

Brazilian Amazon Deforestation and land governance

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SUMMARY

This article's aim is to show that the main cause of deforestation in the Amazon³ rain forest is the lack of land governance. The deforestation occurs mainly because property rights are not clearly established, and occurs on land directly or indirectly related to the state. After making a literature review on the Amazon deforestation causes, data from PRODES (published by IMAZON, IPAN and ISA) on deforestation for the Amazon region and for the states will show the main landowners types in which deforestation occurs more frequently. Based on this data, the article will show that most of the deforestation happens in land under different types of state control, making more evident that the need of land governance for the diminishing of the deforestation should start with state controlled land. New actions on land administration of the Brazilian government plays an important role: efforts to improve the cadaster (SIGEF) and Terra Legal that is solving problems with public land in a large area of the Amazon. The concluding section will synthesize the main findings and remark that the continuous effort to reduce deforestation will only be possible through a more efficient land governance for the country, particularly for the Amazon region. It will also show other important contributions that the participatory Land Governance will have on the better use of land, on the control of land ownership, mainly through the charging of land taxes.

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³ The Legal Amazon region comprises all six states of the Brazilian Northern Region (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins) and part of Mato Grosso and Maranhão, for a total of 5,217,423 sq. km (521,742,300 ha) (Brasil, 2014). In other words, 59% of the Brazilian territory is part of Legal Amazon and 12.34% of the Brazilian population lives here summing up to more than 25 million, 62 % of them in urban areas.

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1. INTRODUCTION

The deforestation of the Amazon rainforest has been debated on a number of different fronts, often superficially or steeped in ideology. Amongst the subjects most commented upon we find the debate that revolves around changes in the Brazilian Forestry Code and the recent increase in the rates of deforestation. First, it is necessary to clearly identify the process, then determine the causes and, finally, reflect on short, medium and long-term solutions.

It is undeniable that the strong command and control policies⁶ and economic incentives⁷ implemented in recent years have played a crucial part in reducing deforestation. As these depend on the direct intervention of the State, it is difficult for them to be maintained in the long run, mainly because the principal production-related agents of deforestation, ranging from livestock farming to the production of grain and ultimately the production of electricity, will persist and lasting solutions must be found. The core aim of the present study is to demonstrate that the definitive solution to this problem must necessarily address the solution of the country's agrarian problems that mainly consist of the Brazilian State taking on, in conjunction with the society, the effective governance over land ownership, particularly land under the control of the State.

Initially, the present article presents a brief description of the main causes of deforestation that have been identified in the literature on this topic. After that, in the third item more data on the deforestation is showed, and can be noticed that most deforestation occurs on land that is directly or indirectly ruled by the State. Then it will be shown how two problems that appear at the margins of the literature are, when brought together, the main drivers of deforestation: land speculation via the deforestation of land itself and the absence of land governance. The fourth item analyzes historically the creation of the institutional framework that leads to the absence of regulation in the land market. The fifth will show the efforts from the government in increasing land governance trough two main instruments: the Terra Legal regularization program that has finally, in the last section, as well as arguing for the need for effective land

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⁶ The main Command and Control Policies, direct State interventions that change the behavior of the deforesters, were: a) the operations known as Curupira (2005) and Arco de Fogo (2008), to combat illegal timber extraction; b) decree 6321/07, which restricts the granting of bank loans and obliges owners in the municipality who are the biggest offenders of deforestation, to reregister; c) the creation of Conservation Units, adding a further 20 million hectares to the more than 80 million already in existence, totaling 273 units; d) certification of 87 Native Lands and approximately 18 million hectares; e) limited to agricultural products emanating from municipalities with highest rates of deforestation.

⁷ Economic Incentive policies that use economic mechanisms (prices or otherwise) to incentivize or inhibit economic agents to reduce deforestation are as follows: a) operation Arco Verde (2008), and b) Special line of credit in the area of FNO, FNE and FCO for the recovery of degraded areas, reforestation, management and regularization in the Legal Amazon.

property governance, the main implementation mechanisms and the benefits it will generate will be demonstrated.

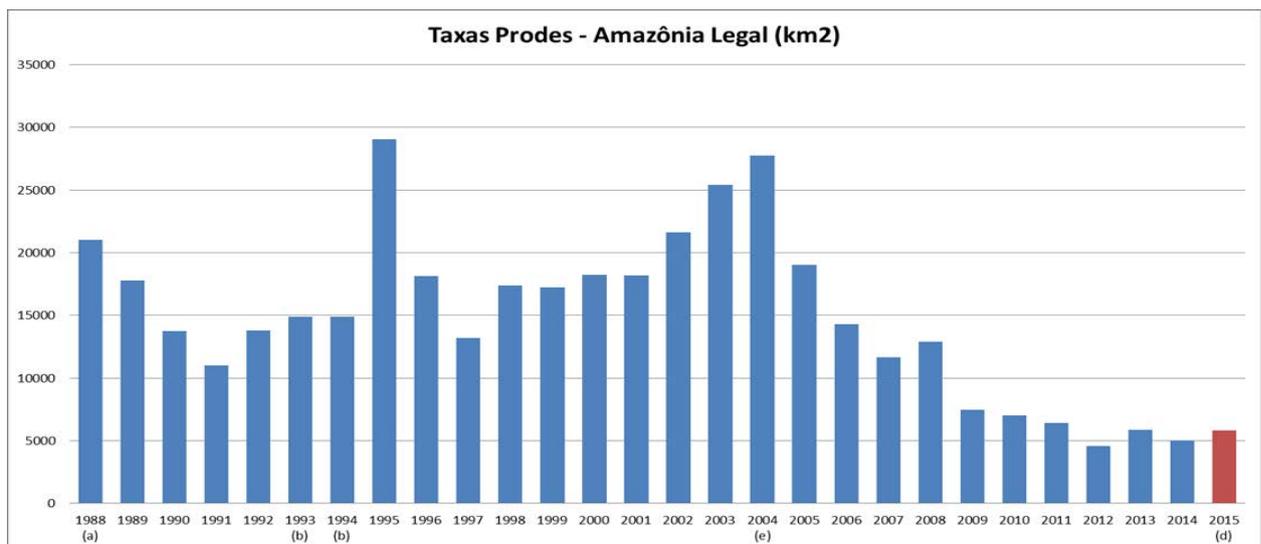
2. DEFORESTATION AND ITS PRINCIPAL CAUSES

According to the FAO (2010),

“Brazil has lost an average of 2.6 million hectares of forest per year over the last 10 years, compared with an annual loss of 2.9 million hectares in the 1990s; in Indonesia the losses were 500,000 hectares between 2000 and 2010 and 1.9 million hectares between 1990 and 2000.”

Graph 1 shows deforestation in Amazonia based on images produced by the PRODES satellite and it shows that the average annual deforestation between 2000 and 2013 was 14,315 km² per year, amounting to 200,416 km² (around 20 million hectares) in the period. The decrease in annual deforestation from 2004 (27,700 km²) to 2013 (5,891 km²) represents a substantial improvement but it is still a very high level of deforestation for a biome with the characteristics of the Amazon. This is a biome whose standing forest represents its greatest riches, given its great biodiversity, its importance for regulating the climate of the planet, its production of fresh water and a soil that is unsuited to agricultural pasture activities.

