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Exploring the boundaries between individual and collective land use management in a CPR system: the PAE Chico Mendes (Acre, Brazil)

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Abstract: The economic modernization of the Amazon fostered by the Brazilian military government during the 1960s and 1970s was largely realized without taking into consideration the presence of local households which lived from the extraction of forest products (mainly non-timber). When they began to be expelled, a political resistance, often guided by the Catholic Church, appeared as well as the creation of unions based on traditional identities, especially that of rubber tappers. During the 1980s, these unions made a strategic alliance with the ecologist movement which started to consider traditional populations, whose lifestyle depended on the forest, as allies for the protection of the Amazon rainforest. The movement gained a decisive momentum at the end of the decade by putting forward new proposals of land tenure for traditional populations, grounded on collective land rights. This strategy has been very efficient during the 1990s and 2000s, during which about 1,300,000 km² of rainforest were set apart and reserved for the use of “traditional communities” under a variety of legal status. But it has also led to mix under the same “collective” etiquette and principles a number of different ways of using and managing land and natural resources. This assumption however should be nuanced by a careful analysis of the resource management systems existing in each case, for they are in general complex and mix varying proportions of individual and collective decisions. The aim of this paper is to explore this question using the example of the Chico Mendes agro-extractive settlement (PAE-CM), inhabited by about 100 rubber tapper families and symbolic of the political struggle of traditional populations in the Amazon for being the home of the rubber tapper leader Chico Mendes assassinated in

1988. Applying Ostrom “design principles”, we try to catch what are the local institutional arrangements and to see if they suggest collective or individual management, and what the boundaries between both categories are. As a conclusion, we find that the PAE-CM’s system is much less collective than expected, and also very much controlled by external authorities, in a logic pretty much away from the idea of a CPR system. This finding is useful to understand the shortcomings in the actual management of the PAE but also to foresee difficulties which will probably arise in the management of many of the areas which have gained collective land rights or collective management statutes in the Amazon.

Keywords: Amazon, Brazil, common pool resources, design principles, protected areas, traditional populations

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1. Introduction

The economic modernization of the Amazon fostered by the Brazilian military government during the 1960s and 1970s was largely realized without taking into consideration the presence of local households which lived from the extraction of forest products (mainly non-timber¹) and occupied large areas of the rainforest but had no legal title to justify their tenure. In the technocratic vision of the government, the Amazon was seen as an “empty space” and such families were considered as mere squatters and often expelled and dispossessed of the areas they lived in. These expulsions prompted a political resistance, often guided by the Catholic Church which organized these families in “communities” so that they could gain a substantial political weight, and also favored the creation of unions based on traditional identities (rubber tappers, Quilombolas, fishermen, etc.). During the 1980s, these unions made a strategic alliance with the ecologist movement, which was wary of the deforestation induced by governmental plans. To the eyes of some (not all) ecologists, traditional populations, whose lifestyle depended on the forest, were basically fighting for the same goals as they did, that is the protection of the Amazon rainforest. At the end of the decade, the movement gained a decisive momentum putting forward new proposals for solving the problem of land tenure for traditional populations, grounded on collective land rights which were viewed as corresponding to their traditional land use.

¹ Such practices are named *extractivismo* in Brazil. Following the literature, we will use the terms “extractivism” or “extractivist activities” throughout this paper to refer to them. It mustn’t be confused with extractive industries.

This strategy has been very efficient during the 1990s and 2000s, during which about 1,300,000 km² of rainforest were set apart and reserved for the use of “traditional communities” under a variety of legal status. But it has also led to mix under the same etiquette and principles a number of different ways of using and managing land and natural resources. In particular, all traditional communities were considered *a priori* involved in some kind of collective resource management, resulting in collective land titles and land management plans. This assumption however should be nuanced by a careful analysis of the resource management systems existing in each case, for they are in general complex and mix varying proportions of individual and collective decisions.

The aim of this paper is to explore this question using the example of the Chico Mendes agroextractive settlement (PAE-CM),² inhabited by about 100 rubber tapper families and symbolic of the political struggle of traditional populations in the Amazon since rubber tappers were at the vanguard of their movement and since the PAE-CM was the home of their famous leader Chico Mendes, assassinated in 1988. Applying the “design principles” identified by E. Ostrom in her studies of common pool resource systems and common property regimes,³ we try to catch what are the local institutional arrangements and to see if they suggest collective or individual management, and what the boundaries between both categories are. The paper first presents the historical context as well as how the new categories of land rights which have been created in Brazil at the end of the 1980s relate to the general discussion about the *commons*. We then present the situation of the PAE Chico Mendes and analyze the current institutional setting in the light of E. Ostrom’s design principles. Finally, we discuss the question of the boundaries between individual and collective management and ask whether the PAE-CM should really be considered as a CPR.

2. Context

2.1. The political struggle of the *seringueiros* in Brazil and the PAE Cachoeira

The Acre has been one of the last areas gained by Brazil in the early XXth century. At that time, poor peasants coming from the Northeast region of Brazil were flooding the Amazon in search of a better living, lured by the fantastic profits made by the rich *seringalistas* (Schmink and Wood 1992). Most of the time, they ended trapped by landowners who put them in plots generically named *colocação*⁴ where they had to collect latex from rubber trees (*seringueiras* or *hevea brasiliensis*).

² Not to be confused with the Chico Mendes extractive reserve, see Figure 1.

³ The acronym CPR is communally used for both concepts. In this paper we will use “CPR” as the acronym of common property regime and “CPR management system” or “CPR system” to designate common pool resource management systems. It is important to note that E. Ostrom used to reserve the expression “common pool resources” to designate the biophysical system, the interaction between those systems and local societies being called CPR management systems.

⁴ Literally “the place where you are put in”.

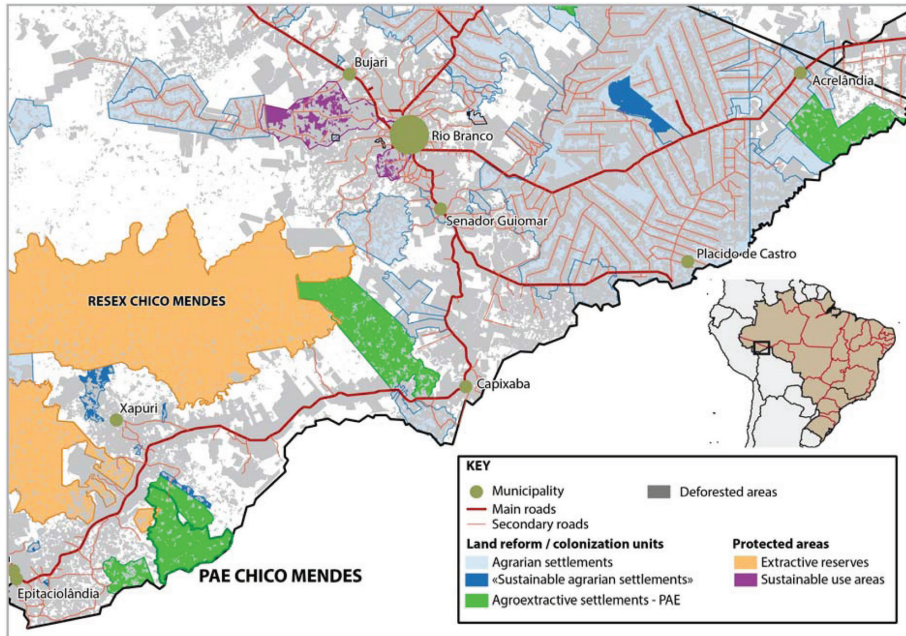


Figure 1: Localization of the PAE Chico Mendes in acre.

