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Institutions for Governance: the role of formal rules for control of deforestation within extractive reserves in the Brazilian Amazon

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ABSTRACT
Brazil is known to have one of the most efficient deforestation control policies in the world. However, the deforestation rates have continuously increased from 2012 on, fact that demonstrates the need to rethink the institutional strategies to control the deforestation in Amazon region. Thus, the aim of the current study was to analyze the association between the acknowledgement of formal rules and the control of the deforestation within extractive reserves. The study was developed based on two cases with opposite deforestation rates. These results suggest that the governance of common resources strongly depends on factors external to the extractive reserve.
Keywords: Deforestation; Brazil; Amazon; Extractive Reserve; Institution; Environmental Governance.

1. INTRODUCTION

Brazil has one of the most efficient and important deforestation control policies in the world. Its acknowledgement dues to more than 83% reduced deforestation in the biome between 2004 and 2012; the country was able to reduce deforested areas from over 27 thousand km^2 to approximately 4.5 thousand km^2, during this period (PRODES / INPE, 2016). This impressive result was achieved due to a number of factors such as the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAM - *Plano de Prevenção e Controle do Desmatamento na Amazônia Legal*), which addresses the main deforestation causes in the region, among other functions. The 112 reasons for deforestation were organized in three axes: issues in sustainable productive activities; in land-use and land-tenure planning; and in monitoring and controlling the biome. More recently, in 2016, the axis 'economic and normative instrument' was incorporated to the document.

The cycle of struggles to restrain deforestation in the Amazon, which counted on the integrated and efficient performance of several actors, ended in 2012. The main coordination and control instruments no longer had the strength to significantly reduce the deforestation rates or to sustain any type of containment, since increasing deforestation rates were perceived at that time and lasted until 2016, with prospects of a worse scenario for the subsequent years. Thus, Brazil is currently seen as one of the most deforested countries in the world (FAO, 2016). The deforestation rates in 2016 were even higher than those presented in 2009. In addition to the collapse of the institutional instruments controlling the deforestation in the biome, there was the inclusion of targets, which were internationally agreed by the Brazilian government in the Climate Conferences and directly affected the conservation / preservation of Brazilian tropical

forests. These international agreements helped building 33% reduction targets for Legal Amazon deforestation by 2020 and required clearing illegal deforestation in the region by 2030. Although these targets are seen as little daring by most of the civil society working on the issue, mainly due to the possibility of reaching these numbers in a shorter time (MOUTINHO, 2016), the challenge is great and requires efforts from several society sectors, regardless of the established timestamp.

If one takes into consideration the PPCDAM, some assumptions may help understanding why the deforestation control in the Amazon was hampered and resulted in a trend of increasing rates for 4 consecutive years. The first possibility lies on the efficiency loss of the three axes initially built as main intervention strategies. This possibility became clearer in studies that pointed out issues in monitoring and control mechanisms (SCHIMITT, 2015); in the production of sustainable activities (DRUMMOND; SOUZA, 2016); and in land-use and land-tenure planning (IEB, 2015; EPOCA, 2016). Nevertheless, one could bet that the deforestation dynamics in the region has changed and that the action in other fronts could help building a more robust intervention framework so that the deforestation rate reduction trends could be achieved again, while both preserving the forest and fulfilling the international agreements (EPOCA, 2016 b).

The aim of the current study was to address new institutional ways to control deforestation in the Brazilian Amazon. The main idea lied on investigating the importance of collectively constructed deforestation control rules. The deforestation analysis focused on a specific conservation unit category called "Extractive Reserve" - RESEX, as well as on official and audited data - known as PRODES - provided by the federal government. The institutional path herein associated with deforestation was the instrument called "Management Agreement", which is mandatory in the RESEXs and aims to plan land-use and land-cover activities within these areas. Accordingly, the research question herein elaborated was: **what is the association between the acknowledgement of formal rules and the deforested area rates in the Brazilian Amazon RESEXs?** Understanding this association allows thinking about the "Management Agreement" rules as composition elements that help coping with the deforestation in the region.

The institutionalization and institutional change for governance processes are the object of the current study, whose proposal lies on partially implementing the IAD-Framework model (OSTROM, 2003) - which suggests individualized forms of governance related to shared property resources - by putting special focus on the "rules in use". In addition, the current study attempts to identify how these rules influence interactions and help creating governance

environments among individuals belonging to the traditional community, in such a way that they direct the results of this interaction to prevent the deforestation within these reserves or to prevent the exhaustion of resources. The possibility of applying the institutional governance model dues to the fact that extractive reserves are characterized as common property resources holding state-property rights. Therefore, it was possible using the model by having the role played by and the behavior of the institutions as the main topics in the current study.