Graph 1. Annual rate of Deforestation in square km the Legal Brazilian Amazon



SOURCE: PRODES (2016).

The question that remains is, how can we turn an increase in the rates of deforestation inviable and more importantly, how do we significantly reduce them? Deforestation of the Amazon forest is a complex process with multiple drivers and has been the object of various theoretical and empirical studies⁸. Margulis (2000:9) states: “We do not believe that there is a single,

⁸For an in-depth review, see Soares Filho et al (2005).

principal force which drives or explains the deforestations in Amazonia. The causes are manifold and result from a sophisticated combination of diverse variables and factors”.

The main groups of variables that lead to deforestation, evident in Margulis (2000) and in the best part of the literature are:

- a) Benefits associated with the use of land in Amazonia, determined by agricultural prices, increase in the price of land, variation in the price of inputs, increase in the price of timber and the reduction in rural wages;
- b) Public policies and credit – the availability of cheap credit (FINAM, FNO) and fiscal incentives (SUDAM);
- c) Accessibility – the construction of highways and/or other works that facilitate access to the frontier areas;
- d) Macroeconomics – cycles of GDP growth, population growth.

Inasmuch as these four groups of variables have directly interfered with the deforestation of Amazonia, it may be said that, after the interventions of recent years and the crisis of 2008/2009, all have probably had positive impacts on deforestation, nevertheless deforestation has decreased. On the other hand, even in the periods in which these variables are not growing, deforestation rose. This shows that there are other, more profound factors at work whose relative importance has not been highlighted.

3. DEFORESTATION IN DETAIL: IN THE STATES AND BY TYPE OF LAND ACCESS

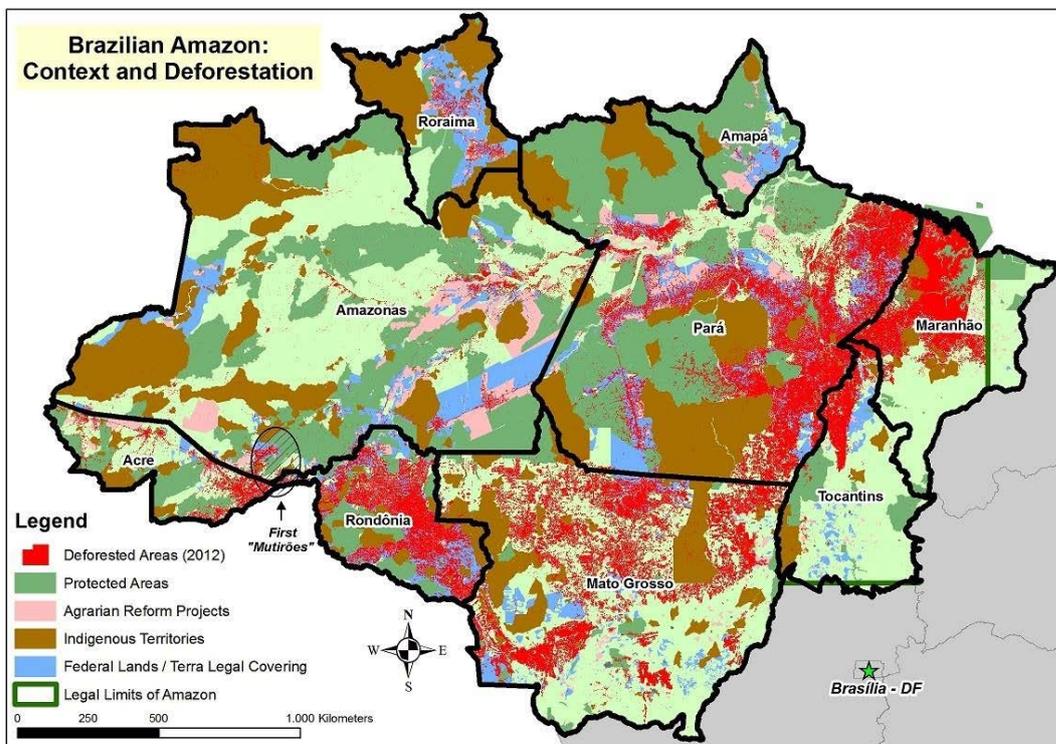
Before discussing the causes and main steps to be taken with regard to deforestation, it is necessary to go deeper into its characteristics, in other words to find out in which states it is happening more intensely and if there have been any significant changes in incidence over recent periods. Table 1 shows that the state with the highest incidence of deforestation is Pará, with a little more than 40% of the total deforestation of the Amazon region and an area of 2,037 km² cleared in 2013. However, deforestation in the state of Pará, though higher, grew at a slower pace between 2012 and 2013, at 13%, than states like Mato Grosso and Rondônia that exhibited the highest deforestation growth, at 38.3% and 29% respectively. However, other states demonstrated significant reductions in deforestation: Amapá, Tocantins and Acre fell between 21% and 94%. The reason for these differences requires greater research and explanations. The Map 1 shows this linked with the geographical space. It also shows the large amount of conservation units and indigenous people's lands that surely reduced deforestation as established clearly that that is state land.

Table 1. Deforestation of the Amazon forest per km² in different states in the northern region of Brazil -2012 and 2013.

State	Deforestation in 2012	% of total 2012	Deforestation in 2013	% of total 2013	2013/2012, %
AC	274	6.2	158	3.2	-42.4
AM	458	10.3	360	7.4	-21.4
AP	20	0.4	1	0.0	-94.4
MA	304	6.8	230	4.7	-24.4
MT	774	17.3	1,070	21.9	38.3
PA	1,794	40.2	2,037	41.8	13.6
RO	679	15.2	876	18.0	29.0
RR	108	2.4	116	2.4	7.4
TO	48	1.1	27	0.6	-43.9
Grand Total	4,459	100.0	4,875	100.0	9.3

Source: ISA/IMAZON/IPAM (2014).

Figure 1: Deforestation and Main Public Land Use Categories in the Amazon 2016



Source: Duchrom (2016)

The information that is most important for the objectives of this study is the type of property (agrarian category) where the deforestation took place. It is interesting that Robinson et al (2013:8) made a complete review with international literature, trying to verify how security of land tenure impacted on deforestation. Firstly they did not come to very strong conclusions when stated that

“At an aggregate level, the form of land tenure seems to matter in different ways in different regions of the world. We cannot rule out selection or publication bias given our relatively small sample of case studies in each region, but these outcomes emphasize the importance of local factors”.

But latter in the same page they proposed that:

“Overall, protected land is associated with positive outcomes [less deforestation] in all regions, and public land seems to be particularly vulnerable to negative forest outcomes in South America. Communal land performs well in our Central American cases but worse in Africa, possibly due to the effects of regional conflict and/or weak governance.”