sis) scattered in the rainforest and sell it to their patron in exchange of industrial goods at prices so high so that the “client” would always be indebted towards his “patron” and thus unable to leave his place whatever the working conditions were (Hecht and Cockburn 1990). Called *aviamento*, this system could range from interested paternalism to slavery-like brutal exploitation of the workers (Taussig 1987), who were called *seringueiros* or rubber tappers. Meanwhile the patrons, who were frequently adventurers, became powerful people. They claimed and managed to legalize the huge areas (named *seringais*) where they put their workers in as their properties (Serier 2000).

The fate of rubber as a commodity dramatically changed just before World War I (Weinstein 1983; Stokes 2000). The success of the British in cultivating *hevea* in Asia led to massive production in very efficient plantations (an option unavailable to the Amazon because of local pests which destroy any concentration of *seringueiras*) and to the collapse of the Amazonian rubber economy.

The *seringueiros*, however, stayed where they had come and improved their knowledge of the forest through intermittent contact (not always peacefully) with indigenous peoples and by a local learning process (de Almeida 2002). They were still dependent on their patrons but the products they traded were more diversified because of the low prices of the rubber and also because the strict rules of the latex boom, which were made to maximize rubber production (and also to make the

seringueiros even more dependent on their patrons), were no longer completely enforced (Bakx 1988). They thus started to cultivate small plots, a practice in general formerly prohibited. Many of the great landowners would lose their interest on their *seringais* in the following decades, leaving them in the hands of local administrators or abandoning them altogether. This led the *seringueiros*, in many cases, to gain much more autonomy (Stone 2003).

Until the 1970s, the situation remained such in the Acre, a very remote and difficult to access part of Brazil. But the investments made by the military-led federal government from 1970 on changed the situation. With the consolidation of the Brasília-Porto Velho-Rio Branco road (the BR-364), a portion of the lands at the border of Bolivia and Peru could now be exploited with high profits, especially for cattle ranching (Bakx 1988; Revkin 1990; Diegues 1995). Many *seringais* were sold to new owners, in general coming from the south of Brazil and determined to “tame” (*desbravar*) the Amazon and to turn the forest into a “productive land”. The question of the *seringueiros*, however, was overlooked by both parties (de Almeida 2002). The sellers would not take any measure to reallocate their former clients to another place, and the buyers would soon consider their presence illegitimate and seek to expel them.

Such a process led to the progressive organization of a political resistance against expulsion, especially in the county of Xapuri. There, under the leadership of Chico Mendes, the *seringueiros* created a rural syndicate in 1977 and confronted the expulsions, to the surprise and dismay of the federal government (Allegratti 2008). They used a passive resistance technique named “*empate*” (impeach), invading the deforestation sites with families, kids and babies against whom the landowner’s henchmen could not fight without creating public outrage. During the 1980s, the *seringueiro* movement gained a national audience with the creation of the *Seringueiros’* National Council in 1985 and changed its ideological basis (de Almeida 2002; Schmink 2011). At first, it had tried to force the federal government to an “agrarian reform” where individual plots, corresponding to the *colocações*, would be distributed to the actual occupants. But the government proved reluctant to accept giving bigger plots to the *seringueiros* than it did to colonists, and thus wanted to limit the size of the properties to 100 ha, an unfeasible size as far as extractivist activities are concerned. The lack of success with the agrarian reform strategy made the *seringueiros* look towards the ecologist movement and change their discourse. They started to present themselves as “guardians of the forest” against the deforestation, which was peaking at that time and raised international concern (da Cunha and de Almeida 2000). They also worked out a new proposal for securing their land rights, inspired by the model of Indigenous reserves which were created by the Federal government: the creation of areas collectively held by extractivists where they could pursue their traditional activities according to their norms and rules and which could protect their tenure against external invasions or encroachment. But even if a first model for this type of settlement was presented as early as 1986, the government was not ready to endorse it at that time.

Tension in Acre was high throughout the 1980s. In 1988, Chico Mendes was assassinated by a farmer who had bought some parts of the *seringal* where Chico Mendes and his family lived (Revkin 1990). The repercussion of the case was intense at national and international level and forced the government to put an end to the stalemate and create first the PAE and then the RESEX categories (see Section 2.2). The area near the trijunction Brazil/Peru/Bolivian, from which Chico Mendes and other *seringueiro* leaders originated, benefited from both mechanisms. First of all Chico Mendes' original area, the *seringal* Cachoeira, was turned into the "PAE Chico Mendes" in 1989.⁵ Then a huge RESEX was created north of the BR-364 road and named RESEX Chico Mendes. In this study we will focus on the first one.

2.2. Collective land rights and environmental protection: PAE and RESEX statutes

The alliance between the *seringueiros* and the ecologists was not evident at first. For decades ecologist movements had been considering that the human presence is incompatible with the preservation of nature, following the so-called "Yellowstone model" where the creation of protected areas implied the eviction of local population. During the 1980s however, they changed their doctrine and started to consider the forest communities (Indigenous peoples but also rubber tappers or riverine dwellers, all designated by "traditional people or communities" or "forest people", see Redford and Padoch 1992) as efficient protectors of the environment (McNeely 1995), therefore deserving the recognition of special land rights (Colchester 1994; Murrieta and Rueda 1995; Brown 2002). Some, like Diegues (1998a) even considered that traditional communities were inherently prone to environmental conservation since the outstanding biodiversity of the rainforest is in part a byproduct of their presence and resource management, a point which was much debated over.

Introduced by the *seringueiros* in their demand for "extractive reserves" from 1985 on, the choice for a collective usufruct (as opposed to private property rights) has been a point of consensus between both parts (Allegretti 1990; Hall 1997). This was also due to the influence of Indigenous peoples in the ecologist lobby at that time and to the fact that other types of traditional communities were often considered as sharing a number of social characteristics with them, especially collective systems of land management. Hence, the concept of extractive reserve was very much inspired by Indigenous reserves (Rosendo 2007). Also, the intellectual influence of the discussion about the commons may be acknowledged. Progressively, a consensus appeared about the idea that, contrary to Hardin's "tragedy of the commons", disasters would occur more surely if individual property rights were granted to the members of those communities, whereas collective

⁵ This area has, therefore, two names: its former denomination "*seringal* Cachoeira" and its current denomination "PAE Chico Mendes". Many people continue to refer to it as "Cachoeira".

titles would deter deforestation. From “communally managed areas” (Fearnside 1989) to “collective” institutions or “commons” (Diegues 1998b, 2000; Cardoso 2002), a semantic slip soon occurred, leaving to believe that all traditional groups had common pool management systems regardless of the reality and complexity of local arrangements.