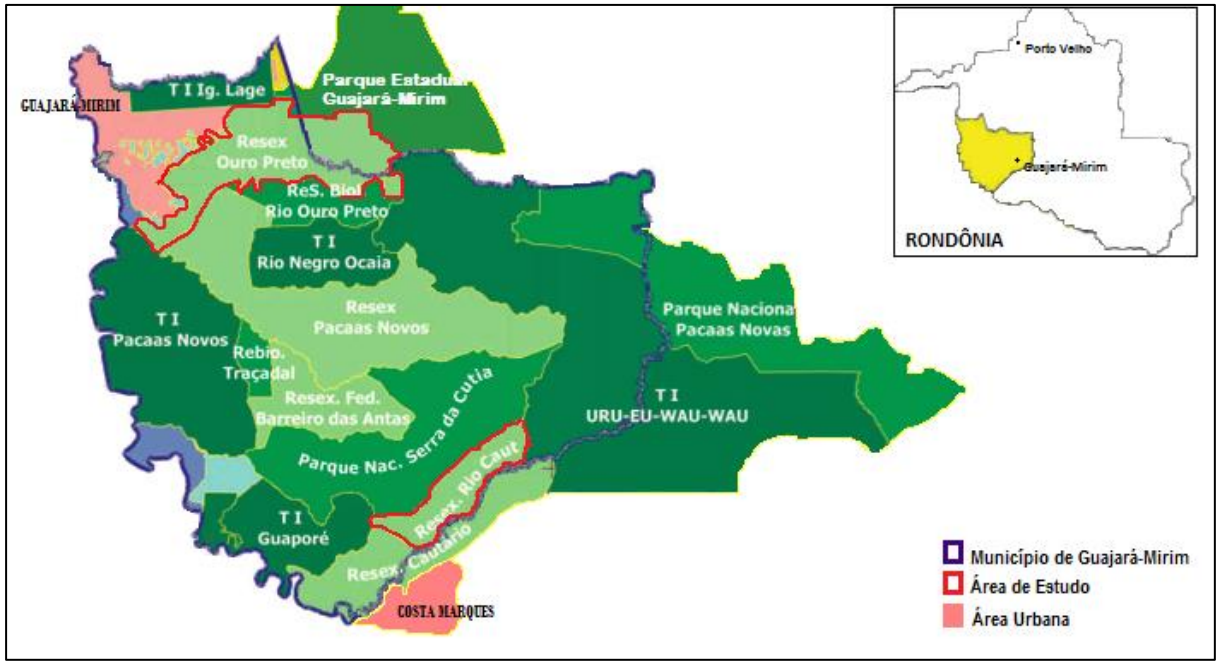
2. METHOD

The current research is methodologically characterized as a qualitative study supported by a case study approach (GERRING, 2012; CRESWELL, 2007; GEORGE, A.; BENNETT, 2005). Two cases were intentionally chosen (STAKE, 2005), namely: Rio Ouro Preto and Rio Cautário Extractive Reserves. The two cases were chosen through the extreme-case technique, i.e., the choice was based on a given variable, either dependent or independent, holding extreme values (GERRING, 2006). The variable selected for the choice of cases was "deforested area rate". The construction of this variable took into consideration the historical series of deforestations that took place between 2000 and 2015, whose data were made available by the PRODES / INPE Program.

Other criteria were also relevant to the choice of cases, mainly those that Elinor Ostrom (POTEETE; OSTROM; JANSSEN, 2001) calls second-order criteria, which are responsible for facilitating/making it difficult to overcome the collective action dilemma among individuals. The chosen criteria were the number of internal users (families); the size of the extractive reserve; the location of the area; and the features of the extracted unitary resources. However, the proposal in the current study lied on observing similar rates between reserves. Although the two herein chosen RESEXs did not show identical rates for these 4 criteria, these rates were close to each other, mainly when they were compared to the group of thirty-three areas.

These two areas are located in the following geographic coordinates:

Figure 1: County of Guajará-Mirim/RO and Study Areas



Source: Prepared by the authors.
Information: (Guajará-Mirim County; Study Areas; Urban Areas).

The data collection technique comprised interventions based on the focus group practice (MORGAN, 1988), which was applied between November and December 2015. Eight (8) focus groups were formed, 4 in each case study, totaling 61 participants. The communities studied in Rio Ouro Preto RESEX were Nova Colônia, Ramal do Pompeu, Nova Esperança and Ramal dos Macacos. All these communities belong to the same association and are, in a way, close to each other, as well as close to the most deforested area in the reserve. The communities studied in Rio Cautário RESEX were Laranjal, Jatobá, Canindé and Cajueiro. These communities represented the total communities living in the reserve.

The "Management Agreement" of the two extractive reserves was partially transformed into the base instrument to conduct the focus group (Figure 20). We say partially, because the "Management Agreement" was not used in its entirety, since there were rules in it, which did not address the use and management activities in the place of residence or the "ideal" behavior of the extractive communities inside the reserve; these rules only addressed general subjects such as the possibility of conducting scientific research within the area or presented an introduction about the purpose of the "Management Agreement". Most of these subjects were excluded because the current proposal did not comprise addressing the "Management Agreement". In addition, since we were conducting a scientific research, it would not be appropriate to ask about it at the site. Twenty-five (25) rules were analyzed in Rio Ouro Preto RESEX, whereas 19 rules were analyzed in Rio Cautário RESEX.

The construction of the focus group-guiding instrument consisted in two moments. Firstly, a playful and didactic story, which could work as justification for the current research, was created. This story was composed of a main actor called "Mister X"; he was a rubber tapper from another region who had recently settled in the investigated reserve due to a transfer agreement made with ICMBio and with the reserve residents who accepted him. "Mister X" had a family - 4 children and a wife - and since he did not know the activity dynamics within the reserve, because he was a newcomer, he gathered the group of residents in order to ask them how he could develop his activities. He wanted to know what he was allowed (or not) to do such as hunting, fishing, cutting rubber trees, making crops and flour, collecting products, changing his place of residence, building a house, going to the city, selling his products, among other daily activities. All his doubts were based on the rules forming the "Management Agreement" instrument. The aim of this procedure was to identify to what extent these residents would properly guide "Mister X's" actions within the reserve, and it would show - and it did - the level of acknowledgement or internalization of the formal rules by the residents.

The herein created categories aimed at reproducing the set of rules showing similar contents; however, it was not possible building identical categories when the reserves were compared to each other, although we tried to approximate them as much as possible. The categories in common were: PLACE OF RESIDENCE; ANIMAL BREEDING; PLANTING; RUBBER TAPPING; FISHING; TRADING; NEWCOMERS; WOOD. Another category was added to Rio Cautário RESEX, namely: ANIMAL SLAUGHTER; whereas two other categories were added to Rio Ouro Preto RESEX, namely: MONITORING; and VISITS and CELEBRATIONS. Thus, Rio Cautário comprised 9 categories, whereas Rio Ouro Preto comprised 10.

The qualitative data were transformed into descriptive quantitative ones through the development of an "internalization level assessment mechanism". This mechanism had three levels: internalized; medium internalization; non-internalized. The "internalized" level corresponded to score 10 (absolute value); the "medium internalization" level corresponded to score 5; and the "non-internalized" level corresponded to score 0. In addition, we used colors to make these values more visible and playful; thus, the internalized level was green; the medium internalization level was yellow; and the non-internalized level was red. The researcher conducted a subjective analysis to identify the level of the extractive dwellers' response to each rule. The original rule was placed on the same page as the extractive dwellers' responses and the proximities and differences between the formal rule and the responses were identified according to some predefined instructions (Figure 2).