So we would expect that in Brazil the same would occur. But there are information on the Brazilian land ownership main categories that helps dealing with this issue. What can be seen in table 2 that should be pointed out that the largest share of deforestation goes to the agrarian reform settlements with 28.7% of the total deforestation, a growth of 9.4% in the period. This is clearly down to the absence of a clear policy to limit deforestation in the agrarian reform settlement projects in Amazonia.

Next comes the areas for which no information exists, that may be public or private land, with 23% in 2013, a growth in area in the period of 16.8%. Deforestation on private property, although it dropped slightly in absolute numbers, appears in third place, accounting for over 20% of the deforestation, quite a significant percentage.

The categories of property that should be showing almost zero deforestation, on account of them being protected areas (environmental protection areas, Conservation Units, Indigenous Lands), still appear, however, to have areas of deforestation, between 140 and 230 km² in each category, which is not insignificant. Except for the indigenous lands, all demonstrated significant growth between 2012 and 2013, being higher in the environmental protection areas (a growth of over 42%).

This group of information is more than enough to argue for the need of greater control over the land use and occupation in Amazonia. However if we were to add together all the agrarian categories associated with Brazilian states, excluding those that are clearly private, it can be seen, as depicted in table 2, that 79.6 % of deforestation in 2013 occurred in lands directly controlled by the state. Therefore, an effective control over the different categories of public land is the decisive first step to reduce deforestation in the country.

Table 2. Deforestation by type of agrarian category - Amazonia - 2012 and 2013 - (in km²)

Agrarian Category	Deforestation in 2012	% of total 2012	Deforestation in 2013	% of total 2013	% 2013/2012
Environmental Protection Area	164	3.7	234	4.8	42.5
Settlement Projects	1,279	28.7	1,400	28.7	9.4
Private property (Rural Environment Registry (CAR) certified by INCRA)	1,041	23.3	994	20.4	-4.5
Areas without any information (unregistered public or private land)	960	21.5	1,121	23.0	16.8
Native Lands	174	3.9	148	3.0	-15.0
State public land	15	0.3	1	0.0	-94.4
Federal public land	540	12.1	664	13.6	23.0
State Conservation Units	119	2.7	142	2.9	19.7
Federal Conservation Units	167	3.7	170	3.5	1.9
Grand Total	4,459	100.0	4,875	100.0	9.3

Source: ISA, IMAZON, IPAM (2014).

4. DEFORESTATION AND LAND SPECULATION

It is our understanding that the deforestation of Amazonia is a product of the continuation of the traditional form of expansion of the agricultural frontiers in Brazil which generally occurs by way of the following steps: the occupation of virgin land (private or public), the legal extraction of timber, the introduction of livestock farming⁹ and, finally, the development of a more modern forms of agriculture. These economic activities exercise the role of generating income and legitimizing the occupation of the new owners in the short term, almost without the need for any resources¹⁰. In the long term, the lands either remain under more intensive livestock farming or, if the demand exists, they will be converted to grain or another economic activity.

The most important factor is that there is an expectation that there will be demand for this land¹¹, to be used at some future point in time, meaning that its price is significantly increased. The closer the land is physically to the regions that permit productive use, the higher the price. The appreciation in the value of these lands will occur as these expectations increase.

In the studies conducted by Margulis (2000 and 2003), and in the literature already cited, the question of land speculation appears, but it is usually associated with increases in land price.

⁹ Reydon and Romeiro (2000) show that the main driver of conversion to agriculture is, on the one hand, the existence of a lot of vacant land that can be appropriated, combined with the possibility of introducing agricultural farming, at low cost, turning deforestation into an unbeatable capital appreciation strategy.

¹⁰ It is these occupiers that frequently make use of slave labor.

¹¹ This arises as a result of the increase in the price of an arroba of beef cattle, soy or even the announcement that the country is to be the largest producer of alcohol in the world. In recent periods, these factors have converged, making demand for land, and its price, grow even more, putting ever more pressure on deforestation.

However, the increase in land price does not necessarily mean that a speculation process is underway. In this regard, the price of land in the northern region, roughly speaking, tracks the movement in land price in the rest of the country and does not generate substantial speculative gains.

Land speculation which, as this article proposes, is the driving force of the deforestation of the Amazon forest, occurs in a far more microeconomic way and is associated with the actual occupation of land, and can be seen very clearly in the field research. In reality, what happens is that anybody who acquires or occupies the land that includes forest, has a clear understanding that his land, his investment, will grow in value with the deforestation process. Table 1¹² shows initially that the price of forested land ranges, in the different states, from R\$108 in Acre to R\$546 in Mato Grosso. Here it can also be seen how the least deforested states have the lowest land prices, while the states of Mato Grosso, Pará and Rondônia have the highest prices.

The most important conclusion to be drawn from the table is that in all the states, deforestation always raises the value of property substantially, and in these states, on average, deforestation increased the value of land more than fourfold. This happens because the price of land is still essentially the product of expectations of productive gains arising from the associated agricultural activity and in deforested areas it can be used immediately without the costs involved in clearing the forest.

In the most extreme case, in Acre, deforestation multiplies this value more than 14 times, while in the state of Amazonas, the multiple is almost 10 times. Very few investments have such high returns as these.

It should be borne in mind that these owners, in addition to the increase in net worth occasioned by deforestation, also make gains from the sale of timber (in Cotriguaçu, in Mato Grosso, net returns in the order of R\$2,400 per hectare are estimated) and also from its subsequent economic use (if this is due to livestock farming, it will generate additional net revenue of over R\$120 per hectare per year¹³). Therefore the best catalyst of deforestation is the combination of gains from the appreciation of the land, its conversion from forest to productive land, associated with gains from timber and livestock farming, established in subsequent periods.

Table 3. Average prices of forest and pasture land – states comprising Amazonia- in R\$ per hectare in 2015

STATES	Forest R\$/ha	Pasture R\$/ha	encrease %
Acre	534,25	3.246,80	608%
Amapá	470,00	1.006,50	214%
Amazonas	574,33	1.448,38	252%

¹²The Agra FNP methodology is to collect average prices inhomogeneous regions in the cited states using a non-uniform terminology. To forest we add so-called forest, forests that are easy to access and those that are difficult to access. For pasture land we use formed pasture (easy and difficult access), formed high-maintenance pasture and formed low-maintenance pasture.

¹³See Margulis (2003).

Pará	1.715,09	2.976,84	174%
Rondônia	2.453,40	7.288,89	297%
Roraima	817,00	1.277,50	156%
Mato Grosso	3.005,8	6.906,2	230%
Average NORTH	1.367,12	3.450,16	252%

SOURCE: FNP 2016

This process of acquisition and deforestation, which is already extremely profitable in private areas, is becoming much more lucrative in vacant lands which, according to estimates¹⁴, represents 42% of the total area of Amazonia, where the majority of deforestation takes place. This means that on appropriating vacant lands, the gains from timber, livestock farming and the appreciation of the land are multiplied as the land in itself did not need to be acquired, simply usurped from the public property¹⁵.

