about the subject being asked, but were afraid that it might have negative consequences for them, such as having the cash transfer cancelled.

It is not possible to be totally sure, or reasonably convinced on the accuracy of the answers. However, if treated individuals actually manipulated the replies, it can be presumed that the same situation may have occurred among non-treated ones. The latter might have reasoned that shaping the answer could increase the probability of accessing the program.

Therefore, I have considered that the proportion of respondents who shaped the answers, if so, were similar between treated and non-treated.

The table below shows descriptive statistics of this outcome variable for the complete dataset of treated and controls, as well as other subgroups of recipients (or treatment variables).

Table 4 – Descriptive statistics of the outcome variable *Awareness of Territory Statute*, for control and different treatment groups.

Awareness of Territory Statute	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Treatment - all sample	1,094	.658	.475	0	1
Treatment - less than 1 year	159	.604	.491	0	1
Treatment - more than 1 year and less than 2	275	.647	.479	0	1
Treatment - more than 2 years and less than 3	228	.706	.457	0	1
Treatment - more than 3 years	432	.660	.474	0	1
Control	1,094	.548	.498	0	1

The figures indicate that the proportion of respondents who said to be aware of territory rules oscillates along the treated samples and ranges from 60.3% to 70.6%. In the control group, on the other hand, a significantly lower level of 54.7% of interviewees replied to know the statute of the protected areas.

4.3. New Tools

Another outcome variable evaluated in this study is *New Tools*. It refers to the impact of Green Grant on the acquisition of new tools for production activities and other ends. I believe that this variable may indicate improvements in working conditions and, consequently, contribute to increasing production output and income.

The table below contains descriptive statistics for *New Tools*. Around 39.6% to 44.7% of individuals across different treated groups said to have purchased new tools. Among

control observations, on the other hand, the proportion of respondents who replied to have acquired new working instruments falls to 21.6%.

Table 5 - Descriptive statistics of the outcome variable *New Tools*, for control and different treatment groups

New Tools	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Treatment - all sample	1,094	.448	.498	0	1
Treatment - less than 1 year	159	.396	.491	0	1
Treatment - more than 1 year and less than 2	275	.484	.501	0	1
Treatment - more than 2 years and less than 3	228	.447	.498	0	1
Treatment - more than 3 years	432	.444	.497	0	1
Control	1,094	.217	.412	0	1

5. Empirical Strategy

Estimating the causal effect of a program that benefits traditional groups in a variety of environments and protected areas, across a continental country like Brazil, presents considerable challenges.

As discussed in section 2, treatment assignment was based on a few criterions on families, as well as on the territories in which they are settled. Given that beneficiaries were not randomly selected for the program, the occurrence of cofounders - that is, systematic differences between treated and control groups -, can lead to biased estimations of the programs' effects (Villalobos et al., 2018).

In order to isolate the impact of Green Grant on the outcomes of interest, it is necessary to control for possible sources of bias across the groups, e.g. unobserved differences related to socioeconomic status, household sanitation conditions, ecosystems, among other variables.

I fit an OLS regression using different sets of control variables. The benchmark model refers to the specification that includes socioeconomic and household conditions covariates.

$$Y_i = B_0 + B_1 Treatment_i + \sum_{s=1}^{S} \boldsymbol{\alpha_s} \boldsymbol{X_{is}} + \sum_{d=1}^{D} \boldsymbol{\delta_d} \boldsymbol{Z_{id}} + \varepsilon_i + \gamma_i + \rho_i + u_i$$

In the equation above, Y_i is the outcome variable and B_1 is the coefficient of interest, which stands for the effect of Green Grant. $Treatment_i$ is a binary variable that takes the

value of 1 if the observation *i* is a recipient, **X** is a vector of S household socioeconomic characteristics and **Z** consist on a vector of D domiciliary conditions. Finally ε_i is biome dummy, γ_i refers to territory class, ρ_i consist on institution dummy and u_i is the error term.

Moreover, I estimated the effect of Green Grant with OLS for each biome separately. That is, I only compared treated and non-treated observations found in the same ecosystem. This procedure was carried out for the outcome variable *Logging*, and may indicate whether Green Grant has had an impact on any specific environmental context, which may not be identified in the OLS benchmark model.

Likewise, I also fit an OLS estimation by institution. That is, recipients were only compared to non-recipients located in territories run by the same institution. This model was estimated considering the variable of interest *Awareness of Territory Statute*, since the effect of Green Grant on that outcome may exhibit a large variation across institutions.

5.1. Matching Method

The characteristics of the data set also recommend the use of propensity score matching method (PSM) as a robustness check for the OLS estimation results.

Matching have been applied in a variety of studies assessing environmental programs, including Payments for Environmental Services - PES. In this method, a counterfactual group is constructed to resemble treated individuals as much as possible, based on observed characteristics (OCDE, 2018). The counterfactual group is a set of control observations that shows what would have happened had the recipients not being assigned to the treatment. Thus, the impact of the program is estimated by comparing the average difference in outcomes between the treated and the counterfactual group. This difference is interpreted as the average treatment effect of the program on the treated (ATT). That is, Matching estimations are valid only among individuals who behave or mirror the treated group.

The PSM design estimates the probability of participating in the program for each individual. This probability is then summarized into a propensity score or index, and each treated unit is matched with a non-treated one based on the value of this propensity score (Kandker et al., 2010).

In order to provide an unbiased estimation of the treatment effect, the PSM method must fulfill 3 assumptions: conditional independence, common support and individuals are similar in both observed and unobserved characteristics.