Figure 2: Description of the Three Internationalization Points of Rules

Internalized	The "internalized" level of responses to the "Management Agreement" rules refers to the correct response to a particular rule. Thus, when the group demonstrated knowledge about the rule, responding to the question presented so that the answer is fully contained within the "Management Agreement", we consider the rule internalized. In this case, the content of the response and the adherence of its content to that of the formal rule described in the "Management Agreement" did matter.
Average Internalization	The "average internalization" level of responses to the "Management Agreement" rules translates moments of confusion and some doubt between the actors, but in the end they arrive at the correct answer. At such times, even with the wrong individual responses, the group's motivation to signal the correct answer and to conclude it as correct was an excuse to consider it as average internalization. The partial knowledge of the rule was also considered average, that is, when the final answer did not contemplate the entire formal rule either because it lacked something or because it went beyond and inserted elements that did not belong to the rule.
Not Internalized	The "non-internalized" level of responses to the "Management Agreement" rules considers the wrong answers. That is, when the group confirms a response that has no relation to the formal rule. Also contained in this level were the wrong answers that emerged in times of doubt and confusion within the group. On these occasions, even when correct answers existed, the mere fact that the wrong answers stood out at the end was a reason for considering non-internalization.

Source: Prepared by the authors.

After the responses were classified and scored through the assessment mechanism, a simple arithmetic mean was calculated in each category to allow seeing (in %) to what extent the four communities of each RESEX, as well as the reserve as a whole, have internalized each category. This calculation also allowed extending the analysis to build the dispersion measure known as standard deviation. Thus, it allowed seeing the difference between the internalization levels in each community within a given reserve, and it provided elements that enabled analyzing the rule-acknowledgment homogeneity in the communities, as well as the factors influencing the acknowledgment-level differences among them. Whenever a very high deviation was found, we returned to the extractive dwellers' response in order to find some clue able to provide factual elements to justify the result.

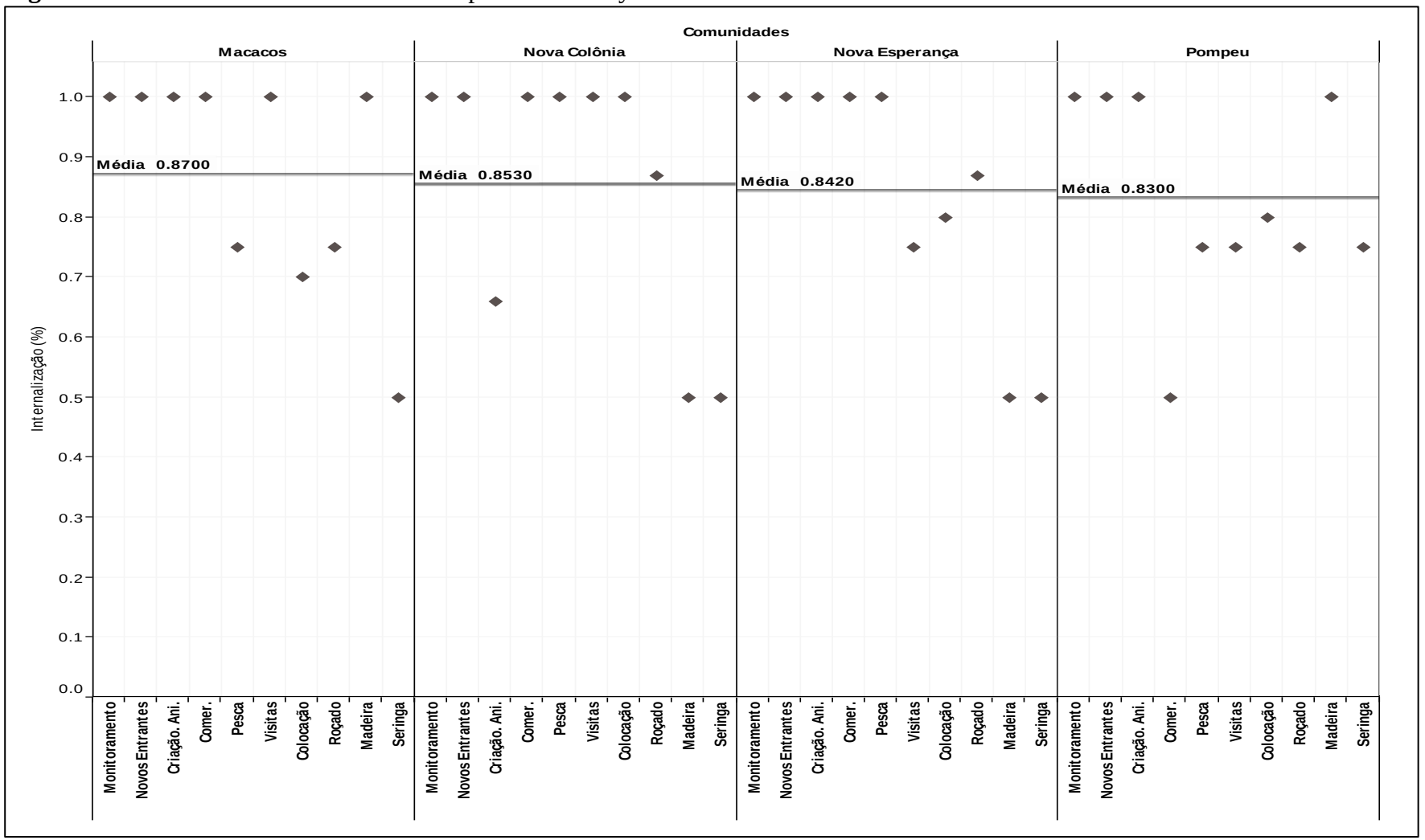
3. RESULTS

3.1 Ouro Preto Extractive Reserve

Overall, the "Management Agreement" showed very good internalization coefficients in Rio Ouro Preto RESEX; its overall mean was 84%, and it indicated that the extractive dwellers understood how the RESEX operated, although the communities did not show homogeneity in the internalization of each specific category, but only at overall internalization level (Figure 3).

The most reasonable explanation for this internalization level would be the booklet, which is a playful way to introduce the rules agreed in the "Management Agreement" to the residents. The dissemination of this booklet, mainly to community leaders and to representatives of the association, seems to have generated an interesting effect on the internalization of the rules in Rio Ouro Preto RESEX. Other factors may have contributed to this dissemination and internalization such as the presence of community leaders engaged in passing on the unit's rules to the residents; the pressure from the area's governing body on the leaders to disseminate these rules; the pressure from the RESEX-funding bodies and programs, among others.