5. LAND APPROPRIATION IN AMAZONIA AND THE INSECURITY OF PROPERTY RIGHTS

The practice of land appropriation can be witnessed with the absence of registration and an effective regulation of land property in Brazil and particularly in Amazonia. Existing registration data, based on the declarations of landowners registered with INCRA, show that in 2003, 35% of the 509 million hectares of land in the Legal Amazon were occupied under the right of private possession, either as registered property or as possession. On the other hand, the recent process of creating Federal or State reserves of different types means that today 42% of the Legal Amazon is under some form of protection; approximately half of this area was Native Land and the other half Conservation Units of various types. The remaining 24% did not belong to any of these categories and therefore is technically considered to be unallocated public land (Figure 1).

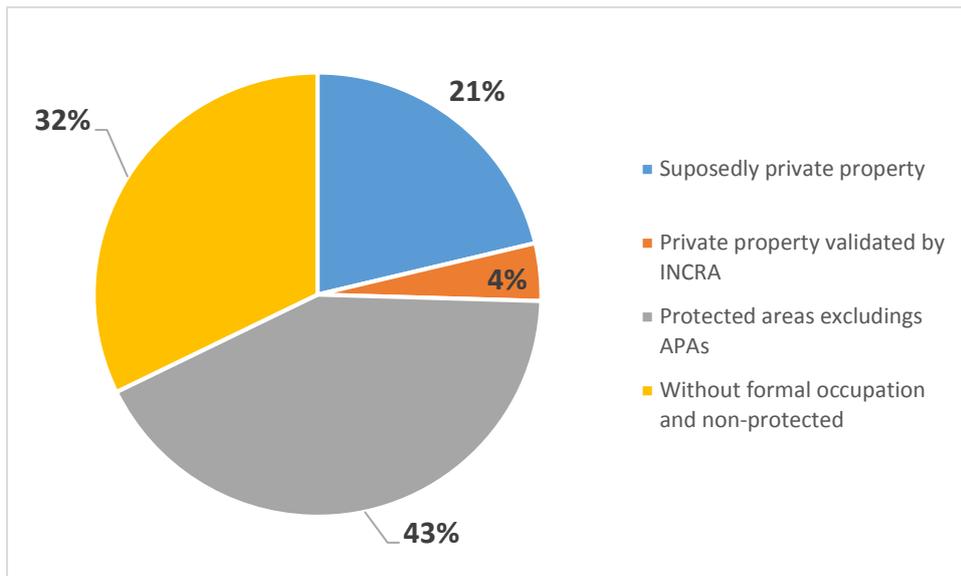
The situation is more complex and uncertain than these numbers suggest. Much of the Protected Areas is physically occupied by private users whose claims to occupation may or may not be valid, depending upon the complex legislation presented. The large area described as private by the registration system is also questionable. Of the 178 million hectares declared as private property, 100 million hectares may be based on fraudulent documentation. A further 42 million hectares of this area are classified based on registry declarations as possession, which may or may not be capable of agrarian regularization, again depending on the circumstances of size, history and location¹⁶. Accordingly 30% of the area could be legally uncertain and/or contested.

¹⁴ Estimates by Shiqui (2007) show that 42% of land in Amazonia is vacant land.

¹⁵ Perhaps some expense incurred on hired thugs, weapons and the legal and illegal costs of regularizing the area.

¹⁶ There are all types and sizes of squatters in the INCRA cadastre, both small holders with less than 200 ha and those with over 1,000 ha.

Diagram 2. Legal status of land in the Amazon from data in the National System of Rural Cadastre (2003) and Protected Areas (2006).



Source: Imazon (2009).

The Brazilian State is so aware of its inability to regulate the use of land, mainly as it does not have a Cadaster, that it was obliged to take the following concrete actions to reduce deforestation in the Amazonia and increase agrarian governance, albeit on an emergency basis without addressing the problem at its source:

- a) It established Law 11952/09 regularizing possessions of up to 400 ha at no cost and selling possessions of between 401 and 1,500 ha (the squatters have to be able to prove they have lived on the land since 2004).
- b) Creation of numerous environmental protection areas (APA) in the form of Conservation Units (based on Law 9985 of July 2000) for the protection of the margins of the main highways under construction in the Amazon region, in order to avoid appropriation and deforestation.
- c) It created the Rural Environment Registration (CAR), under the auspices of the Forestry Code, to oblige owners to georeference their properties to try and identify the properties and their respective Legal Reserves;

The clearest evidence of the Brazilian State's inability to provide effective governance of the land market is the publication of Directive 558/99, applicable to all Brazilian territory and not just the Legal Amazon. With this directive, INCRA imposed on all owners of property with over 10,000 hectares the need to submit documentary proof. Of the 3,065 owners called upon, only 1,438 (46.9%) appeared, meaning that 1,627 properties had their registration canceled, amounting to 46 million ha¹⁷. In addition, 53% of the area of these properties lies in the states of the northern region of Brazil, mostly in the Amazon forest. In the state of Amazonas alone, according to Lima (2002), the equivalent of 48.5 million hectares of property, registered with

¹⁷See Sabatto (2003) for further details.

the respective land registry offices at the start of 2000, were canceled in 14 districts. There have also been academic studies, like the one by Araújo et al (2008), that have evidenced from municipal data that the largely insecure property rights, as in Amazonia, have had a positive impact on deforestation.

6. INSTITUTIONAL FRAMEWORK OF LAND REGULATION: WHY THERE IS NO EFFECTIVE REGISTRATION SYSTEM AND WHY LAND GOVERNANCE IS NON EXISTENT

This section historically analyzes the creation of the institutional framework in Brazil, which leads to the absence of land market regulation. It will be shown that many of the characteristics that causes this absence are inherited from the Brazilian State's historical ineptitude with regard to land governance.

Prior to the Brazilian Land Law of 1850, the rules regarding the occupation of urban and rural soil were defined based upon the powers of the kings, the Church or the political and physical power of the occupants. The Land Law should be understood in a more general context of laws that placed restrictions on access to land in the whole colonized world¹⁸. In keeping with the interests of landowners in the country, the Land Law made it possible to regularize possession¹⁹, the fruit of the occupation of vacant lands, which once again rendered unviable the creation of a register. Put more directly, there always existed the possibility of regularization of possession arising from vacant land occupation. In addition to adverse possession (which establishes that the squatter may regularize his property after a number of years), the states themselves (mainly after the Republic was created) at some points in history granted property with or without titles. This is the basic mechanism which meant and still means that it has never been possible to establish an effective register, which would even permit the definition of vacant areas and assign them for use in various agrarian policies.

Until the Land Law, the registration of property was done with the Parish Land Registries, under the responsibility of the local vicar (law of 1822, with the demise of the *sesmarias*). This registry continued to be used for a long time after the proclamation of the Land Law. In 1864, a land law decree obliged all holders of land to register their possessions in the vicar's registry – however this was never enforced.