Currently, aside from land title granted on an ethnic basis (Indigenous territories and *quilombo* areas) three types of collective tenure exist in Brazil. The first one is the *Projeto de assentamento extrativista* – PAE (renamed *Projeto de assentamento agro-extrativista* in 1996). It is under the control of the INCRA, the federal body in charge of colonization and agrarian reform. It has been created in 1987, directly under the influence of CNS’s claims. The big difference with other colonization settlements created by the INCRA is that in this case there is no individual land title. A right of use (*concessão de direito real de uso*) is transferred to the local association, which in turn grants it to its members provided that they respect a number of rules. This creation of this status has been very innovative in Brazil at that time since the federal government, which had been dominated by a right wing military dictatorship from the 1960s until 1985 and was still ruled by conservative politicians during the second part of the 1980s, was very reluctant to accept collective land rights.

The second type of collective areas, created in 1990 also in the aftermath of Chico Mendes’ death, is the Extractive reserve (*Reserva extrativista* – RESEX). Ruled by the IBAMA, the federal body in charge of conservation units, they have more or less the same characteristics as the PAE but, as they are inserted inside the national system of protected areas, their objective is explicitly to protect the environment. Finally, in the middle of the 1990s a third status was created, the “sustainable development reserve” (RDS), which is somehow a clone of the extractive reserve but may be created in areas where local populations do not live only out of extractivism (Le Tourneau and Kohler 2014).

A number of points have already been analyzed in the scientific literature about the RESEX and the PAE statutes, like the question of their internal and external institutional architecture (Brown and Rosendo 2000a; Rosendo 2003; Ehringhaus 2006), their relation with empowerment (Brown and Rosendo 2000b), or their influence on deforestation (Vadjunec 2007, 2011). However, if the management and the economy of the *colocações* have been quite thoroughly analyzed (Cardoso 1999; Wallace 2004; Ehringhaus 2006; Vadjunec 2007, 2011), the question of individual vs collective dimensions of the land use management system has not been addressed as such.

2.3. Common pool resources, common property resources and design principles

Common pool resources are resources which may be accessed by a number of individuals, but are finite, divisible or subtractable and which may be the object of exclusion by part of the users against others even if this exclusion has a high

cost (Ostrom et al. 1999; Ostrom 2008). They are different from public goods, like air or digital knowledge: common pool resources are not open access, and may be covered by property rights (eventually common property), which may be formal or informal and diverse in their extension, from access to alienation (Schlager and Ostrom 1992). Common pool resource management systems, are the systems set up, mostly by local communities, in order to access and exploit their common pool resources.

Reacting to Hardin's "tragedy of the commons" (1968), which assumes that common pool resources are fated to overuse and destruction because they inherently invite users to freeride upon them, Elinor Ostrom pointed out that many common pool resource systems still existed worldwide and that they were functional and even successful: contrary to the expected tragedy, water resources, fishing banks or forests could be managed collectively by communities with economic and ecological success. She therefore studied what factors made such system enduring or not and proposed a set of eight "design principles" (Ostrom 1990, 2009; Ostrom et al. 1999). Those are not rules nor recipes for success, but were derived from the observation of hundreds of cases where they proved to be present, at different degrees, in most of the successful ones. Importantly, the long-term sustainability of a system is not linked with the extent to which any given principle is present, but with the extent to which the aggregation of principles is present. The robustness of the principles was extensively reviewed by Cox et al. in 2010, based on the analysis of 91 studies done within the design principles framework, and some were reformulated or modified. In this paper we will use this latter formulation of the principles as the base of our analysis.

Common pool resource systems are a "third way", distinct from pure individual private property and from full state ownership, where communities self-organize in order to manage collectively a common asset (Ostrom and Ostrom 2003). Importantly, not every resource has to be collective in a given system: in an irrigation system, water may be managed collectively but the fields may be individual properties. Also, the profits derived from the resources may be individual, the CPR system only implying that the community controls the access to resources (Richards 1997).

The way the community organizes itself is called "institutions". Institutions are sets of rules, rights and obligations which frame the conduct of the members and, if respected, lead to the success of the CPR system. The "design principles" are recurring parameters which proved to be important for effective CPR management systems (Ostrom 1990, 2009; Ostrom et al. 1999). Their formulation was slightly modified by Cox et al. (2010). They include:

1. Clearly defined boundaries for resource (what is exactly the resource and where it is located) and users (who is a legitimate user and who is not);

2. Congruence of rules with local conditions (rules coherent with the ecological possibilities) and between appropriation and provision rules (favorable cost-benefit ratio for the participants);
3. Collective choice arrangements (participants have a say in the rules affecting them);
4. Monitoring (capacity for monitoring the resource and also the users);
5. Graduated sanctions (the fact that there is an incremental grade for offenses and sanctions);
6. Conflict resolution mechanisms (the existence of instances – chiefs, judges, councils, etc. – and rules to promote conflict resolution and minimize the cost of conflict resolution);
7. Minimal recognition of rights (the capacity and right for the local community to establish its own rules on the resources);
8. Nested organization (the existence of several levels of management and political decision).

In this paper, we have chosen to consider the PAE Chico Mendes as a CPR management systems and a common property regime. Such assumptions lie on several factors. First, tropical forests are frequently assimilated as common pool resources as they share most of their characteristics: divisibility, subtractability and difficulty of control and enforcement due to the nature of the rainforest. Thus, the 24,898 ha of the PAE may be considered as a common pool resource for the *seringueiros* who inhabit it. Second, the INCRA ordinance defines the right of use received by the communities in a PAE as a “*regime comunal*” which may be translated by “common property regime”, leaving the concessionary communities to decide if the form adopted for the management is an association, a condominium or a cooperative.⁶ Behind this legal definition is the idea that extractive communities already have rules of use (“cultural peculiarities” mentioned in the preamble of the text) and that they will be able to develop “*activities which are economically feasible, socially just and ecologically sustainable*”. The vocabulary as well as the context and the stress put on a collective regime managed by associations (which is the form chosen by most of the PAEs) justify that we consider the PAE as a *de facto* CPR institution.⁷ However the reality is more complex since most of the authors acknowledge that, in the case of the rubber tappers, the individual plots (named *colocações*) are the relevant production units (Schwartzman 1989) and that they therefore present the case of “mixed” (Vadjunec 2007) or “hybrid” (Ehringhaus 2006) property and resource systems.