Figure 3: Formal Rule Internalization Level per Community in Rio Ouro Preto RESEX.



Source: Prepared by the author using *Tableau Software* (2016).

Information: comunidade – communities; internalização – internalization; media – mean; monitoramento – monitoring; novos entrants – newcomers; criação ani.- animal breeding; comercialização – trading; pesca – fishing; visitas – visits; colocação – place of residence; roçado – planting; madeira – wood; seringa – rubber tapping.

It is worth emphasizing that the "Management Agreement" used in the current research was the one featured in the Management Plan of the Unit, from August 2014. It was the third agreement settled in the unit; however, a fourth document was prepared and approved on the eve of the field survey, i.e., in November 2015. Thus, it was noticed that some residents' answers referred to previous management agreements, whereas others referred to the most recent agreement. It made us reason about the speed of the incremental institutional changes applied to the "Management Agreement" in comparison to the agility to communicate and homogeneously internalize the agreed rules by the entire reserve. Theoretically, the IAD highlights the importance for social actors to share information in order to build trust and reciprocity between them (POTEETE; OSTROM; JANSSEN, 2011). In other words, whenever incremental institutional changes take place at a speed and internalization level that do not contemplate most dwellers in a *commons*, it is less likely that these individuals will organize themselves into a self-managed cooperative model. Thus, communicating and disseminating information is essential to improve internal relations within the RESEX, as well as to reduce free-rider cases, since the actions taken by rubber tappers would be more easily planned and controlled. Therefore, the results show that there is still room to work on the internalization of these rules within the RESEX, as well as to make this process faster than the time necessary for the rules to become obsolete. Thus, these rules need to be improved and / or replaced by others, based on local or regional demands.

Three important rule-internalization points were observed in the field: **rules** - not adapted to reality and / or imprecisely written; **external environment** - socioeconomic changes and land-tenure conflicts; and **internal environment** - conflicts between extractive dwellers.

The focus groups found **rules** that were not adapted to the daily reality of the residents, as well as rules that could not be understood by them due to some ambiguity in writing. This type of issue led the categories PLANTING and VISITS to internalization levels below the potential they could achieve. According to the IAD, the social actors use the rules to guide their repetitive and structured interactions, since rules are behavior inducers. In addition, the ability to organize and coordinate their activities is directly related to the knowledge about and acknowledgement of the rules. Therefore, the willingness by individuals to overcome the collective action dilemma is imbedded in their efforts to acknowledge the rules concerning the use of a given resource. (OSTROM, 2003; OSTROM; GARDNER; WALKER, 1994). The extractive dwellers' difficulty to assimilate certain rules opens an unimaginable range of possible paths for their actions, and it often helps creating environments where a single community acts in different and contradictory ways, thus generating internal conflicts and

increasing their vulnerability to external pressures. It also allows the emergence of free riders, who try to take advantage of an ambiguous situation by using legal mix-ups for their own benefit and for the benefit of their family members.

The imbalance in the equation - reserve size *versus* human capacity of the body into environmental agency to perform its core activities - may explain the issues found in the formal rules, namely: lack of adherence to reality and confusing writing. It may also justify the slowness in reframing these rules and / or in better interpreting them in order to allow the rubber tapper families to incorporate them into their daily activities. The conversations with the RESEX manager allowed perceiving the emptying in the federal technical staff of the unit in the last years, to the point that he alone was responsible for managing the entire area. Thus, manager's activities such as visits, assistance to the community, supervision, partnerships, among others were carried out according to priority levels. The herein discussed rules may have their treatment postponed due to the understanding that they generate little change in the daily routine of the communities. However, as it was presented in the theoretical writings, this impression tends to be false, since the misinterpreted rules influence the internalization results and help reducing the rubber tappers' trust in the legal management instruments. Consequently, it opens the way for internal and external conflicts, as well as hampers the cooperation and coordination advances aimed at overcoming the collective action dilemma (BALAND; PLATTEAU, 1996; OSTROM *et. al*., 2002; DIETZ *et. al*., 2003).

The dead-locks related to the **external environment** of the RESEX directly influenced the results of five rule categories, namely: MONITORING, TRADING, RUBBER TAPPING, WOOD and PLACE OF RESIDENCE. Although this scope has generated opposite results, since the external influence may have been the motivator for the high internalization levels in the monitoring category, overall, such environment has negatively affected the extractive dwellers' perception about the rules. The two major counterproductive influences from the external environment on Rio Ouro Preto extractive communities lied on the change in the economic profile of Rondônia State - and of Brazil as a whole -, as well as on the increased external pressures for wood and land, which generated conflicts and death threats due to land-tenure issues. Thus, a common resource cannot be studied without being contextualized in time and in space. In addition, managing and understanding its external factors are essential to increase the number of successful shared environment governance cases.

This type of perception was exhaustively addressed by Agrawal (2003), who criticized IAD-Framework studies. According to Agrawal, demographic and technological changes, market penetration, and national and subnational state policies are factors that need to be

incorporated to the IAD and to common resource governance studies as a whole. He supported his arguments by citing several studies that demonstrated the impact caused by external variables on internal cooperation actions among actors (PIMENTAL *et. al*., 1994; OASTES, 1999). Besides the impact, Agrawal argued that there is some interdependence between internal and external environments, so that both are built and modified together throughout history. He also argued that, somehow, the internal rules are more vulnerable to regional and national changes. Accordingly, Moran (2016) analyzed the great works performed in the Brazilian Amazon - roads and hydroelectric dams - and how they changed the demography, the economy and the landscape around them. His arguments showed the negative effects these works had on nature and on the social dynamics of the cities in the region. It is worth highlighting other authors such as Messier *et. al*. (2015) and Andersson (2013), who have also studied the subject, although they focused their studies on the agent-structure debate.