Conditional independence refers to the situation in which treatment assignment is not affected by the outcomes of observable variables (on which PS value is estimated). The common support, in turn, requires that the propensity scores distributions between treated and non-treated are fairly close, meaning that there exists a large number of comparable individuals in both groups (Kandker et al., 2010). Finally, Matching assumes that if individuals are similar in the observed characteristics, they are also similar in the unobserved ones (OCDE, 2018).

I estimated the Propensity Score (PS) value with the variables that most affect the likelihood of becoming recipient of the program. Then, I used the nearest neighbor technique to compare control observations to each treated units with the closest scores.

As mentioned, *Family Grant* is one of the eligibility criterions for Green Grant. Therefore, it was included in the PS calculation, since it affects the probability of accessing the conservation program.

In addition, as *Family Grant* requires children to be enrolled and meet minimum school attainment, covariates such as *percent of children in school* were also added to the PS estimation.

The reason is that Green Grant families probably have a higher proportion of children enrolled and attending school than non-beneficiaries due to the conditions imposed by *Family Grant*. Therefore, children education-related variables will likely affect the probability of being recipient of the conservation program.

The table below presents the variables that most affect the likelihood of becoming Green Grant beneficiary. The coefficients sign were estimated using a Probit model.

Table 6 – Probit Model. Variables that affect the probability of receiving Green Grant

Treatment - All sample	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
Family Grant	.471	.099	4.77	0.00	.277	.664
Income	-.001	.001	-1.15	0.25	-.003	.001
Union Membership	.417	.070	5.93	0.00	.279	.554
Elementary School Enrollment (%)	.003	.001	4.75	0.00	.002	.004
High School Enrollment (%)	.004	.001	6.70	0.00	.003	.005
_cons	-1.05	.122	-8.56	0.00	-1.286	-.806

As expected, *Family Grant* influences the likelihood of accessing Green Grant. Beneficiaries of this conditional cash transfer have a higher probability of being admitted into the conservation program than non-recipients.

The variable *Income*, in turn, refers to the total income obtained in production activities, as well as other sources - such as pensions, wages, etc. -, divided by the number of household members. The negative coefficient indicates that the likelihood of becoming Green Grant beneficiary is decreasing in *Income*.

Although the result is in line with one of the eligibility criterions to the program, since families should have an income not higher than the extreme poverty cut-off, the coefficient is not statistically significant.

Regarding *Union Membership*, the table shows that joining a union is positively correlated to participating in Green Grant. That is, union members have a higher chance to access the benefit than the ones not affiliated to institutions alike.

Intuitively, the advantages of union membership may rely on the fact that these associations hold more information about government programs and benefits oriented to the territories.

Moreover, they usually enjoy institutional communication channels with state authorities, since they are the legitimate representatives of families. Thus, it is likely that members get more access to information about government programs and benefits like Green Grant than non-members.

Concerning education-related variables, I used two covariates for the percentage of school enrollment of children from 6 to 14 and of teenagers from 15 to 17. As stated before,

these variables capture the effect of *Bolsa familia* compliance rules. The positive sign on both variables indicate that the higher is the proportion of kids and teenagers enrolled in school, the larger is the probability that that family will access Green Grant benefits.

The next section presents the results of this study regarding the effect of the conservation program on the outcome variables described in section 4.

6. Results

In this section, I present the results of this investigation concerning the effect of Green Grant on each of the three outcome variables analyzed. First, I report the estimations for the main environmental outcome: *Logging*, both for the whole sample of beneficiaries and for subgroups of recipients. Then, I present the results for the other outcome variables, reporting the estimations also for different treatment variables.

6.1. Main Outcome Variable: *Logging*

Logging is the main environmental outcome examined in this study. The table below presents the estimations of the effect of Green Grant on this variable in four different OLS models (columns 1 to 4), which differ to each other according to the covariates used. The rows on the table contain the treatment variables.

Table 7 - OLS estimation of the effect of Green Grant on *Logging*, using different sets of covariates and treatment variables.

Dependent variable: *Logging*	**(1)**	**(2)**	**(3)**	**(4)**
Treatment Variables	**OLS - (Socioeconomic and household Covariates)**	**OLS - (socioeconomic and biome covariates)**	**OLS (socioeconomic and territory covariates)**	**OLS - (all covariates)**
Treatment - all sample	0.001 (0.015)	0.002 (0.014)	0.0006 (0.014)	0.0005 (0.014)
Treatment - less than 1 year	0.003 (0.029)	-0.025 (0.028)	-0.020 (0.008)	-0.016 (0.028)
Treatment - more than 1 year and less than 2	0.044 (0.24)	0.013 (0.022)	0.013 (0.023)	0.012 (0.022)
Treatment - more than 2 years and less than 3	0.047 (0.025)	0.006 (0.025)	0.0006 (0.025)	0.004 (0.025)
Treatment - more than 3 years	-0.028 (0.020)	-0.006 (0.020)	-0.008 (0.020)	-0.009 (0.020)

Column (1) refers to the estimation using socioeconomic and household controls. In column (2), biome dummies are also included. The model in column (3) comprises socioeconomic and household variables and dummies indicating territory category. Finally, the model in column (4) brings together all covariates. The number of observations for each treatment variable was reported on table 1 of section 4.

According to the table, the estimations are not statistically significant across all models and treatment variables for the effect of Green Grant on *Logging* activities. Moreover, the size of most coefficients are considerably small to have a meaningful interpretation. Therefore, the results do not suggest an impact of Green Grant on environmental conservation through reducing wood extraction.