The Proclamation of the Republic in 1889, by passing to the states the rights over the vacant lands, generated the possibility that their representatives might transfer them via the granting of unregistered titles. This happened to a greater or lesser degree according to the state, but irrespective of this, it created yet another ambiguity over the granting of titles, which made the state registration of the land market difficult²⁰.

¹⁸As in Latin America, Australia and the USA.

¹⁹ i.e. transformation of possession into property through legal channels.

²⁰ In spite of this, there has been a failed attempt at regulating property via the Torrens Registry (1891) in which squatters and owners would be able to obtain definitive title through an uncontested petition. On the other hand, the possibility of legalization of squatter's possession in 1895 and in 1922 (in respect of possession between 1895 and 1921) has the effect of creating the conditions for squatter's possession to persist and for land market regulation, as expressed in the Land Law of 1850, to be weakened.

The institutionalization of the Public Land Registry in 1900 is arguably the main step to the system that prevails today for registering property in registry offices. This ruling states that everyone must demarcate and register their rural or urban properties, though without any form of audit and without the existence of a registry. The State would also need to demarcate and register their (vacant) lands, which is impractical given that they are defined by process of elimination. The State itself therefore is acting illegally. This obligation has the effect of augmenting the possibility of fraud in the registration at public registry offices.

The proclamation of the Civil Code of 1916 created the inability to regulate the Brazilian land markets, whether by reaffirming the registry office as the institution of registration or by enabling public lands to be the object of adverse possession. In the words of Ligia Osório Silva (1996:324),

“with this, the framework for the transformation of the State into an owner like anyone else, was complete. And thus the doctrine of statute of limitation over vacant lands was sustained. In other words, the possibility of adverse possession of vacant lands”.

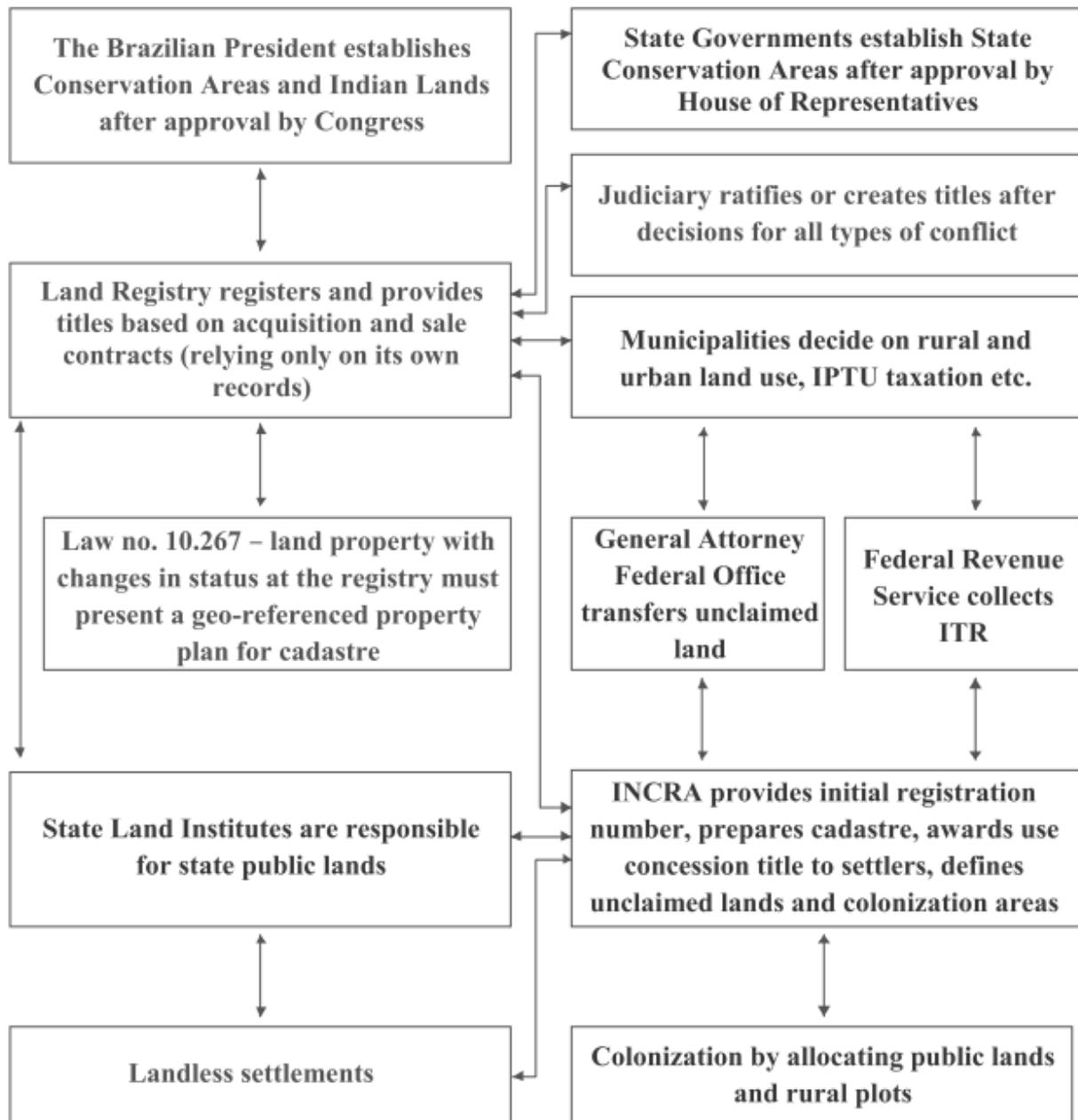
The Civil Code, therefore, through motives not necessarily linked to the interests of landowners, had the effect of establishing the great milestones in the institutionalization of land access in Brazil, by defining that the registration in property registries was required (sometimes it was also sufficient) to prove ownership. In a way, the registration at the registry office gave an air of legality to the property without there being any mechanism to guarantee it²¹.

The big institutional innovation in the area of Agrarian Policy and Administration in Brazil is the Land Statute of 1964, whose rules and concepts continue to be valid to the present day. Therefore, to guide the implementation of agrarian and agricultural policy, the Statute of 1964 created the Rural Property Registration²². All private or public property should be registered, including squatter's possession. The owners should provide information on the situation of documentation and use of land (used to estimate productivity) in order to facilitate agrarian reform. INCRA, created in 1970, became responsible for the management of the National System of Rural Cadastre (SNCR), which maintained the Rural Property Registration. Once the property was registered, INCRA would issue a Rural Property Registration Certificate (CCIR) required for any type of land transaction. Squatters registered by INCRA also received the CCIR and would have to pay the Rural Property Tax, though the value of these taxes was always kept at a low level. The Land Statute once again maintained legitimacy of possession, thereby permitting entitlement to informally occupied public lands.