By analyzing Rio Ouro Preto RESEX under the perspective of external factors, it is possible seeing that it shows several cases such as changes in the rubber chain economic profile, the construction of Santo Antônio and Girau hydroelectric plants and, after 1984, the paving of BR 364, which is main grain and cattle transport route in the Brazilian Northern and Midwestern regions; these cases may affect the internal dynamics of the formal rules set in this RESEX. In addition, the BR 364 highway crosses the main cities in the state, namely: Vilhena, Cacoal, Ji-Paraná, Ariquemes and the State's capital city Porto Velho. It also gives access to Acre State and to the two aforementioned hydroelectric power plants. Moreover, the deforestation dynamics in the state has taken shape through this highway in the last decades (RIBEIRO; VERESSIMO; PEREIRA, 2005; IMAZON, 2015d). Therefore, the economic, social and infrastructure transformations in Rondônia State have been pressing and cornering the studied RESEX. They also make pressure on the extractive dwellers themselves, who witness the increased invasion in their lands, the increased conflict with neighboring agricultural actors and with timber companies in the region, as well as the expansion of increasingly clear job opportunities in Guajará-Mirim County, which directly competes with the extractive activities they have been practicing for years. Regardless of issues such as access to education and to public health, these transformations in Rondônia State and in Guajará-Mirim County itself are appealing to the residents and, at the same time, diminish their commitment to the extractive activity, lifestyle and culture.

Although the Ostrom couple have introduced new external environment-related elements such as governmental influences, influences from other actors - market, researchers and civil society organizations - and technologies in the most recent IAD updates, mainly in the Socioecological System (SEE), it would not be exaggeration to say that this subject is not yet fully resolved in the model, since the empirical basis for the external validity of the prototype has made little advancements in comparison to Agrawal's criticism. Incidentally, advances have been seen in collaborative, parallel IAD groups formed around Agrawal's ideas, such as the International Forestry Resourses and Institutions (IFRI). In any case, this subject could be addressed in future studies about common resource governance in order to help investigating the herein presented model, which focused on the methodological individualism and on the study of collective actions and games, under a more macro-analytical perspective.

The **internal environment** showed results partly derived from the issues found in the external environment and had aspects related to relationship conducts between Rio Ouro Preto's extractive dwellers. Just as the external environment has positively and negatively influenced the internalization results of some rule categories, the internal environment showed the same duality, since it improved the ANIMAL BREEDING category internalization levels, whereas it negatively contributed to the results of categories such as NEWCOMERS and PLACE OF RESIDENCE. According to the analysis of the ANIMAL BREEDING category, the reserve residents showed consideration for each other as they easily talked about the need to breed enclosed animals in order to keep a good relationship with their neighbors. This appreciation for keeping an adequate coexistence among residents led to an interesting result in the acknowledgement of the rule, namely: it would probably be followed even if it was not written in the “Management Agreement”. Thus, breeding enclosed animals seems to be an “intrinsic” rule to the community, which would be acknowledged, followed and respected in the human relationships found in the RESEX, regardless of whether it was written (or not) in the “Management Agreement”.

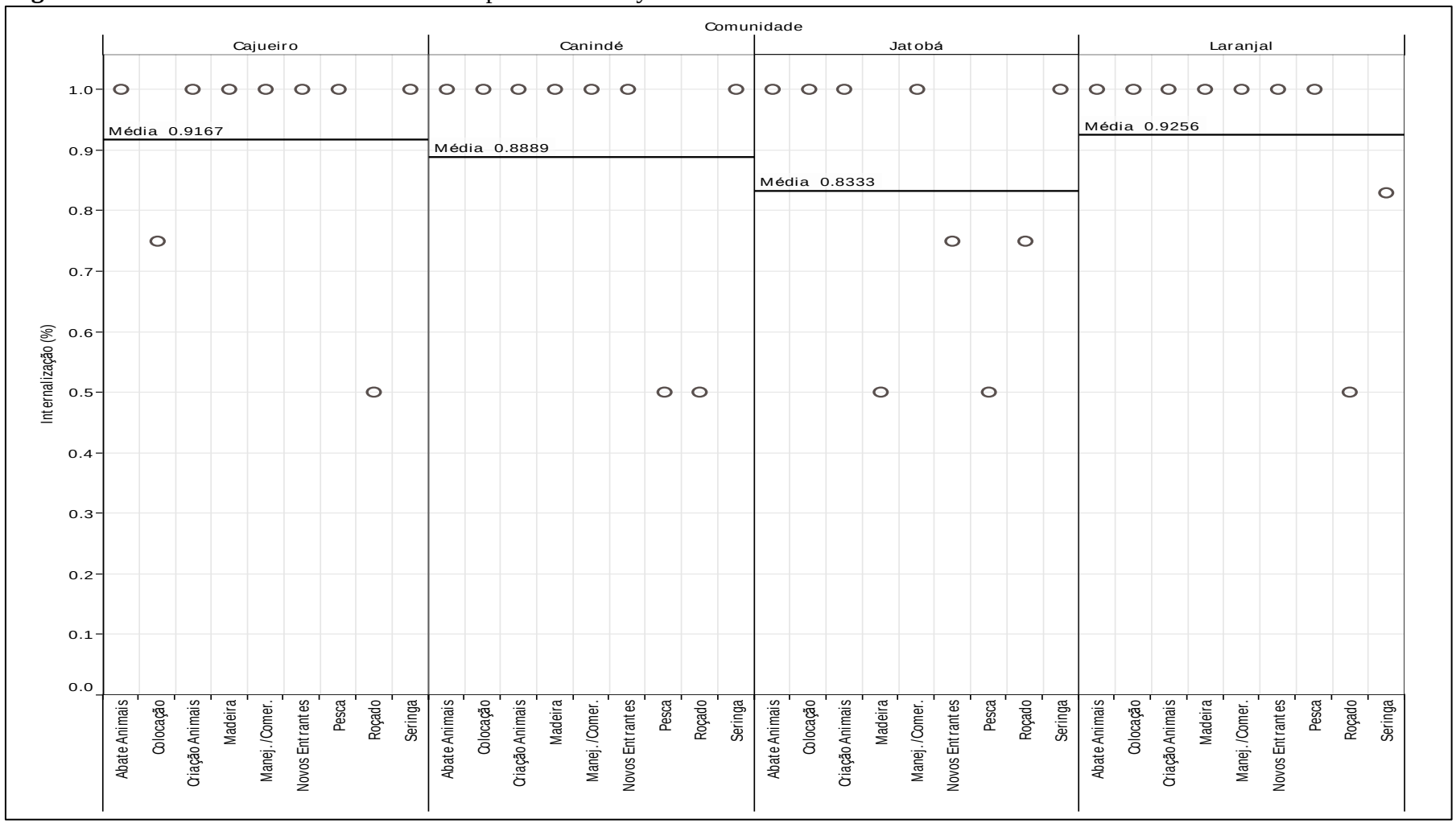
On the other hand, the communities did not obtain good indicators concerning the internalization of the set of rules related to categories such as NEWCOMERS and PLACE OF RESIDENCE when they realized that there were residents who were taking advantage of ordinary social situations that took place within the RESEX. Here, more than in any other situation, it was possible seeing what the IAD-Framework called rational cost-benefit perception. The perception of the residents who remained more often in the reserve was that some extractive dwellers owned a house in the city, as well as the right to use a place of residence in the reserve - double dwelling. These dwellers lived longer in the city and only