The table also shows that the estimations on the subgroup of Green Grant beneficiaries who have been in the program longer - more than 3 years -, are the only ones whose coefficients are negative in all models - columns 1 to 4. The estimations for this group varies from -0.006 to -0.028, which means that treated individuals have between 0.6% to 2.8% lower chances of engaging in logging than untreated. However, the coefficients are not statistically significant and, therefore, the results do not corroborate the hypothesis that the longer recipients are exposed to the program, the stronger is its effect on environmental outcomes.

Next, I estimated the impact of Green Grant on each biome separately. As stated before, the reason for this procedure is to control for unobserved differences related to the environmental contexts, which could have biased the estimations. Hence, I compared only treated and non-treated observations located in the same biome.

Table 8 reports the results of the OLS estimation by biome. The columns refer to the ecosystems, whereas the rows correspond to the treatment variables. Once again, I estimated for different samples of beneficiaries, according to the period they have been in the program. The table also shows the number of beneficiaries and controls in each treatment variable. The models included all socioeconomic and household covariates, in line with the benchmark model.

Table 8 - OLS estimation of the effect of Green Grant on *Logging* by biome.

Dependent variable: *Logging*	(1)	(2)	(3)	(4)	(5)
Treatment Variables	Amazon	Caatinga	Savannah	Coastal Marine	Atlantic Forest
Treatment - all sample	-0.010	0.007	0.067	-0.004	0.055
Std. Error	(0.014)	(0.060)	(0.054)	(0.049)	(0.065)
N^0 Obs Treated	706	37	90	220	41
N^0 Obs Non-Treated	707	37	90	219	41
Treatment - Less than 1 Year	-0.025	-	0.042	-0.240	0.240
Std. Error	(0.024)	-	(0.109)	(-1.14)	(0.159)
N^0 Obs Treated	128	0	15	10	6
N^0 Obs Non-Treated	707	37	90	219	41
Treatment - More than 1 Year and less than 2	0.002	-0.006	-0.020	0.054	0.460
Std. Error	(0.020)	(0.139)	(0.172)	(0.072)	(0.233)
N^0 Obs Treated	193	6	6	67	3
N^0 Obs Non-Treated	707	37	90	219	41
Treatment - More than 2 Years and less than 3	-0.022	0.024	0.078	-0.052	-0.018
Std. Error	(0.026)	(0.056)	(0.074)	(0.130)	(0.073)
N^0 Obs Treated	103	31	45	17	32
N^0 Obs Non-Treated	707	37	90	219	41
Treatment - More than 3 Years	-0.018	-	0.062	0.033	-
Std. Error	(0.018)	-	(0.092)	(0.058)	-
N^0 Obs Treated	282	0	24	126	0
N^0 Obs Non-Treated	707	37	90	219	41

*** p<0.01, ** p<0.05, * p<0.1

According to the table, the impact of Green Grant on *Logging* is not statistically significant for all the biomes investigated, regardless of the period the beneficiary has been exposed to the program. Moreover, the magnitude of the coefficients do not show any trend of growth along the treatment variables. That is, the effect of Green Grant does not increase from beneficiaries who have been in the program for the least period - less than 1 year -, to the ones who have been recipients for more than 3 years, regardless of the biome they are in.

Therefore, the results presented in table 8 do not suggest an increasing effect of Green Grant with the period of treatment, even when controlling for ecosystem.

Concerning robustness checks, I estimated the impact of the program on *Logging* using Propensity Score Matching Method (PSM). I first ran matching regressions comparing beneficiaries and controls for the whole dataset. Then I matched only individuals from the treated and non-treated groups located in the same ecosystem.

The table below presents the results for the PSM on the first set of regressions. For the sake of comparison, the coefficients obtained with OLS model in column (1) of table 7 - the benchmark model -, are also reported on it. This specific OLS estimation provides a suitable comparison to the Matching one because both models use similar control variables.

Columns (1) and (2) shows the results for the OLS and Matching estimations, respectively. In rows, treatment variables are listed. All coefficients refer to the impact of Green Grant on *Logging* and information on the number of treated and non-treated observations are included.

Table 9 – OLS and matching regressions. Effect of Green Grant on *Logging* using different treatment variables

Outcome variable: ***Logging***	(1)	(2)
Treatment: Sample of beneficiaries	**OLS**	**Matching**
All sample	0.001	-0.009
Standard error	0.015	0.028
Nº treated observations	1094	1094
Nº control observations	1094	1082
Beneficiaries - less than 1 year	0.003	0.017
Standard error	0.029	0.020
Nº treated observations	159	159
Nº control observations	1094	1033
Beneficiaries - more than 1 year and less than 2	0.044	0.002
Standard error	0.024	0.018
Nº treated observations	275	275
Nº control observations	1094	1056
Beneficiaries - more than 2 years and less than 3	0.047	0.016
Standard error	0.025	0.013
Nº treated observations	228	228
Nº control observations	1094	1025
Beneficiaries - more than 3 years	-0.028	-0.039
Standard error	0.020	0.035
Nº treated observations	432	432
Nº control observations	1094	1074

Column 2 in Table 9 reports the Matching estimations. According to it, the effect of Green Grant on *Logging* is not statistically significant across all treatment groups, which is analogous to the OLS results (column 1). Moreover, the magnitude of the coefficients

estimated in columns 1 and 2 are considerably close, indicating that the estimations performed with Ordinary Least Squares are robust.