⁶ The 1996 INCRA ordinance re-defining the PAE statute indicates: “*the destination of the lands for such settlements will be given through a right of use, in a comunal regime, according to the form decided by the concessionary communities – association, condominium or cooperative.*”

⁷ Interestingly, the communal dimension of management is much less present in the legal definition of extractive reserves (law 9985/2000) even if they are considered by many authors as paramount examples of CPR in the Amazon.

Our point here is to see how the PAE Chico Mendes rules incorporate both the individual and collective dimensions, and the importance of each. To that end, we investigate the rules governing the use of an array of resources which are important locally (their importance is shown in Section 2) using the design principles as an analytical framework.⁸ This analysis led to the elaboration of a table (Table 2) which we analyze in Section 3. The findings are discussed in section IV. The overall objective of this study was to evaluate the extent of the local CPR as far as different resources are considered.

2.4. Methods

The present study has been conducted with the support of the DURAMAZ project phase 2 (Le Tourneau and Droulers 2010; Le Tourneau et al. 2013). This multi-disciplinary research project aims at studying sustainability in the Amazon by comparing the evolution of several sites of different types (colonization projects, traditional communities, agribusiness areas, etc.). To that end, extensive fieldwork has been conducted on each site, including the gathering of systematic economic and social data, and also the elaboration of an institutional analysis in the perspective of a general cross-sites comparison.

All data presented here were thus collected during the fieldwork held in the PAE Chico Mendes in July-August of 2013,⁹ when 72 families have been interviewed, representing 80% of the PAE's population. Interviews included structured questionnaires about economic and social aspects, and also open discussions. Among other data used within this paper, income figures were collected in face to face interviews where informants would detail all of their formal¹⁰ income sources and estimate how much they had gained from them during the last year.

Meetings were also held with leaders and important persons of the PAE on the basis of informal conversations in order to gather elements about the local institutional arrangements, which were later checked with other informants before or after the formal interviews. Finally, written documents, such as the PAE management plan, were carefully studied and confronted with the interviews' content. The formal and informal rules governing the use of natural resources and the tenure arrangements were extracted from those data using a special form elaborated by the DURAMAZ research team after E. Ostrom design principles and institutional analysis device. This form was created ahead of the fieldwork and its categories and questions were used as a blueprint to orient the data gathering and informal interviews.

⁸ Some of the principles were used by Vadjunec (2011) in her analysis of the Chico Mendes Extractive reserve, but as variable of her analysis and not as a system like we are doing here.

⁹ After a first campaign in 2008.

¹⁰ Formal means monetary here. Salaries, pensions but also timber, Brazil nut or latex sales are monetary transactions and people know the amount of each. Obviously this formal income is completed by informal sources like subsistence agriculture.

3. The current situation of the PAE Chico Mendes

3.1. Status and governance

The PAE Chico Mendes was created by the Ministry of agriculture decree n°158 of 8th march of 1989, with an area of 24,898 ha, benefiting 68 families. The federal government is the proprietary of the land, local residents being granted a right of use (*concessão de direito real de uso*). The PAE is ruled by an inner regulation elaborated jointly by the INCRA and the local population, which was sanctioned only in 1997. The text defines which activities are allowed in the PAE and to what extent. For instance, deforestation is limited to 10% of each *colocação* and cattle ranching is authorized but must be limited to 30 heads by family. One polemical point is the exploitation of timber. Article 12 of the Management Plan of the PAE states that: “*The entrance of wood loggers is forbidden in this PAE, with the aim of realizing commercial wood exploitation of any form*”. However, it leaves open the possibility of “forest management”. As we will see later on, timber is today an important economic activity in the PAE.

The regulation clearly assumes that there is a collective management of the PAE, and makes the local association the effective intermediary with public bodies. However, the internal organization of the PAE is grounded on the *colocações*, or plots occupied by the *seringueiros*’ families. As they are not properties, those cannot be sold: in case a family wishes to abandon its plot, the right of use is transferred to another by the general assembly, which chooses the beneficiary, and the procedure is afterwards validated by the INCRA. This does not imply that there is no monetary transaction implied. The former tenant may claim a compensation for the *benfeitorias*, i.e. for the investments he has made on the land. Most of the times, the compensation process is merely a way to overcome the legal prohibition on plot sale, the amount of money claimed being equal to the theoretical price of the property.

The *colocações*’ distribution and boundaries have been inherited from the *seringal* Cachoeira, and were not altered by the creation of the PAE. They are not equal in size, which was originally estimated assuming that each rubber trail (*estrada de seringueiras*) was about 100 ha in size; the original *colocações* had from 2 to 12 trails, or an extension ranging from about 200 ha to 1200 ha. However, a process of division of the *colocações* started at the end of the 1990s in order to accommodate the new families formed by the *seringueiros*’ children. The number of units grew from 68 to 89, but this was quickly seen as a threat to the PAE’s integrity, since some of the new *colocações* were considered very small and unfeasible. From 2008 on, the INCRA decided not to recognize any more the subdivisions in order to freeze the process. However as young people get married, new families continue to appear on the original plots, but now without any official recognition of their presence or rights. They are called *agregados* and their absence of official status is a serious issue nowadays.

Isolation has been one of the main other issues faced by the *seringueiros*. Until the 2000s, most of the *colocações* were very difficult to access, since the

road stopped at the entrance of the PAE, forcing people to take small forest trails to get to their home or to evacuate their production. This point greatly improved in the last 10 years. A number of internal roads (*ramais*) were opened in the PAE, making a number of *colocações* (not all of them) much closer to the cities of Xapuri or Eritaciolândia. Also, the roads brought energy to many houses, fulfilling an important local demand. It is important to note that these roads have been opened in connection with the project of expanding community timber production and that they have been of utmost importance in the decision of many families to engage in this activity. Today over 80% of the households have energy, against only 47% in 2007.

There are currently two associations in the PAE. The first one, named *Associação dos Moradores e Produtores do PAE Chico Mendes* (AMPPAE-CM), was created in 1989. Including 58 families today, it is the historical association and it is in general ruled by relatives of Chico Mendes. A second one appeared in 2007, principally composed by families living in the center or in the backside of the PAE, in reaction to the perception that families living at the entrance of the area did monopolize development projects and other benefits. It represents 29 families today. After a period of colder relationships, the two associations apparently managed to find a common ground and they have worked along the same lines since 2011. It is worth to mention that each association defines its members as “rural producers” in their status and not as “*seringueiros*”.

The associations’ decisions are monitored by the INCRA, which has the power to overrule them if it finds them contrary to the management plan or to the general objectives of the PAE’s status.

3.2. The current economic activities

The economic activities of the PAE are rather diversified, and not every family is involved in each activity (See Table 1). The most important from a symbolical point of view is rubber extraction, which gives their identity to the *seringueiros*. However, due to the very low price of rubber on the local market, it had almost ceased to exist in the beginning of the 2000s. A certain revival happened since then, with the institution of public subsidies on the rubber price by the Acre government. Moreover, from 2007 on, the federal government started a program based on the creation of a male condom production facility in Xapuri, which uses liquid rubber as its primary material and offers good prices for it. But the work is hard since the latex must be kept liquid, which means that the collecting activity must be done swiftly and also that the *seringueiro* has to handle chemical products.