Diagram 1. Institutions responsible for Land Administration System in Brazil 2014

²¹The most common irregularities are the granting of titles for nonexistent or vacant properties and the superimposition of various areas, i.e. various owners having title over the same land. When this occurs, it is said that the land has 'floors': for every owner with an irregular title in that area, an extra floor is added. The federal government is taking a decisive step in the regulation of the rural and urban land market by implementing, not without some difficulty, Law 10267/2001 in which the registry offices are obliged, whenever there is a change in property, to transfer it to INCRA on a plan with its boundaries in map form (latitude and longitude).

²² As the 1967 registration and subsequent re-registrations were for fiscal purposes (ITR) based on the declarations of the landowners and were not audited, this is not very reliable as was shown in the study by Sabato (2003), based on information arising from Decree 558/98. Other recent attempts to integrate the cadastres of the various public agencies in order to improve the quality of information, have failed on account of the absence of political will and of an agency that is prepared to take on the role of carrying out agrarian governance in the country.



Source: Reydon, Fernandes, Telles (2015).

Diagram 1 aims to summarize, from a schematic point of view, the interrelationships between agencies in the Agrarian Administration system in Brazil. One can see that there are no links between INCRA and the municipalities, causing many agrarian problems in the linkage between rural and urban lands. Moreover, there is no single institution that centralizes the registration and provides a link with the Judiciary bodies responsible for property entitlement. It does not appear in the chart, but a large part of agrarian problems in Brazil, both rural and urban, when not resolved in the administrative domain, end up in court, and this, as there are a lot of cases in the various courts, ends up taking years to process, meaning that land-related cases, whether rural or urban, are tried as *faits accomplis*.

Therefore, the big problem with deforestation in Amazonia is associated with the absence of agrarian governance in the country, resulting from the historical process of the construction of a legal and institutional framework that is inadequate to this end. Only with the construction of

an institution whose goal is to improve the land governance and build an appropriate legal framework in Brazil it will be possible to reduce deforestation and have an adequate use of the soil in the country.

7. THE NEED FOR LAND GOVERNANCE²³ AS A PREREQUISITE FOR THE REDUCTION IN DEFORESTATION

Agriculture in Brazil is exemplary, with growth in food production, supply of energy and foreign currency earnings, greater inclusion internationally, amongst others. Nevertheless, the security associated with land ownership remains a big problem, particularly in Amazonia. The solution to this requires adequate, participative agrarian governance, according to FAO (2007) and Deininger et al (2010), amongst others.

The benefit to be obtained from an adequate system of land management depends on the clear identification of registered properties and a simple, effective mechanism to obtain the information and keep it up-to-date. This process needs to be started without depending on title information or other forms of formal documentation that can be used whenever property disputes arise.

Only with the effective governance of the land, particularly the creation of a modern, self-perpetuating register will it be possible to:

- a) Guarantee the rights of private property for different ends: business, leasing, credit guarantees, for the granting of payments for environmental services, amongst others;
- b) Identify public land and guarantee its adequate use for: creation of reserves, settlements or colonization;
- c) Establish other agrarian policies with greater security: agrarian reform, agrarian credit, taxation of land;
- d) Regulate the land purchase processes to: limit access to foreign stakeholders, owners who already have a lot of land or other owners;
- e) Zone the use of land– establish and regulate by imposing limits through Zoning, agricultural and livestock production in specific regions. Establish protected areas and prohibition of deforestation;
- f) Regulate the processes of conversion of agricultural land into urban land and therefore establish a register for the collection of taxes on property (IPTU and ITR);

Agrarian governance will not solve the problem of deforestation in Amazonia, but it is a prerequisite²⁴ for addressing the problem. As for the vacant lands, registration, by permitting

²³FAO (2008:9) operates with an adequate definition of agrarian governance: “We shall adopt as the starting point the conceptual definition proposed by the FAO in its recent analysis on this topic: ‘Governance is the system of values, policies and institutions by which a society manages its economic, political and social affairs through its interactions within and between the state, civil society and the private sector. Land governance concerns the rules, processes and organizations through which decisions are made about access to land and its use, the manner in which the decisions are implemented and the way that competing interests in land are managed’.”

²⁴ There is a large literature advocating that the preservation of the Amazon forest can only be obtained with Payment of Environmental Services. Robinson, B.E. (2013:13) in a seminal article about land tenure and forest conservation, argues that: “However, in light of PES programs and REDD, where future incentives are tied to

the State to identify and control them will make inappropriate private appropriation and deforestation very difficult. It will also make it possible to use these vacant lands in the execution of agrarian policy in Brazil, through organized colonization, agrarian reform and others.

On private land, effective, participative governance will, based on knowledge of the actual situation, allow for a discussion of priorities for use and adequate enforcement, planning and regulation of soil use. Moreover, through zoning and other compulsory tools, it will prevent deforestation and will certainly limit land speculation, which is the main cause of deforestation.

8. RECENT ADVANCES IN LAND GOVERNANCE AND IN THE AMAZON REGION

With the incentive of the FAO Voluntary Guidelines land administration and land governance is improving much in Brazil through actions related to public and private land. The main advances are taking place are the: a) improvements of the cadaster²⁵ efforts based on the law 10.267/2001; b) regularization of land ownership, urban and rural. For the purpose of this paper will only be analyzed what has had an impact in the Amazon region.

8.1. Land cadaster in Brazil CNCR, SIGEF

The enactment of Law 10,267/2001 created to CNIR (National Cadaster of Rural properties) a georeferenced cadaster. The procedure is to obligate the owner to georeference its property when registering any change in it at the notaries. This georeferenced information would be sent to be integrated to INCRA and the RFB (Receita Federal - Federal Income Tax agency) existing main cadasters (SNCR and CAFIR).

As Reydon *et al* (2013) showed only around 2010 the system started to have some progress in the cadaster of private properties and the land ownership mosaic begun to be formed. But in 2013 an important innovation happened linked to the Terra Legal was designed: the Land Management System - SIGEF (Sistema de Gestão Fundiária). The SIGEF is an electronic tool developed by INCRA and MDA, which automatized the procedures and since then the cadaster has mapped already 61 % of the Brazilian.

INCRA's Land Data Collection (Acervo Fundiário) is a visualization tool that allows the general public access to downloading and visualizing 3485 million hectares of georeferenced parcels (public and private). Summed up with the information from other government agencies (FUNAI – indigenous land, ICMBio – federal and other protected areas, for instance) this area reaches up to 522.4 million hectares or 61.3 % of the Brazilian territory, excluding overlaps.