The group of beneficiaries who have been longer in the program, *Treatment - more than 3 years*, is the only one for which both OLS and Matching estimations are negative,-0.028 and -0.039 respectively. However, since both coefficients are not statistically significant, it is not possible to affirm that the impact of Green Grant on reducing *Logging* starts only after three years of "treatment" in the program.

Next, I used matching method to estimate the effect of Green Grant on *Logging* for each biome separately. That is, I only compared the Propensity Score values of beneficiaries and controls located in the same ecosystem.

The table below presents the results for matching estimation. OLS coefficients are also included for the sake of comparison.

Table 10 - OLS and matching regressions. Effect of Green Grant on *Logging* by biome, using different treatment variables.

Dependent variable: ***Logging***	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Biome	**Amazon**		**Caatinga**		**Savannah**		**Coastal Marine**		**Atlantic Forest**	
Treatment Variables	**OLS**	**Matching**	**OLS**	**Matching**	**OLS**	**Matching**	**OLS**	**Matching**	**OLS**	**Matching**
Treatment - all sample	-0.010	-0.0191	0.007	-0.004	0.067	0.008	-0.004	0.023	0.055	0.064
Std. Error	(0.014)	(0.012)	(0.060)	(0.033)	(0.054)	(0.026)	(0.049)	(0.058)	(0.065)	(0.087)
N^0 Obs Treated	706	706	37	37	90	90	220	220	41	41
N^0 Obs Non-Treated	707	693	37	31	90	83	219	213	41	36
Treatment - at least 1 Year	-0.025	-0.033	-	-	0.042	0.029	-0.240	-0.313	0.240	0.285
Std. Error	(0.024)	(0.028)	-	-	(0.109)	(0.073)	(-1.14)	0.175	(0.159)	(0.232)
N^0 Obs Treated	128	128	0	0	15	15	10	10	6	6
N^0 Obs Non-Treated	707	585	37	-	90	80	219	150	41	19
Treatment - at least 2 Years	0.002	-0.005	-0.006	-0.095	-0.020	-0.014	0.054	0.079	0.460	0.167
Std. Error	(0.020)	(0.015)	(0.139)	(0.147)	(0.172)	(0.150)	(0.072)	0.067	(0.233)	(0.103)
N^0 Obs Treated	193	193	6	6	6	6	67	67	3	3
N^0 Obs Non-Treated	707	669	37	22	90	72	219	209	41	16
Treatment - at least 3 Years	-0.022	-0.0264	0.024	0.014	0.078	-0.018	-0.052	-0.053	-0.018	0.024
Std. Error	(0.026)	(0.033)	(0.056)	(0.050)	(0.074)	(0.053)	(0.130)	0.123	(0.073)	(0.094)
N^0 Obs Treated	103	103	31	31	45	45	17	17	32	32
N^0 Obs Non-Treated	707	618	37	31	90	79	219	143	41	31
Treatment - at least 4 Years	-0.018	-0.020	-	-	0.062	0.046	0.033	0.043	-	-
Std. Error	(0.018)	0.023	-	-	(0.092)	0.068	(0.058)	0.044	-	-
N^0 Obs Treated	282	282	0	0	24	24	126	126	0	0
N^0 Obs Non-Treated	707	688	37	-	90	82	219	212	41	-

*** p<0.01, ** p<0.05, * p<0.1

According to Table 10, the impact of Green Grant on *Logging* is not statistically significant throughout all treatment variables and biomes, considering both OLS and Matching regressions. Besides, the size of the coefficients estimated by Matching are, in most cases, analogous to those found by OLS method. Therefore, the matching estimations seem to confirm the OLS results considering the outcome variable *Logging*, suggesting that our models are robust.

6.2. **Other Outcome Variables: *Awareness of Territory Statute***

I examined the impact of Green Grant on *Awareness of Territory Statute*. Following the methodology used for *Logging*, I fit OLS models for different sets of covariates and treatment variables.

The table below presents the results. Column (1) refers to the estimation using only socioeconomic and household controls. In column (2), biome dummies are also included. Models in column (3) comprises socioeconomic and household variables, as well as dummies indicating territory category. Finally, the model in column (4) brings together all covariates. The number of observations for each treatment variable was given in table 4 of section 4.

Table 11 - OLS estimation of the effect of Green Grant on *Awareness of Territory Statute*, using different sets of covariates and treatment variables.

	(1)	**(2)**	**(3)**	**(4)**
Dependent variable: ***Awareness of Territory Statute***	**OLS - (Socieconomic and household Covariates)**	**OLS - (sociecon and biome covariates)**	**OLS (socioecon and territory covariates)**	**OLS - (all covariates)**
Treatment - all sample	0.086***	0.088***	0.086***	0.086***
	(0.022)	(0.021)	(0.021)	(0.021)
Treatment - Less than 1 year	0.037	0.075	0.072	0.077
	(0.043)	(0.042)	(0.042)	(0.042)
Treatment - More than 1 year and less than 2	0.0689*	0.090**	0.0911**	0.089**
	(0.034)	(0.033)	(0.033)	(0.033)
Treatment - More than 2 years and less than 3	0.114**	0.058	0.058	0.045
	(0.037)	(0.037)	(0.037)	(0.037)
Treatment - More than 3 years	0.079**	0.089**	0.070*	0.080**
	(0.029)	(0.028)	(0.028)	(0.028)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table shows that Green Grant has had a statistically significant effect on *Awareness of Territory Statute* for most models and treatment variables.

Considering the whole sample of beneficiaries, the program has had a statistically significant effect on this outcome variable. Recipients in this group have around 8.6% more probability of knowing the territory statute than non-recipients.