The other main extractivist activity of the PAE is the collection of Brazil nut, which is sold to the local cooperatives or to private firms. As the nut price was very good in the last years, almost all the families are involved (60 of 72), the limitation being the quantity of Brazil nut trees present in their *colocações*. From our fieldwork, it appears that this activity is the most important economic activity in the PAE, with 41 families out of 72 placing it as their most lucrative activity

Table 1: Sources of income and participation of the PAE-CM *seringueiros* in economic activities (source: field interviews).

Activity	Gross revenue in the PAE-CM	Minimum income	Maximum income	Number of families involved	Mean income	% families involved
Latex	38,830 R\$	400 R\$	4000 R\$	28	1493 R\$	39%
Brazil nut	256,400 R\$	300 R\$	18,000 R\$	60	4273 R\$	83%
Timber	63,500 R\$	500 R\$	15,500 R\$	11	5773 R\$	15%
Cattle	88,080 R\$	100 R\$	15,000 R\$	29	3037 R\$	41%
Salaries	13,094 R\$	648 R\$	2000 R\$	13	1007 R\$	18%
Pensions and social benefits	25,069 R\$	60 R\$	1356 R\$	50	487 R\$	69%

(only 6 families place timber extraction as most lucrative, 4 cattle raising and 4 latex extraction).

The last significant economically forest activity is timber collection. It has been initiated with the help of NGOs like WWF in the beginning of the 2000s among intense controversies (Stone 2003). How could the *seringueiros*, who fought against the deforestation done by farmers, turn themselves into timber sellers? However, as, at that time, extractive products (including Brazil nut) had very low prices on the market, it was decided that this option was not to be overlooked. Guarantees were also given that the exploitation would be sustainable, by the adoption of low impact forest management practices certified by the FSC. The original project involved a participation of the *seringueiros* themselves at all stages of the production process (complying with the management plan prohibition of the entrance of *madeireiros* in the PAE), and the production of high value timber for luxury furniture designers in São Paulo. But this market niche never really materialized.

In 2005, with the support of WWF the COOPERFLORESTA (*Cooperativa dos Produtores Florestais Comunitários* – Cooperative of community managed forest producers), was set up in order to commercialize the timber. As rationalization was also sought for, the production process, originally manual, was redesigned with the use of skidders and the entrance of specialized teams. As a result, fewer *seringueiros* were involved in it. Two years later, the Acre government initiated a policy based on the expansion of forest management and exploitation by local communities. One of the pillars of this policy was the opening of new roads in the areas which would engage in the program, in order to facilitate the transportation of the production. The PAE thus saw the opening of more than 60 km of new roads (*ramais*), responding a long standing demand by the *seringueiros*. But in this new project timber was to be harvested by local firms, meaning in practice that *madeireiros* would enter the PAE (which they already did since some of the *seringueiros* already sold timber when needing money) and that the *seringueiros* would passively receive the timber's price. This was a conflictive issue since the management plan explicitly prohibited such a process. After some discussions

between both associations, a middle ground was found: the harvest would be made by the COOPERFLORSTA and not by *madeireiros*,¹¹ and the *colocações*' owners would also pledge FSC certification in order to comply with the cooperative's inner regulation and ensure that exploitation is sustainable.

If it has prompted important debates, timber extraction remains somehow marginal in the PAE from the economic point of view. Only 11 families have declared revenues linked with timber selling in 2013, a proportion much inferior to the 80% of the families officially involved in this activity. This may be linked with the instability of the COOPERFLORESTA, which, despite continuous public financial support, struggles to achieve continuity in its activities and to find markets.

The other economic activities of the PAE are linked with agriculture. Most of them are subsistence-type activities, which provide a great part of families' diet. Sale of agricultural products is not very frequent except for cattle. There are currently about 1336 cattle heads in the PAE. If this yields a mean number of 25 by family, under the threshold of 30 heads defined in the management plan, many *colocações* hold more than 50 heads, two having more than 100 heads (120 and 160 heads). This fact has collective impacts as cattle ranching implies the opening of permanent pasture and was responsible for a surge of deforestation in the PAE which reached 10% in the middle of the 2000s. As the internal rule of the PAE fixes this value as the maximal deforestation value, INCRA and IBAMA have prohibited new clearings since that time.¹² The problem is that not every family had reached their deforestation quota and that the type of agriculture practiced by the *seringueiros* implies the cutting of about 1ha of forest areas each year, which are exploited during a few years and then left in fallow during 10–20 years. With the current situation, people are forced to work only on the already existing fallows, in shorter cycle, a new practice that they do not master and which implies either mechanization or fertilization in order to be sustainable.

Aside from productive activities, salaries have become a source of income in the PAE, even if they concern only 14% of the families. Most of them are linked with public employment (school teachers, nurses, etc.), but some are also linked with timber extraction. Social benefits, which reflect the social policies promoted at the national level by the federal government, are much more important. About 20% of the households receive retirement pensions of about 800 R\$ per month, and 40% receive family allocations of about 100 R\$. The total of all those incomes

¹¹ Even if there is no real practical difference between the two processes, the COOPERFLORESTA is a cooperative of small producers and not a firm ruled by a *madeireiro*, which makes a big symbolic difference.

¹² The management plan also states that only half of the allowed clearing (or 5% of the *colocação*'s area) may be converted into pasture. Those who want to raise cattle frequently overpass also this limit.

was of about 525,000 R\$ in 2013, which is probably more or less equal to the total revenue of all the economic activities.¹³

4. Resources and rules in the PAE Chico Mendes

In order to analyze how the CPR management system in the PAE-CM works, we chose to focus on four different resources available to the *seringueiros* and connected with their territory. The first one is non-timber forest products, especially rubber and Brazil nut. The second is timber. The third is cattle. The fourth is different in nature since we have chosen to consider land as a resource. This allows us to analyze some issues which would have passed unnoticed if we were to focus only on economic resources, such as the shortage of land to accommodate the new families. Table 2 summarizes the rules and facts linked with each resource in function of the 8 design principles (in the version of Cox et al. 2010).

1A, 1B & 2A User and resource boundaries and congruence with local conditions

Most of the legitimate users of the resources are defined as the families owning a given *colocação*. They are registered by the INCRA, which issues a type of ID card called *cartão de assentamento*. However, this social boundary is relativized in two ways as far as land is concerned. First of all, in the immediate aftermath of the PAE creation, some *colocações* were sold and newcomers, who favored cattle ranching against extractivism, were able to step in. This has however been made much more difficult, if not impossible, by INCRA in the last decade. Second, and more important, as young people get married, they tend to install themselves in separate houses and to open their own agricultural plots. But as the INCRA has prohibited any new subdivision of the actual *colocações*, the new households are not recognized. They are called *agregados* (“aggregates”) and cannot participate in the projects which are implemented in the area, be granted a clearing license in order to open a new agricultural plot, or pledge credit for agricultural activities of any kind. In 2013, about 25 families were in this situation, out of a total of 104 families living in the PAE’s area.