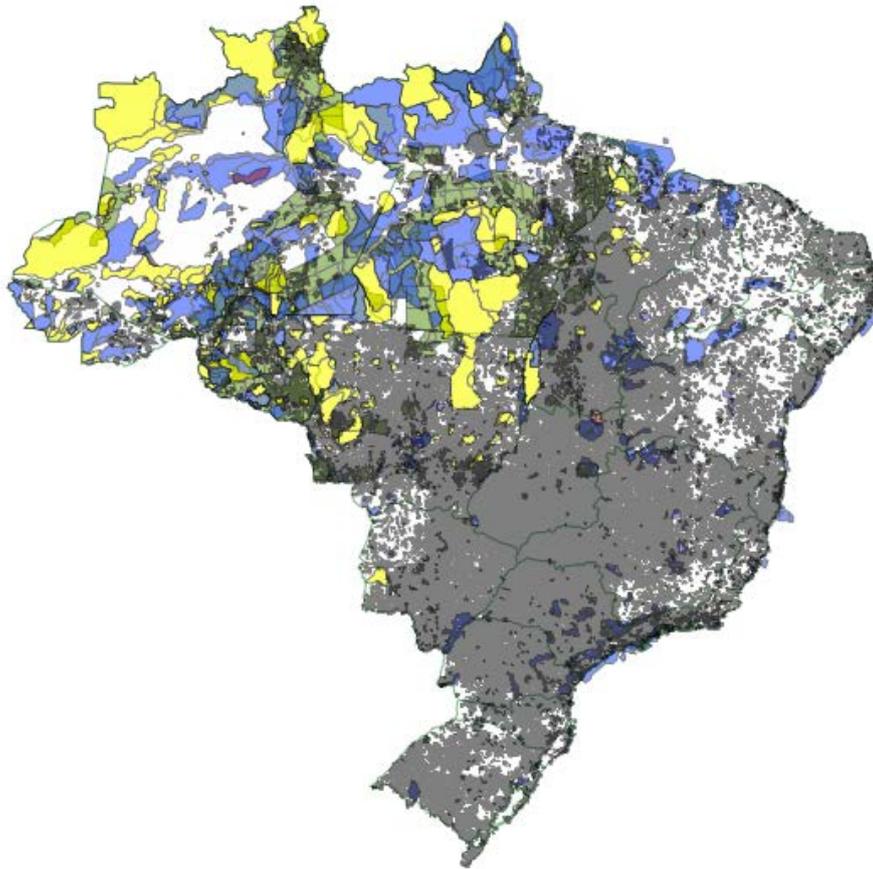
The Map 2 below illustrates the dimension of the certified parcels (public and private) in Brazil and the table 4, below shows the data on the Land Data Collection (Acervo Fundiário/INCRA) related to the georeferenced parcels.

The advances demonstrated are significant to improve the Brazilian land governance; nevertheless, the main question unsolved is the consolidation of the CNIR and the practical integration of all the cadasters related to land – i.e. building a integrated consolidated cadaster.

particular land use-based outcomes (e.g. maintain forest), the security of tenure is crucial to influence landholders' decision-making. (...)Therefore, security is necessary to prevent deforestation through market-based conservation mechanisms, but alone does not necessarily protect forests.”

²⁵ The new environment Cadaster (CAR) and its system SICAR is also part of that but will not be analyzed here.

Map 2. Public and private parcels georeferenced at the CNIR Cadaster 2015



Source: Acervo Fundiário
INCRA/MDA

-  Government Land in Amazon
-  Federal Conservation Land Units
-  Native People Land
-  Former Slaves' Land
-  Certified Private Property - SIGEF

Table 4. Cadaster information available – Brazil 2016

INCRA CNIR Consolidated			
INCRA own information			
TYPE	Properties	Área (ha)	%
Settlements projects	7,796	76,907,385.5915	22.1
Tradicional people's land - Quilombola	312	2,323,928.4275	0.7
Certified Public Properties Number/Area	9,800	86,554,346.3380	24.8
Certified Private Properties Number/Area	263,038	178,342,807.0506	51.2
Agreements of Land Regularization	107,853	4,335,993.9629	1.2
subtotal	388,799	348,464,461.3705	
BASE ACCESS OF ENTITIES PARTNRES			
TYPE	Properties	Área (ha)	%
Indegenous people's land	588	116,625,185.0128	18.1
Conservation Areas UC	1,481	152,029,511.1307	23.6
Geo reference Polygons of SRA	80,041	3,254,260.6942	0.5
Geo reference Polygons of Terra legal Program	148,969	23,976,310.1240	3.7
subtotal	231,079	295,885,266.9617	45.9
Total Geral	619,878	644,349,728.3322	
	Área líquida no acervo:	522,397,153.39	61.3
	Área líquida (257,5 mi) mais certificados (264,8 mi)		
Total Area of Brazil		851,576,700.0000	
Source: INCRA acervo fundiario September 2016			

8.2. Land Destination and the Terra Legal Regularization Program

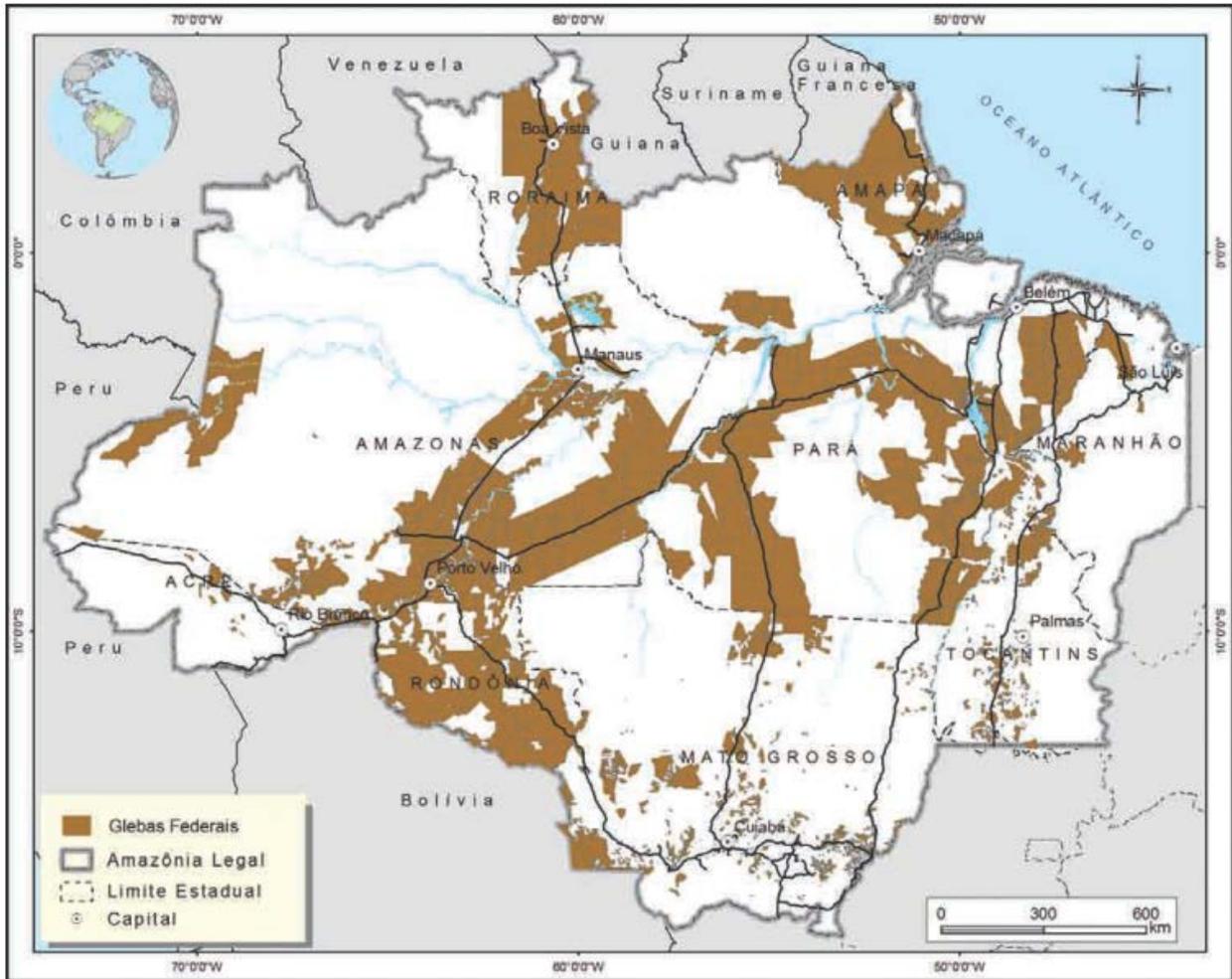
The Terra Legal (Legal Land) federal program was designed to tackle problems related to the large amount of land with no clear property rights, mostly through land regularization of private land and destination of land to public uses. The Law 11,952, passed in July 25 of 2009, provides on regularization and titling of individual or familiar land holds on federal public land located in the Legal Amazon territory.