A positive impact is also found among beneficiaries who have been in the program longer - more than 3 years -, whose probability is as much as 7.9% to 8.9% higher than non-beneficiaries, when it comes to *Awareness of Territory Statute*.

Finally, Green Grant recipients who have been in the program *more than 1 year but less than 2* also have a larger and statistically significant probability of knowing the territory rules than untreated, around 6.8% to 9.1%.

Nevertheless, taking into account the other treatment variables - *Less than 1 year* and *More than 2 years but less than 3* -, the effect of the program on Awareness of Territory Statute is not significant for most specifications. Therefore, the impact of Green Grant show an irregular pattern with the period of treatment and the statistical significance of the estimations varies across the treatment variables.

Next, instead of estimating the impact of Green Grant by biome, as was performed for *Logging*, I carried out regressions controlling for *Institutions* variable. Hence, I compared only treated and non-treated observations situated in areas managed by the same governmental agency to avoid the influence of unobserved differences among institutions. Moreover, as the variable *Awareness of territory statute* is likely affected by the management performance of institutions in charge of the protected areas, it is useful to investigate whether Green Grant`s impact on this outcome has varied across governmental agencies.

The table below shows the results of OLS estimation by institution for different treatment variables. In line with the benchmark model, the specifications on columns 1 to 3 used covariates for socioeconomic and household conditions.

Table 12 - OLS estimation of the effect of Green Grant on *Awareness of Territory Statute* by *Institution*.

Dependent variable: *Awareness of Territory Statute*	(1)	(2)	(3)
	ICMBio	INCRA	SPU
Treatment - all sample	0.062	0.075***	0.156*
Std. Error	(0.035)	(0.029)	(0.076)
N^0 Obs Treated	357	646	91
N^0 Obs Non-Treated	357	646	91
Treatment - less than 1 Year	0.008	0.0073	0.334**
Std. Error	(0.091)	(0.053)	(0.112)
N^0 Obs Treated	29	106	24
N^0 Obs Non-Treated	357	646	91
Treatment - more than 1 year and less than 2	-0.047	0.124**	0.155
Std. Error	(0.055)	(0.048)	(0.094)
N^0 Obs Treated	97	135	43
N^0 Obs Non-Treated	357	646	91
Treatment - more than 2 years and less than 3	0.036	0.137**	-0.071
Std. Error	(0.074)	(0.045)	(0.152)
N^0 Obs Treated	47	166	15
N^0 Obs Non-Treated	357	646	91
Treatment - more than 3 years	0.109*	0.0052	-0.103
Std. Error	(0.042)	(0.039)	(0.179)
N^0 Obs Treated	184	239	9
N^0 Obs Non-Treated	357	646	91

*** p<0.01, ** p<0.05, * p<0.1

The results reported in table 12 are mixed. The National Institute of Settlement and Land Reform (INCRA) - column 2 - exhibits statistically significant coefficients in three out of five the treatment variables. Green Grant beneficiaries located in INCRA areas have between 7.5% to 13.7% more chances of being aware of the territory rules than non-beneficiaries, considering only the statistically significant estimations. However, there is no growth trend observed on the effect of the program on *Awareness of Territory Statute* as the treatment period increases inside INCRA territories.

The impact of Green Grant in territories managed by Chico Mendes Institute of Biodiversity (ICMBio), on the other hand, is only statistically significant for the group who have been in the program longer, more than three years. This sample of recipients have 10.9% more chances of knowing the *land`s statute* than non-recipients.

Finally, concerning SPU agency, the statistically significant estimation for the entire sample (15.6%) seems to be reflecting the large impact of the program observed among beneficiaries who have been in the program for the least period, *less than 1 year*. This group has 33.4% more chance of knowing the territory rules than non-treated. Contrary

to our expectation, the longer beneficiaries are exposed to the program, the less they are aware of territory rules when it comes to areas managed by SPU. In some cases, Green Grant recipients have a lower probability of knowing the statute than non-recipients, even though the coefficients are not significant.

In sum, the OLS estimation by *Institution* provides mixed results for the effect of the program on *Awareness of Territory Statute*. For some governmental agencies, the period of exposure to Green Grant increases the probability of knowing the territory statute, e.g. ICMBio; whereas for others the effect is stronger among the recipients who were admitted in the program more recently, e.g. *less than 1 year* in SPU areas. Moreover, in areas administered by INCRA, the effect of the program is erratic throughout the treated groups.

These results suggest further analysis of the impact of Green Grant by *Institution* are necessary. The variations observed on the estimations could be reflecting differences or imbalances across the treated samples, as well as performance variations within the same institution. INCRA territories included in one treatment sample (e.g. *less than 1 year*) may be worse managed than other INCRA areas located in another treatment group (e.g. *more than 2 years and less than 3*). Therefore, the estimations by *Institution* should be taken with caution and demand more investigation.

Regarding robustness check, I used PSM method to estimate the effect of the conservation program on this outcome variable. The estimations are reported on the table below. To facilitate comparison, the coefficients obtained with OLS benchmark model, in column (1), of table 11 are also included below.