Regarding the physical boundaries of the resources, most of them are defined in relation to the *colocações*’ extent. This does not mean that the resources are equally distributed, but that the limits recognized socially for their exploitation are not following ecological patterns. The *colocações*’ boundaries (Figure 2) were always considered as very clear by the tenants, but there were no map showing them. Today, the management rules associated with timber extraction imposed the realization of a detailed cartography showing the properties’ limits as well as the exact determination of the areas to be exploited. Some spaces are considered as collective, like ponds or streams where all users may collect resources.

2B Appropriation and provision rules

¹³ It is difficult to calculate this amount since some activities are not immediately converted in money (for instance the augmentation of cattle heads, which may be sold or not depending on the circumstances) and since the importance of the subsistence agriculture is very difficult to evaluate.

Table 2: Local rules classified in function of resources and design principles.

Principle	Latex/Brazil nut	Timber	Cattle	Land
1B User Boundaries: who may use?	– Owning family – <i>agregados</i>?	– Owning families – COOPERFLORESTA – <i>madeiros</i>?	– Owning families – Pasture rental?	– PAE members – <i>agregados</i>
1A Resource boundaries	– Individual <i>colocações</i>	– Individual <i>colocações</i>/grouped areas	– Individual <i>colocações</i>	– Individual <i>colocações</i> – Informal subdivision
2A Congruence with local conditions	– Individual <i>colocações</i>/no natural limits	– Individual <i>colocações</i>/no natural limits – Eventual grouping to match tree abundance and operational efficiency	– Individual <i>colocações</i> natural limits	– Individual <i>colocações</i>/no natural limits – Some products may be collected everywhere, fishing rights
2B Appropriation and provision	– Owner of the <i>colocação</i> is owner of the production – Must take care of the estradas de seringueiras/castanheiras	– Owner of the <i>colocação</i> is owner of the production – Exploitation must be managed and sustainable/certification	– Owner of the <i>colocação</i> is owner of the production – Maximum of 30 heads/15% of the <i>colocação</i> – owner must build fences and is responsible for eventual damages	– Families have right of use of the <i>colocações</i> – payment of the <i>benfeitorias</i> – Local association rules about <i>colocações</i> transfers – INCRA validates in function of the management plan
3 Collective choice arrangements	– PAE Management plan elaborated collectively – Association membership	– PAE Management plan elaborated collectively – Association membership – Individual or grouped management plan	– None, the exploitation is an individual choice.	– Local associations may accept or reject transfers in general assembly, but the INCRA has the power to overrule; – Right of use recognized by the INCRA
4A Monitoring users	– Neighbor's eye – Protection committee in the association	– Certification for some <i>colocações</i>,	– Neighbor's eye – Protection committee in the association	– Protection committee in the association – INCRA monitors the users by recognizing or not the new associates
4A Monitoring the resource	– None/traditional practices	– incomplete monitoring – Inventories/management plan	– Deforestation monitoring by an external body (SEMA)	– Local monitoring by the associations – INCRA monitors the transactions – Deforestation monitoring

Table 2: (continued)

Principle	Latex/Brazil nut	Timber	Cattle	Land
5 Graduated sanctions	– Warnings issued by associations – Loss of the right of use (i.e. expulsion)	– Warnings issued by associations – Loss of the right of use (i.e. expulsion) – Illegal timber selling may theoretically be sanctioned by public authorities	– Prohibition of further deforestation (in effect) – Loss of the right of use (i.e. expulsion) – PAE dissolution	– <i>Colocação</i> transfer invalidated – Loss of the right of use (i.e. expulsion) – PAE dissolution
6 Conflict resolution mechanisms	– Collective mediation during assemblies, dialogue between the tenants. – Mechanisms are informal – No formal mechanism to mediate conflicts with authorities	– Collective mediation during assemblies, dialogue between the tenants – Mechanisms are informal – No formal mechanism to mediate conflicts with authorities	– Collective mediation during assemblies – Dialogue with INCRA	– Collective mediation during assemblies – Dialogue with INCRA
7 Right to organize	– Collective elaboration of rules and management plan – Dialogue with INCRA	– INCRA did put provisions for this activity in the management plan against local will – NGO elaborated rules with local association – State government imposed its own system without local input	– Collective elaboration of rules and management plan – Dialogue with INCRA	– General assembly with INCRA participation – INCRA visits, conversations... – Political articulation of the PAE with local and regional authorities
8 Nested organization	– Rules elaborated with INCRA, a federal agency	– Intervention of NGOs, the Acre state government & INCRA	– Rules elaborated with INCRA, a federal agency	– Rules elaborated with INCRA, a federal agency

The 2B design principle may be short labelled as the cost/benefit relation of the system for each user. The PAE management plan provides a number of rules to be obeyed in the exploitation of the *colocação*. Most of them are about how rubber must be collected and how rubber trees must be taken care of. There are also provisions about deforestation, timber extraction (only possible within management plans), non-timber forest products extraction and cattle ranching. Some provisions are also made on collective spaces, mainly the access roads and the streams and rivers. Some fishing techniques are prohibited in the latter.

The rules (which are at times infringed), broadly determine which activities are allowed, which are prohibited and which may be allowed if they are proved sustainable “by technical reports”. Most of the “costs” for participating from the CPR may be viewed as individual investments which the user may valorize as