returned to the unit when it was absolutely necessary, although they received equal treatment from the managing body and from the entities funding protection activities. This type of cost-benefit thinking generated the perception by some residents that they were having a higher cost for staying in the RESEX, whereas the benefits were equally divided among those entitled to a place of residence. Thus, the rules, which were more flexible during the period when these dwellers were absent from their place of residence, were considered more severe. It clearly showed that the perception of families who did not have double dwelling was that the formal rule was more tolerant with free riders than it really should be. They also created a pejorative name – "seri-rua" (off-site rubber tapper) - to illustrate the behavior of these double-dwelling residents, and it was also a clear sign that they felt uncomfortable with the situation.

3.2 Cautário Extractive Reserve

The level of internalization of the formal rules written in the "Management Agreement", which guides the land use and management activities in Rio Cautário RESEX, showed consistent results. It happened because the level of acknowledgement of the formal rules by rubber tappers was approximately 89%, although with considerable standard deviation between communities, fact that showed certain heterogeneity in the understanding of these rules by the extractive dwellers (Figure 4). Thus, this significant result directs the analysis of the reserve to the following conclusion regarding the hypothesis guiding the current study: Rio Cautário RESEX, which has low deforestation rate, showed good formal rule internalization level.

Figure 32: Formal Rule Internalization Level per Community in Rio Cautário RESEX



Source: Prepared by the author using Tableau Software (2016).

Information: comunidade – communities; internalização – internalization; media – mean; abate de animais – animal slaughter; colocação – place of residence; criação de animal – animal breeding; madeira – wood; manejo/comercialização – management/trading; novos entrantes – newcomers; pesca – fishing; roçado – planting; seringa – rubber tapping.

There are many explanations for this good internalization result. Firstly, there were two institutions implementing the extractive reserve conservation policy in the RESEX, namely: CEDAM and ICMBio. These institutions have implemented a shared "Management Agreement", although not identical, which allows rubber tappers to circulate in both sides of Cautário River knowing that the basic formal rules to be followed are the same, regardless of the side they are on. In addition, the monitoring and inspection structure of the two bodies together contributes to the stronger physical presence of inspectors in the region, since they use the operational bases and field equipment belonging to the two bodies, although it may not be enough. Thus, the joint management appears to be able to explain the internalization results, since the reserve is based on an internalization arising from the practice implemented through an error-hit-coercion-punishment-reward model. Although many statements have reported the absence of managers in their communities, the inspectors seem to be playing their role with some constancy and, therefore, collaborating to the internalization process.

Other factors may have contributed to this rule acknowledgement level. The field work allowed seeing a movement of long cycles regarding the changes in reserve rules. The rules in Ouro Preto RESEX were updated four times throughout its existence, whereas the rules in Rio Cautário RESEX were updated just two times, maybe because it was constituted later, in 2001. However, the cycle of incremental institutional changes observed in this conservation unit took place at longer intervals, and it may have contributed to the greater information sharing consistency among social actors. Theoretically, information sharing is a crucial element to the development of trust and reciprocity relations between actors (POTEETE; OSTROM; JANSSEN, 2011; OSTROM; WALKER, 2003). In turn, it helps inhibiting free-rider behaviors and favors *commons'* maintenance and conservation practices from inside out.

We compiled the main inflection points that helped understanding the formal rule internalization levels in Rio Cautário RESEX in order to systematize and map what was previously presented in the current study, namely: **external environment** - socioeconomic changes and common good privatization; **rules** - imprecise writing; **internal environment** – knowledge-related rivalry between residents and technicians, and leadership profile.

With regard to the **external environment**, some relations between the levels of internalization and community proximity with actors who did not live in the reserve were herein observed. These relations collaborated to the distorted interpretation of the formal rules, either in

a more restricted or more flexible perspective. The categories FISHING and WOOD showed the aforementioned distortions. They both presented more restrictive interpretations for wood extraction activities in the place of residence aimed at internal use and for fishing techniques allowed within the reserve; it may have happened due to the conflicting environment observed in the reserve. Therefore, the so-called "border organization" becomes a fundamental element to the evolution of institutions responsible for the governance in shared areas (GRAY, 2016).

The external environment may also influence the extraction activities developed within the reserve, since the prices of forest products are framed in an economic model based on supply and demand, wherein demand is an element formed by needs and desires, which are distant from the reserve and even from Brazil, when the product is exported. The low rubber extraction case and its negative influence on the acknowledgement of the RUBBER TAPPING category is an example of how the economy of a forest product may influence its extraction dynamics. The external environment, which buys latex at low price and has no prospect of improvements in its selling price in the short- and medium-term, is the same environment that raises the nut and copaiba prices to an astronomical level to the point that rubber tappers wish that these two products could be harvested throughout the year. This economic focus on the two aforementioned products facilitated the acknowledgement of rules referring to the category MANAGEMENT AND TRADING, since they are the products of major importance in the composition of the annual family income of the residents.