Columns (1) and (2) present the results for the OLS and Matching estimations, respectively. In rows I listed different treatment variables: the whole sample of beneficiaries, as well as subgroups of recipients according to the period of time they have been in the program. All estimated coefficients refer to the impact of Green Grant on *Awareness of Statute,* comparing treated and non-treated individuals

Table 13 – OLS and Matching. Effect of Green Grant on *Awareness of territory Statute* using different treatment variables

Outcome variable: ***Awareness of Territory Statute***	(1)	(2)
Treatment: Sample of beneficiaries	**OLS**	**Matching**
All sample	0.086***	0.077***
Standard error	(0.022)	0.020
Nº treated observations	1094	1094
Nº control observations	1094	1082
Beneficiaries - less than 1 year	0.037	0.029
Standard error	(0.043)	0.028
Nº treated observations	159	159
Nº control observations	1094	1033
Beneficiaries - more than 1 year and less than 2	0.0689*	0.060
Standard error	(0.034)	0.038
Nº treated observations	275	275
Nº control observations	1094	1056
Beneficiaries - more than 2 years and less than 3	0.114**	0.115***
Standard error	(0.037)	0.013
Nº treated observations	228	228
Nº control observations	1094	1025
Beneficiaries - more than 3 years	0.079**	0.086***
Standard error	(0.029)	0.011
Nº treated observations	432	432
Nº control observations	1094	1074

According to the table, matching estimations are fairly close to those obtained by OLS method, with some negligible differences. Both the size and statistical significance of the coefficients are considerably similar between the two estimation methods, implying that the models are robust.

Concerning the estimations by *Institution*, table 14 reports the results found with Matching as a means of robustness check. To facilitate comparison, OLS coefficients for each institution and treatment variable are also shown.

Table 14 - OLS and Matching. Estimation of the effect of Green Grant on *Awareness of territory Statute*, by *Institution*, for different treatment variables.

Dependent variable: *Awareness of Territory Statute*	(1)	(2)	(3)	(4)	(5)	(6)
	ICMBio		INCRA		SPU	
	OLS	Matching	OLS	Matching	OLS	Matching
Treatment - all sample	0.062	0.060	0.075***	0.067*	0.156*	0.127
Std. Error	(0.035)	(0.034)	(0.029)	(0.034)	(0.076)	(0.108)
N^0 Obs Treated	357	357	646	646	91	91
N^0 Obs Non-Treated	357	348	646	635	91	86
Treatment - less than 1 year	0.008	0.025	0.0073	0.014	0.334**	0.370**
Std. Error	(0.091)	(0.110)	(0.053)	(0.053)	(0.112)	(0.125)
N^0 Obs Treated	29	29	106	106	24	24
N^0 Obs Non-Treated	357	280	646	607	91	72
Treatment - more than 1 year and less than 2	-0.047	-0.016	0.124**	0.103***	0.155	0.107
Std. Error	(0.055)	(0.037)	(0.048)	(0.027)	(0.094)	(0.112)
N^0 Obs Treated	97	97	135	135	43	43
N^0 Obs Non-Treated	357	334	646	559	91	78
Treatment - more than 2 years and less than 3	0.036	0.038	0.137**	0.171***	-0.071	-0.046
Std. Error	(0.074)	(0.051)	(0.045)	(0.042)	(0.152)	(0.129)
N^0 Obs Treated	47	47	166	166	15	15
N^0 Obs Non-Treated	357	288	646	604	91	77
Treatment - more than 3 years	0.109*	0.128***	0.0052	0.008	-0.103	-0.040
Std. Error	(0.042)	(0.019)	(0.039)	(0.032)	(0.179)	(0.131)
N^0 Obs Treated	184	184	239	239	9	9
N^0 Obs Non-Treated	357	347	646	625	91	69

*** p<0.01, ** p<0.05, * p<0.1

According to Table 14, matching estimations either confirm the results granted by OLS method or provide close figures for most coefficients. However, it casts doubt on the statistical significance of the OLS estimation for SPU agency, considering all the sample of beneficiaries (*Treatment – all sample*). While the coefficient estimated by OLS is statistically significant (0.156*), the Matching regression did not identify any significant effect of Green Grant (0.127) considering SPU areas and *all the sample* of beneficiaries. Although the size of the coefficients are fairly similar, I believe the Matching estimation looks more accurate and coherent than the one produced by OLS. Nevertheless, further analysis and data are needed to allow more trustworthy conclusions.

6.3. New Tools

Following, this study examined whether Green Grant had an impact on the acquisition of new tools for production activities and other ends. As before, I ran OLS regressions for different models and treatment variables.

Table 15 - Effect of Green Grant on *New Tools*, with different models (covariates) and treatment variables

Dependent variable: *New Tools*	**(1)**	**(2)**	**(3)**	**(4)**
	OLS - (Socieconomic and household Covariates)	**OLS - (sociecon and biome covariates)**	**OLS (socioecon and territory covariates)**	**OLS - (all covariates)**
Treatment - all sample	0.210***	0.210***	0.211***	0.211***
	(0.020)	(0.020)	(0.020)	(0.020)
Treatment - Less than 1 year	0.161***	0.148***	0.148***	0.148***
	(0.037)	(0.037)	(0.037)	(0.037)
Treatment - More than 1 year and less than 2	0.249***	0.245***	0.240***	0.239***
	(0.030)	(0.030)	(0.030)	(0.030)
Treatment - More than 2 years and less than 3	0.209***	0.189***	0.195***	0.192***
	(0.032)	(0.033)	(0.033)	(0.034)
Treatment - More than 3 years	0.204***	0.210***	0.217***	0.221***
	(0.026)	(0.026)	(0.026)	(0.026)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The impact of Green Grant on the acquisition of new tools is statistically significant in all models and across all treatment variables. According to the table, the program has contributed to the purchase of new tools by recipients. The impact of Green Grant varies from 14.8% to 22,1%, depending on the model specification. That is, recipients have as much as 14.8% to 22.1% higher probability of acquiring new tolls than non-recipients.