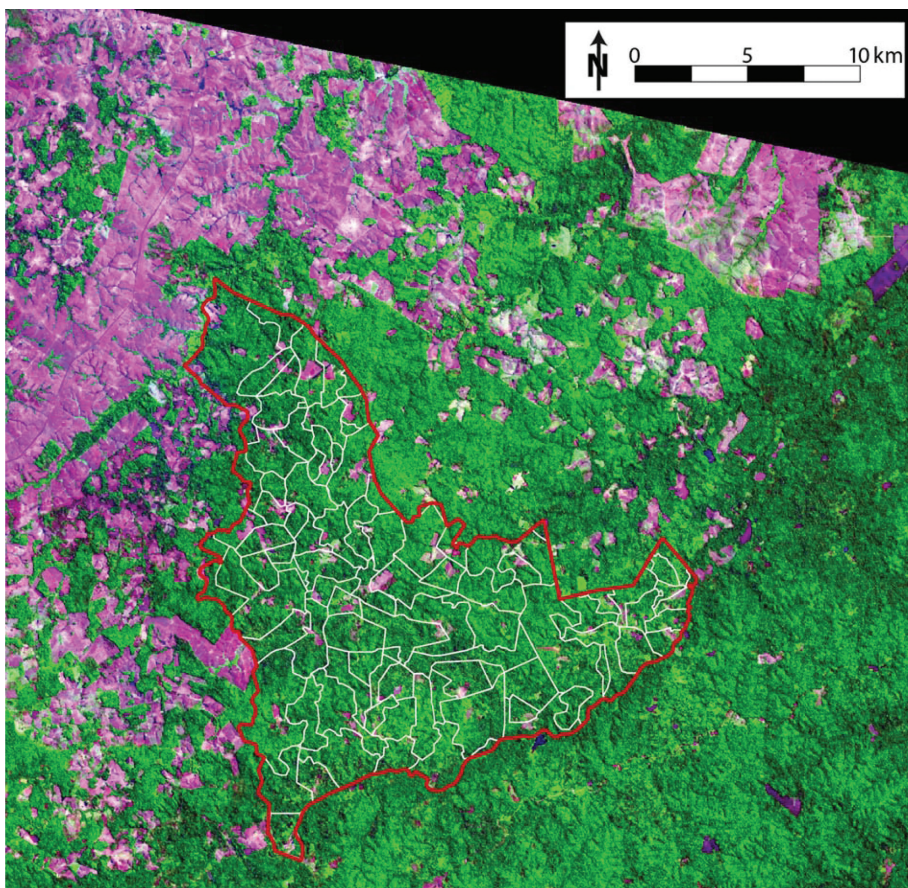


Figure 2: Map of the *colocações* boundaries (background Landsat eight image 01/09/2013). About 5% of the *colocações* could not be plotted on the map because of lack of information.

benfeitorias: taking care of the rubber tapping trails and Brazil nut trees, constructing fences for cattle... The only real costs are mostly limitations, especially those imposed on cattle ranching and on the *colocações*' sales. But both are eventually bypassed by various mechanisms.

As for the benefits, they are mostly depending on the *colocação* management, which means that they are only marginally affected, at least on a short term basis, by the good functioning of the CPR.

3 Collective choice

The management plan was elaborated jointly by the INCRA and the local population but the latter made it more open than the *seringueiros* were initially willing to, allowing, for instance, some forms of timber extraction. In general, the local population choices must always be validated by the INCRA. Thus, even if the general assembly agrees to the recognition of new *colocações*, either by subdivision or by the transfer of right of use, the INCRA may bar this decision.

If most of the *colocações* management decisions are individual (to exploit or not a given resource, to develop or not the agriculture, to raise cattle or not, etc.), it must be noted that timber exploitation is different in that respect. First of all, engaging in the program of collective forest management is made through the associations and is thus associated to a collective choice. It was a much debated issue among the families in the 2000s. Second, given the technical aspects of collective forest management laws in Brazil, the decision about which area of the *colocação* will be exploited, and about which trees will be felled is made by technicians appointed by the COOPERFLORESTA and not by the *seringueiros* themselves.

4A & 4B User and resource monitoring

The management plan does not provide for any effective monitoring mechanism. Most of the existing monitoring is about looking to what the neighbor is doing and reporting it to the associations' general assemblies. The lack of internal monitoring may explain why some *colocações* passed the deforestation threshold or the cattle heads maximum number.

External monitoring of the deforestation is done by federal or state agencies in charge of emitting deforestation authorization. Those have prohibited new openings since 2008 because the overall deforestation rate passed the 10% limit.

5 Graduated sanctions

The management plan mentions two levels of sanctions. The first one consists in a formal (i.e. written) warning issued by the local association. After two warnings the general assembly may communicate the case to the INCRA, which may break the contract of the misbehaving family and expel it from the PAE. Additionally or alternatively, people may be subject to the penalties defined in the environmental laws, especially in the case of unauthorized deforestation or unauthorized use

of fire. Practically, the sanctions are never put into effect. The only mechanism which seems to have an effect is the external monitoring of deforestation. Some of the PAE's leaders are quite convinced that satellite imagery is efficient to monitor unauthorized burnings or forest clearings, and they are concerned with the fact that clearing authorizations are no more issued. But this sanction is collective, whereas the infringements are individual. At the same time, the deforestation today seems to have lowered, but control authorities are lagging in acknowledging this new situation.

6 Conflict resolution

No explicit conflict resolution mechanism was set up. Obviously the associations are the privileged forums for discussing misbehavior and mediating conflicts, but this is not clearly explained in the PAE status. Informal talks with INCRA technicians also occur, but they are not a regular mechanism. Also, several prominent families, especially those linked to Chico Mendes, have an important influence on the others.

7 Right to organize

The PAE-CM rules were produced in part by local consultations, and then slightly modified and sanctioned by the INCRA. Furthermore, the local associations are the principal partners for the PAE-CM management. Regarding timber, if the first attempt was done in close partnership with the *seringueiros*, the state sponsored system was imposed in exchange for the opening of roads.

8 Nested organization

The PAE is very well inserted in a nested network because of its political importance as the homeland of Chico Mendes. This network involves municipal authorities (when the PT political party is in charge in Xapuri), state government (ruled by the PT since 1998) and several local (CTA) and international (WWF) NGOs. Because of it, the PAE Chico Mendes has benefited from a number of social, educational or development programs, and is always in the first line in the state government initiatives (Le Tourneau and Droulers 2010). This explains its role as one of the most emblematic suppliers of the COOPERFLORESTA,¹⁴ as well as its excellent level of equipment compared to other forest areas. The networks involved are different in function of the resources, but not all are governance networks. In the case of extractivist productions, they are more commercialization networks. In the case of timber, the COOPERFLORESTA was designed to include local governance and economic aspects. In the case of land, the relation with INCRA shows much more a top-down organization.

¹⁴ Even if the cooperative engineers do not consider it as a very interesting area if considering its potential for timber production.

5. Discussion

One of the most celebrated features of the PAE (and later RESEX) status was that they were based on collective land rights. But does this guarantee that they are functional CPR management systems? The detailed analysis conducted in section III allows us to pinpoint a set of issues which show that there are flaws in the collective management system.

The question of the *agregados* is probably one of the most critical issues and shows many of the shortcomings of the current system. It may be explained by demographic factors: the *seringueiros* continue to have large families (even if far more restricted than before). Also, as the PAE has a relative economic success and is very well served in terms of education and transport infrastructure, families avoid migrating to the city. Therefore, emigration from the PAE is low, and young people prefer to stay. Those factors create a demand for new plots, but there are no collective areas where they could be opened since the PAE is already completely appropriated. It could be handled up to a certain point by having the *colocações*' subdivisions acknowledged by the associations and the new families accepted as members of the PAE, as it has been the case until the mid-2000s. But since the INCRA, fearing abuses, decided not to release new *cartões de assentamento* inequality was created between the official families and the *agregados*. People in the PAE are quite divided regarding the issue since they would like to see many of the young people recognized as members of the PAE, but at the same time they acknowledge that subdivisions may lead to economically unfeasible plots.¹⁵

What seems clear is that the management rules adopted in the 1997 plan had no long time vision. Until the PAE creation, this question was handled by the *seringal's* owner. There is thus little local practice in relation to the question of inheritance of the rights on the land – since there were no rights. Probably, on this point rules will have to be reconsidered, but it is not clear how a consensus might emerge among the population. Also, the relative power of the INCRA and the local associations may have to be reconsidered since the possibility for the INCRA to overrule creates a situation where no negotiation is possible.