In addition, the external environment also helps reproducing capitalist market practices in environments where the collective labor practice has prevailed for many years. Thus, it leads to situations wherein families socially organize themselves in those families wherein the residents hold the production goods – nuts tree – and for residents who only have their labor force. It shows that the community starts adhering to a form of social organization of labor that originates from an expansion model that is not their own model. Somehow, the introduction of this model, which was initially generated by the privatization of the nut exploitation activity, turns social relations into private relations, since any form of collective work happens only through the payment of daily rates and this very same collective effort is seen as an effort that generates disproportional gains between the residents who own the labor force and those who own the production goods. This is so true that a family in a given community started accumulating wealth and the income derived

from their nut exploitation activity seemed to be exponentially unequal to what other residents were profiting from the exploitation of that very same product.

The discussion about the privatization of a collective natural good forces a theoretical return to the IAD-Framework bases, mainly to the so-called resource class. As it was observed, Elinor's model was based on principles for common pool resource, i.e., a class of resources within which exclusion of access to the natural resource is difficult and joint use involves high subtraction rates (OSTROM; GARDNER; WALKER, 1994). As common resources are transformed into private resources, their characteristics change in essence, since exclusion becomes easy and the resource subtraction becomes high, fact that also affects the way the resource should be handled so that institutional environments could emerge and collaborate to overcome the collective action dilemma. By providing an initial transformation in the overall resource ownership characteristics, the residents generate rupture situations that escape the average range proposed by Ostrom's model and create private property right regimes wherein exploitation and regulation are organized by a single individual and no longer by a group of individuals who have common and equal interests and duties on the resource. The consequences of this transformation are innumerable, but the most relevant one is the development of a system that encourages unlimited competition in a limited environment. It shows the individual rationality to meet one's own interest and reduces the likelihood of individuals to self-organize, to develop effective monitoring mechanisms and to change rules in the bottom-up direction. In addition, it widens inequality among residents (MWANGI, 2007; JANSSEN, *et. al.*, 2008; GOETTER; NEUDERT, 2016).

As for the **rules** and their imprecise writing, two categories changed in the final results due to the herein attested ambiguity, namely: FISHING and PLANTING. The PLANTING category, which showed interpretation issues in all the communities, was the one that most stood out. It happened because the residents showed deep difficulties in understanding the size of the planting area allowed within their place of residence and mentioned metrical elements that did not meet what was written in the rule. Although this issue seems to be related to the lack of reading the "Management Agreement" by the residents, it is also linked to the bad writing of the formal rule, which does not properly specify the total size of the area allowed for planting and confuses the extractive dwellers about the size of the forest area that can be cut, as well as about the size of the forest area that has been cleared and can be annually reused. These misunderstanding about

planting volume clearly expresses the need to adjust the rule writing in order to avoid utterances such as those found in the field work.

The transparency of a rule and its adherence to the local context are essential to the successful protection of inhabited forests (OSTROM, 2005; TUCKER, 2010). The residents' understanding about the rules is related to the way they are designed, to the approach of local needs in the text, to the respect for local and cultural techniques, and to the appropriate incorporation of the local knowledge about ecology, flora and fauna. These aspects generate a set of elements that facilitate the rule legitimacy and obedience by local residents. The survival of forest reserves in Uganda/Africa, which faced high population growth and increasing demand for forest products, is directly related to the transparency of the rules built by the reserve residents (VOGT *et al.*, 2006). On the other hand, the low rule-assimilation capacity of the residents, which resulted from the fact that they did not understand and showed low acceptance to the rules, led to high deforestation degree in protected areas in Honduras (ASCHER, 1999; TUCKER, 2008).

With respect to the **internal environment**, two points that seemed to be important symptoms of the formal rule internalization dynamics stood out in categories such as WOOD, NEWCOMERS and PLANTING, namely: knowledge-related rivalry between residents and technicians, and community leadership profile. The knowledge-related rivalry, which refers to conflicts in agriculture-related subjects between the ancestral practices applied by rubber tappers and the more "sophisticated" agricultural practices applied by federal-agency technicians, enables the internalization of rules belonging to the category PLANTING through the collision of interests. It is worth highlighting that the divergent thinking between these two parties, in such a way that the rules are made official based on the federal technicians' perspective in a top-down direction, helps residents to acknowledge such rules. However, the residents make a point of saying that these rules are not appropriate or that they are not necessary to the practices they refer to and to the specific moment they live in the reserve. Most likely, this type of situation leads to the nonfulfillment of rules, which become just an ideal model that is not exercised or that is just exercised due some type of coercion on the part of the bodies managing the area. Nevertheless, this specific situation emerges as a very interesting element of acknowledgement of the formal rule, even if it is not perfect.

While we perceived these disagreements, we also observed the local craving for the residents' ancestral knowledge to be used in the rules guiding their routine activities. This type of

circumstance makes it difficult for the rules set in a top-down direction to be more widely accepted. Thus, it generates greater financial effort to implement these rules, as well as longer time for them to be acknowledged and fulfilled (cost/benefit ratio). In addition, it helps reducing the local autonomy of the collective choice. In fact, the users' efforts to include their traditions in the rules may lead to institutional changes with shorter cycles, mainly when there is a large set of rules that do not include their participation in the writing process or when the rule is often used (POTEETE; OSTROM; JANSSEN, 2011). Thus, the situations in Rio Cautário RESEX, wherein rubber tappers perceived the need to increase their participation in the joint construction of the rule, generates an environment that reduces the likelihood that they will accept it, although they internalize it through difference of opinions.

The leadership profile was the second internal factor perceived as relevant to the understanding of the formal rule internalization level. With respect to categories WOOD, NEWCOMERS and PLANTING, the leader's actions undermined the acknowledgement of the rules by the community, since he acted negligently by showing poor knowledge about the "Management Agreement", thus presenting a profile that was not compatible with what was expected from a community leader. Broadly speaking, the leadership role lies on collaborating so that the activities within the reserve are legally carried out through interventions in community/manager, community/reserve and community/community relations. In addition to other activities attributed to the leader, his role requires some technical and political skills, which are not found in some people performing this function. It turns the leader into an ordinary *persona* within the reserve, since he does not have the ability to solve the routine problems affecting his community and, as it was perceived in this situation, he ends up being the main responsible for some community disagreements regarding the formal rules.

Accordingly, the leader stops playing his coordinating role and is no longer an essential element to the development of what the model calls conflict resolution mechanisms within the community. On the contrary, he becomes part of a set of elements that help disseminating conflicts within the community and, ultimately, within the reserve (McGINNIS, 2011; OSTROM, 2003).