Hence, this result indicates a potential impact of Green Grant to improving the livelihoods of beneficiaries through better working conditions. Moreover, it seems to fulfil one of the program's main goals: improving living conditions and increasing the income of the population who lives in extreme poverty situation (Decree n° 7572/2011).

However, the results do not indicate that the more exposed to the program, the stronger is its effect on this outcome variable. The effect of Green Grant oscillates along the treatment variables and does not grow linearly with the period of exposure.

Lastly, I ran matching regressions for the purpose of robustness check. The table below reports the results for the estimation using PSM method. To facilitate comparison, the coefficients obtained with OLS model with socioeconomic covariates are also reported.

Table 16 - OLS and Matching. Effect of Green Grant on *New Tools*, for different treatment variables

Outcome variable: ***New Tools***	(1)	(2)
Treatment: Sample of beneficiaries	**OLS**	**Matching**
All sample	0.210***	0.208***
Standard error	0.020	0.030
Nº treated observations	1094	1094
Nº control observations	1094	1082
Beneficiaries - less than 1 year	0.161***	0.163**
Standard error	0.037	0.059
Nº treated observations	158	159
Nº control observations	1094	1033
Beneficiaries - more than 1 year and less than 2	0.249***	0.240***
Standard error	0.030	0.020
Nº treated observations	275	275
Nº control observations	1094	1056
Beneficiaries - more than 2 years and less than 3	0.209***	0.202***
Standard error	0.032	0.035
Nº treated observations	228	228
Nº control observations	1094	1025
Beneficiaries - more than 3 years	0.204***	0.207***
Standard error	0.026	0.035
Nº treated observations	432	432
Nº control observations	1094	1074

The table indicates that matching estimations are quite analogous to those obtained by OLS, not only for the size of the coefficinets, but also concerning the statistical significance of the impacts. The comparison between OLS and Matching estimations endorse the robustness of the models used in this investigation.

7. Conclusion

Green Grant is a conservation program that makes cash payments to families/individuals conditional on their compliance with environmental obligations. It was first implemented in October 2011 and nowadays benefits more than 47 thousand families/individuals.

The program was designed to reinforce the environmental regulations families and traditional communities are subjected to in protected areas, as well as improve their living conditions.

In this sense, Green Grant contributes to strengthen one of the most important conservation strategies adopted in Brazilian Amazon, consisting on assigning lands to specific purposes and ethnic groups, in order to protect their cultural heritage and reinforce their means of existence.

Furthermore, Green Grant represents an achievement for environmentalists and traditional communities on the on-going dispute with agribusiness and other industries, e.g. mining, over the Amazon territory.

Concerning the conservation outcomes, this investigation found no statistically significant effect of Green Grant on *Logging* activities for the whole sample of treated observations, as well as for subgroups of recipients. Likewise, no impact was identified when biomes were controlled for. Still, the lack of causal effect does not mean that the program has failed to address conservation issues.

Monitoring data on forest cover in areas benefited by the program have shown a fairly stable situation. According to 2016 report using satellite images, only 4.03% of vegetation coverage has been damaged in Green Grant areas (MMA, 2018a). Although the result cannot be attributed to the program`s effect, conservation conditions in the territories seem to be under control.

Moreover, impact evaluations should take into consideration the time span since the program was first created. Green Grant has been implemented for as little as 6 years by now and its effects may only be observed in the long-run. Thus, it is important that the program can be sustained for at least one decade and that monitoring activities are carried out periodically.

Considering the outcome variable *Awareness of Territory Statute*, this study found a statistically significant effect of Green Grant for most groups of beneficiaries. According to both OLS and matching estimations, recipients have around 7% to 11% more chances of knowing territory rules than non-recipients.

This study assumes that the larger is the number of individuals who are aware of the conservation norms, the better it is for preservation outcomes. However, the mechanisms

by which enhanced awareness of territory rules may impact the environment preservation is an interesting open problem.

Furthermore, when controlling for the *institution* in charge of the territory, the effect of Green Grant on this outcome variable was found to be uneven across governmental agencies and groups of beneficiaries. In territories administered by ICMBio, the impact of the program is statistically significant only among recipients who have been in the program longer, *more than 3 years*. On the other hand, in areas managed by SPU and INCRA, the effect of Green Grant was observed for different treatment groups: *Less than 1 year* in the program, *More than 1 year but less than 2* and *More than 2 years but less than 3*.

These results suggest that a heterogeneous performance within and among the governmental agencies may be occurring when it comes to handling their administration duties, e.g. communication with families about the rules applied to the territory, implementation of a new governmental program, among others. That is, differences in the structure and efficiency of each institution could be affecting how Green Grant contribute or not to enhance *Awareness of territory statute*. Moreover, there might be imbalances among treated groups with potential bias on the estimations. Although the program is having, on average, a positive impact on this outcome, further investigation on the relation between Green Grant and the institutions in charge of the territories is necessary.

Finally, this study identified a statistically significant effect of the program on the acquisition of new tools and equipment for production. Although this result seems promising for the potential impact on increasing production and income, other governmental programs on agroforestry and sustainable production are needed to complement and enlarge the effect of Green Grant.