First of all, the law requires the Agrarian Development Ministry (MDA) to transfer the lands without destination to the municipalities, provinces and other federal institutions for regularization of urban plots, indigenous lands, protected areas, land reform settlements, *quilombola's* settlements and other public interest ends. For this purposes the law also created the Legal Amazon Land Regularization Special Office (Serfal), under the MDA hierarchy.

The main purpose of Law 11,952 is the regularization and titling of landholders without legal titles (adverse prescription) up to 15 fiscal modules (the maximum size varies depending on the municipality, but the limit is 1,650 hectares, for a fiscal module of 110 hectares). The basic requirements are that the landholder cannot have other land titles and must, to receive the title, have its land under productive use.

Initially, the federal government forecasted the titling of 300 thousand rural and urban land occupants during a 3-year period in 463 municipalities located on the Legal Amazon. This represents 67 million hectares of public land that could be destined to landholders via regularization – equivalent to the area of Germany and Poland together or 13.42% of the Legal Amazon area (Oliveira, 2013, p. 69). Figure 1, below, illustrates the location of these federal lands.

Map 3. Federal public lands in the Legal Amazon



Source: Brito, Barreto (2010).

Until now, the main actions developed by Serfal was identifying, georeferencing and digitalizing the federal land, as determined by Law 10,267/2001, because this information was not available. Data from Legal Amazon Land Regularization Special Office (Serfal, 2015) shows that between 2009 and 2015 already a grand total of 113 million hectares of federal public land in the Legal Amazon were identified, around 51 million were georeferenced and certified and 29.7 million ha were registered at the register offices, as can be seen in table 1. The same table shows that from the total land of Terra Legal about 58 million hectares (51.3%) has been destined, 21 million (36.2%) of this has been georeferenced and 11.4 million (19.7%) is registered at the notaries. Table 5 shows that from the land yet to be destined 30 million ha has been georeferenced and certified (54%) and 29.7 million ha has been registered (33.3%).

Table 5. Federal public land destination in the Legal Amazon, 2015. (all in million)

	Hectares	Hectares Georeferenced and certified	Hectares registered at the land notaries
Federal public land destined	58	21	11.4
Federal public land yet to be destined	55	30	18.3
Total	113	51	29.7
Legal Amazon total area	501.6		

Source: Serfal, 2015.

Analyzing the results from 2009-2014, the Terra Legal program georeferenced almost 10 million hectares of federal public land in the Legal Amazon, for a total of 51 million hectares of federal public land georeferenced (45% of the total federal public land in the Legal Amazon). Also, 11 million hectares of land was titled through regularization in this period, representing almost 17% of the initial forecast (56 million hectares). Even with the great increase of titles emitted in 2014, we can see that titling is underperforming through the total number of titles emitted contrasted with the initial forecast.

Table 6: Areas assigned and titles emitted by Terra Legal

LAND ASSIGNMENT (<i>destinação</i>)	Million ha	%
Federal lands assigned by TL until January 2016	38,202,778	67.50%
<i>Federal lands assigned by TL to FUNAI (indigenous land)</i>	2,292	0.00%
<i>Federal lands assigned by TL to INCRA</i>	92,047	0.20%
<i>Federal lands assigned by TL to SPU</i>	55	0.00%
<i>Federal lands assigned by TL to MMA (conservation units)</i>	6,271,543	11.10%
<i>Federal lands assigned by TL to MDA (land reform / tenure regularization)</i>	31,836,841	56.20%
Land currently being studied by TL	8,288,868	14.60%
Land yet to be consulted	6,808,354	12.00%
Assigned federal lands before entering into force of CT	2,000,000	3.50%
LAND TITLES EMITED (<i>titularização</i>)		
Land titles emitted until January 2016	1,300,000	2.30%
TOTAL FEDERAL LANDS IN THE MANDATE OF TERRA LEGAL	56,600,000	100%

Source: Duchrom (2016)

These results, eventhough being below the aim of the program, shows that this is the way forward. There is a large need for more regularization, but this is to occur on public land from the federation states²⁶.

²⁶In the last year some progresses in this field took place, as meetings of the representatives of the State Land Institutes and other ministries related to land issues created the Cartas of Palmas, some principles to be followed by them. For more information see Duchrom (2016).

9. FINAL REMARKS

This articles started debating the main causes of deforestation in the Brazilian Amazon forest. Demonstrating that states with most increase in deforestation are the expected ones: Para and Mato Grosso. The other important conclusion is that most deforestation, at least in the years of 2012 and 2013, occurred in direct or indirect controlled by the state, showing that lack of land Governance is a very important issue. The fourth item showed that besides the macro determinants for deforestation there is a micro determinant that is the speculation with land and the large increase in its value that comes from its deforestation. The fifth and sixth items reaffirmed that the deforestation in the Amazon comes from the lack of adequate land administration/governance system as in the country property rights are insecure, mostly as public land is grabbed and deforested. The seventh item reveals based on literature way land administration/governance is a pre-requisite for the diminishing of deforestation. The eighth item shows the large improvements that the land administration/governance has had in Brazil, mostly through the new cadaster (CNI with SIGEF) that has been created and the experience of regularization of public land in the Amazon region through the Terra Legal.

From all this it is clear that to diminish more the deforestation in Brazilian Amazon improvements in the Land Administration/Governance System are needed. The cadaster has to be completed and integrated also with CAR. The regularization of ownership similar to the Terra Legal has to continue and amplified to public land from the States. As has been proposed with a good cadaster land taxes can be improved to diminish speculation and with all this a control over forested land is much more effective to even use the law of environmental crimes.

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