Another essential element within the IAD-Framework is based on the leadership figure, namely: the polycentric governance (OSTROM, 1972). The idea of polycentricity is related to several decision-making centers, which do not depend on each other; however, from the development of cooperation and coordination mechanisms, they start working as an interdependent

governance system to help increasing the effectiveness of joint activities (OSTROM; TIEBOUT; WARREN, 1961; ANDERSSON; OSTROM, 2008). For this to happen in the specific case of Rio Cautário RESEX, the role of the leaders in the four investigated communities should be emphasized and played by rubber tappers showing minimum skills able to help structuring and keeping these independent decision-making centers over time. According to Ostrom (2010), these minimally calibrated and articulated nuclei favor the development of efficient governance environments, which may help increasing the efficiency of several common resources and, in the current case, help internalizing the formal rules. In some situations, the role played by the leadership facilitates the exchange of information and softens complex decision-making processes (FAVERO *et. al.,* 2016).

4. CONCLUSIONS

It is possible concluding that the association between deforestation rate and formal rule acknowledgement level in the Brazilian Amazon extractive reserves is unclear or that there is no clear association between these variables, since the deforestation rate variation between the two herein analyzed reserves was not sufficient to affect the formal rule internalization levels. Therefore, the internalization level was virtually constant, despite the considerable deforestation variations.

The theoretical background of the current study emphasized that the external elements were insufficiently taken into consideration in the IAD-Framework. Such claim was justified by studies such as Agrawal (2003), Harvey (2014) and Block (2011). However, Elinor Ostrom neither underestimated nor valued these external factors (OSTROM, 2008; OSTROM, 2009) because the idea of governance that permeates her studies lies precisely on taking into account the self-organization of individuals substantiated by institutions. She was most interested in knowing how individuals, working together, can develop coordination and cooperation systems able to help keeping the resources for longer in order to avoid the tragedy or the exhaustion of common goods. By taking into consideration assumptions derived from the methodological individualism, from the limited rationality and from institutional theories linked to the rational and public choices, the IAD-Framework focuses on providing individualized responses to specific cases showing little or no concern about the political and economic environments circumscribing the object under analysis. Its main concern lies on understanding how individuals create and transform institutions for the governance of common property resources by using their viewpoint as a third route to

empower local actors to the detriment of the market and/or the State (OSTROM, 2010b), and it justifies its low concern about elements that are not related to individual or group practices.

The findings in the field, which go in the opposite direction to the IAD-Framework, have consistently pointed out that the influences exerted by elements external to the extractive reserves are essential to the development and institutional change of the area. The current study has pointed out how these factors were essential to the institutional changes implemented within the reserves, whether they were elements found in the region of the extractive reserves (infrastructure works, cities and quality of life, local economic factors such as rural properties, companies/industries, population increase, invasions) or elements that changed the region without necessarily being local (Northern region development policies, commodity pricing policies, policies to strengthen or weaken environmental agencies, among others).

This type of influence has a direct impact on the nature of the changes implemented in local institutions. Although the IAD-Framework is in line with the proposed incremental institutional change, it seems that the main issues found in the reserves, which have generated difficulties to the acknowledgement of and non-adherence between formal and informal rules, were more directly linked to another form of institutional change, namely: the change by "critical conjuncture". In fact, the changes implemented at critical moments show two important elements: they are generated through conditions exogenous to the action situation in the IAD-Framework and lead to the rupture with previously institutionalized behavior patterns. At first, these two characteristics appear to form the framework of the elements influencing the changes described above. By taking as an example the specific case of the changes in the rubber kilogram price and how they influenced the product extraction dynamics in the region and, consequently, the entire production chain developed to sell this forest item, which directly involves the extractive workers and the use of their labor forces, it is possible saying that this situation shows no symptom of incremental changes. All the characteristics pointed out to a different direction from the changes highlighted by Ostrom. In fact, the price of the rubber fell in the 1970s and, so far, the extractive workers, along with the area managers, have failed to find a substitute product able to keep them financially stable so that they do not have to rely on jobs outside the reserve in order to survive. This example of behavior is typical of sudden and abrupt changes that externally emerge, as well as that surprise and change the historical path concerning the relation between man and nature,

which was thought about at the first time Northeastern citizens migrated to the Brazilian Amazon in the 1930s.

However, considering that unexpected external changes have impact on collective relations may be very costly to Elinor Ostrom's model because, in addition to including the critical conjunctures in her studies, it would be necessary rethinking the global idea of governance, which permeates the studies conducted by the group based in Bloomigton. By assuming that changes may come from means external to the action situation, as well as that such changes often cause more impacts than internal and incremental ones, this research group would jeopardize the entire proposal of governance based on the collective organization of individuals, since external changes would not be controllable or predictable, fact that would directly affect the coordination and cooperation structures of these local individuals. Therefore, other actors, such as the State, would enter the scene in a much more protagonist way. Thus, the concept of governance would be much closer to increase the intervention capacity of this last entity (OFFE, 2009) instead of seeking a discharge valve in the collective self-organization in order to mitigate the impact caused by the State's schizophrenia (LE PRESTRE, 2000), which tends to reduce the efficiency in solving tropical forest deforestation.

Thus, solving the deforestation issues in the Amazon is a complex and arduous task to be accomplished. The substantial number of actors, processes, levels and positions that can be identified compose a framework of complexity in identifying and controlling the deforestation in the region. At the same time, many characters seek to develop clues on how the deforestation may be slowed or even extinguished, given the federal government's proposal of zero deforestation or zero illegal deforestation, whose deadline is 2030. In fact, there is still much controversy, divergent positions, better performance models, as well as a whole forest crying out for survival. It is clear that a single common resource governance model is not enough to provide elements able to stop the "bloodletting" the forest has been subjected to for years. It also seems clear that it would be too presumptuous thinking that important actors may be left out of the game or even play a supporting role. At a time like this, the duality between co-protagonist and protagonist makes no sense, because there is an urgent need to act, whereas the survival of the modern capitalist society, as it is known nowadays, depends on the survival of this forest and on the socio-environmental and cultural characteristics that it has been protecting for thousands of years. Therefore, it is necessary overcoming the barrier of panacea.

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