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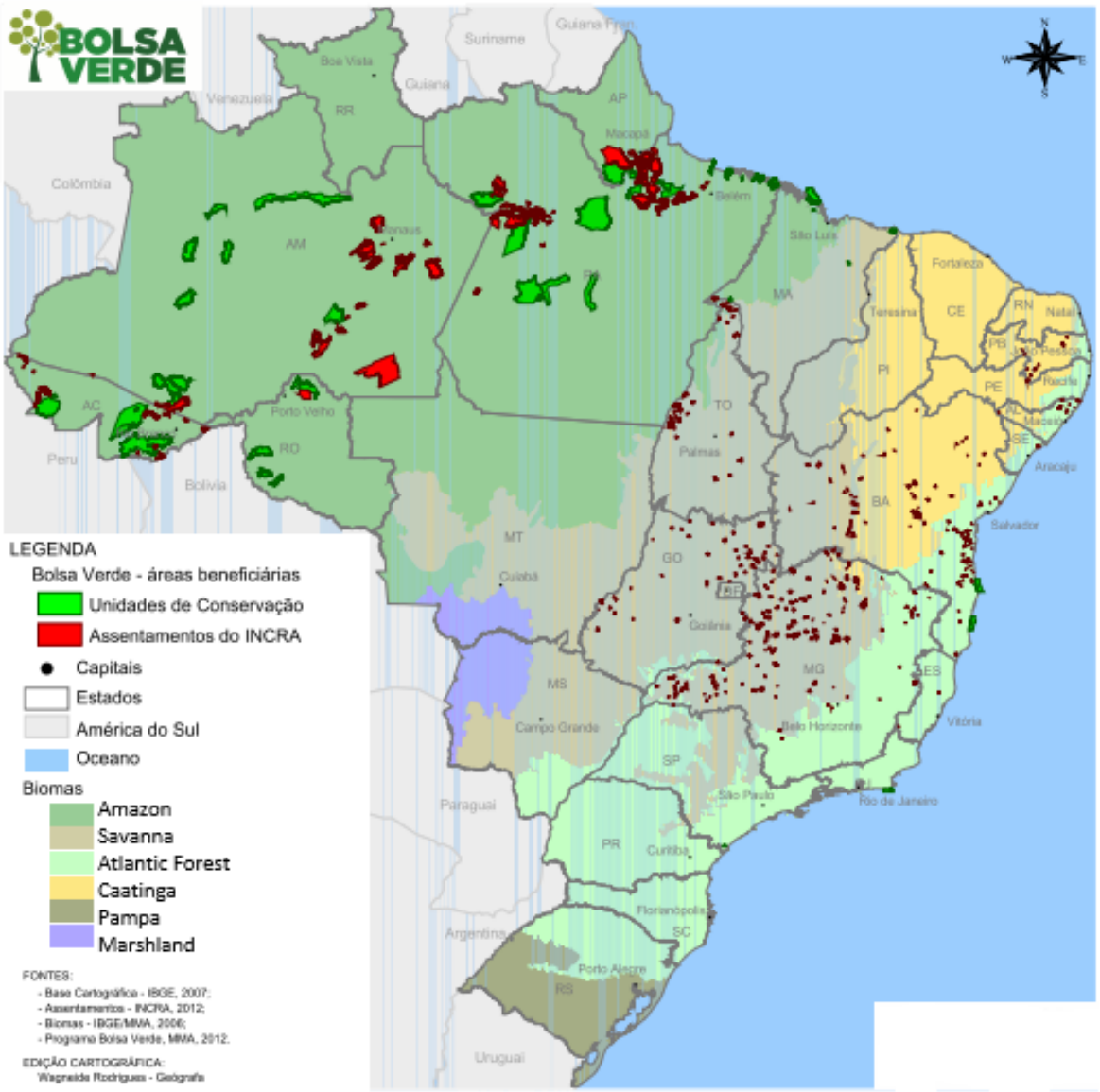
Appendix

The image below illustrates Brazilian Biomes and Green Grant areas. The red spots refer to PAE, PA and PDS territories managed by INCRA, whereas the green ones are Resex, Marine Resex and RDS protected areas run by ICMBio.



Source: MMA, 2018. Coastal Marine biome is not illustrated in the image.

Protected Areas included in Green Grant:

- Multiuse Extractive Conservation Units (ICMBio, 2018),

    - National Forests (FLONA): are multiuse forest areas, in which takes place sustainable use of natural resources and scientific research driven to investigate

sustainable methods of exploring forest products. Traditional communities are allowed to live in Flona territories.

  - Extractive Conservation Units (Resex): are territories occupied by traditional communities, mainly rubber tappers, who carry out low impact extractive activities and subsistence farming. Resex aims to protect the cultural heritage and provide subsistence means for traditional groups, ensuring the sustainable use of natural resources.
  - RDS: are native territories that hold traditional populations, who have mastered across generations sustainable use of natural resources adapted to the local ecosystems. This category of protected area plays a fundamental role in environmental conservation and biodiversity maintenance.

- Land Reform Settlements (INCRA, 2018)

  - Conventional Settlements (PA): are settlements more oriented to production. They also have to comply with environmental regulations, although preservation issues are not of main concern in these locations.
  - Environmentally Sustainable Agroextractive Settlements (PAE): are territories in which sustainable use of natural resources are allowed and that aims to protect and provide susistence means for traditional groups, mainly rubber tapper and forest pickers.
  - Sustainable Development Settlements (PDS): are settlements aimed to enhance environmentally sustainable activities and to protect the cultural heritage and provide subsistence means for traditional populations – riverside groups, rubber tappers, among others.

- Riverside Groups: traditional populations that have been living in public lands in meadows and river banks and were conceded the right to use natural resources in the territory by the governmental agency SPU.