Looking at this fact and at how the design principles are implemented in the PAE-CM, we see that in many cases the local system does not satisfy to the criteria of a successful CPR system. One of the primary flaws is linked with local participation and the interference of external actors. The PAE status is to be enforced by the INCRA, which has the final word on many issues, reducing the possibility for the *seringueiros* to make decisions on their own (for instance divide their land in order to accommodate their sons) or to change the rules. The state government also entered the area and imposed a forest exploitation system which was alien to local demands and rules. Recognizing these issues, Ehringhaus speaks of the extractive reserves as an “hybrid land tenure system” where “*state and local communities share authority over land and resources to different degrees*” (2006, 10).

¹⁵ Or feasible only by adopting unsustainable practices...

But as the INCRA has the last word on most issues, it might be wondered whether there is any sharing at all in the case of the PAEs.

As for monitoring, as the *colocação* is mostly a private area, it is difficult for the neighbors to monitor each other. The “protection committee” established in the status does not seem very active. Therefore, most of the monitoring is left to the external control by state or federal agencies. Furthermore, the sanction system is not very efficient. Bringing the misbehaving families in front of the general assembly is very difficult to achieve, and eventual expulsions would have to be pronounced by the INCRA, showing one more time the interference by federal or state powers. In the absence of an efficient monitoring, families’ choices may contradict the inner regulation and impact the collectivity, as was the case with deforestation. But they were not sanctioned individually and, instead, the current prohibition of new clearings affects the PAE collectively.

One may also question the “collective” nature of the system. As principle 2B shows, the *colocações* owners put little investment in the collective part of the system. They must comply with the rules and participate in the assemblies, but they do not contribute by their work or by paying fees. All the more, most decisions they take in relation to resources (like to engage or not into an activity) are individual and not collective, as well as the benefits are only individual: maintaining the resources on one’s *colocação* does only marginally influence the benefits of the others. Such a lack of collective choices leads to the apparition of ever more distinct economic profiles among the families, which could in turn weaken their collective identity, or at least change its components, as shown by Gomes et al. (2012). In the case of timber, the associations had to insist much in order to convince the families to join the project and to enter the FSC certification. Also in this case, the national legislation about community forest management is being more important than local rules.

On other basis, Vadjunec (2007) had already concluded that the Chico Mendes Extractive reserve was a weak common property regime, while Cardoso also considered the PAE status as weak in this respect. But our analysis may lead to question if the PAE-CM is a CPR system at all. Authors have argued that the nature of the rainforest made the *seringais* CPR systems, or that the *colocações* boundaries were overlapping, which made them *de fato* CPR (Cardoso 1999; Ehringhaus 2006; Vadjunec 2007). But when the forestry operations required that *colocações* limits were mapped in the PAE-CM, those appeared to fit perfectly (or eventual dissensions were quickly resolved) and no overlapping was apparent. As for the resources, all of those with an economic value are individually appropriated (i.e. the owner of the *colocação* is the only legitimate appropriator), regardless of the uneven distribution of the trees or the fertility of the land. Therefore, there are very few items which are really under a collective management: mainly the streams and ponds, as well as the area at the entrance of the PAE-CM where some collective facilities were built.

The limits of the PAE-CM as a collectively managed area may be better understood if we recall the historical context of the political struggle of the rub-

ber tapper for their land rights (Part I). The initial claim was about having their *colocações* recognized individually by a legal title. It is the intransigency of the Federal government in accepting the legalization of their tenure (in part because their extension was far greater than what was allowed inside the agrarian reform program) that they sought new devices and eventually proposed collectively owned areas as a solution. But acting collectively was not an evident product of a common history and, on the contrary, quite a novelty for the rubber tappers. First hand testimonies, like Gomercindo Rodrigues' one, show that in the 1970s they were mainly divided and individualistic and that the construction of their union has been a long and arduous journey. "*Mistrust*" was widespread between them and "...*organization was somewhat forced on them from outside...*" (2007, 102). Therefore, it is not surprising that the formal and informal rules and the PAE-CM are not fully compliant with the definition of a successful CPR: as a matter of fact, the PAE creation was not the recognition of a long living CPR system and on the contrary for most of it the creation of a new system.

This does not mean that the *seringueiros* were not interested in it. On the contrary, they had perfectly understood that this was the only way to secure their land rights, which was their prime objective. But once this achieved, different views on what to do on these lands emerged. Many of them now want to turn to other preoccupations, like livelihood improvement, even if this may be, at times, in contradiction with the provisions or philosophy of the system they have entered in, or if this may imply a redefinition of their identity (Gomes et al. 2012).

6. Conclusion

The *seringueiros* were one of the most organized and powerful political group in the 80s in the Amazon and they were very instrumental in obtaining from the federal government new forms of land titles based on collective rights. The PAE-CM is emblematic of those, especially since, as Ehringhaus (2006) has pointed out, its status has served as a template for both PAEs and RESEXs legal statutes. However, a careful analysis based on E. Ostrom's design principles shows that the PAE-CM's system is much less collective than expected, and also very much controlled by external authorities, which suggests a kind of top-down logic pretty much away from the idea of a CPR system. This finding is useful to understand the shortcomings in the actual management of the PAE but also to foresee difficulties which will probably arise in the management of many of the areas which have gained collective land rights or collective management statutes in the Amazon.

Indeed, the same story is currently being repeated in many places in the Amazon. Traditional populations massively adopted collective land rights because it was a very efficient shortcut in order to secure their tenure and deter urgent external pressures. But in many cases, the recognition of their territories is a not a mere formalization of "traditional" collective systems. It implies on the contrary the creation of new institutions and important changes in the way the inhabitants

see their property rights and their property management, in a complex mixture of collective global rules and individual concrete options.

Recognizing that the collective statutes are new even to traditional communities and that those must pass through a learning process in order to manage them is probably the first step in order to tackle the current problems of plot sales, illegal logging, fishing or deforestation for cattle ranching which appear in many of those areas. Such a process is likely to result in the creation of new local rules, and the capacity of the federal agencies in charge of those areas to recognize those will be an important test for the possibility of the current statutes to be transformed in effective and functional CPR systems.

Such findings do not disqualify the PAE or RESEX as useful devices for environmental protection (deforestation, for instance, is very limited in the PAE-CM), but calls for new forms of management from the authorities and new positioning by those and support NGOs in order for them to be fully efficient. On a theoretical point of view, this would probably correspond to the effective application of design principle n°8, about nested governance, by a horizontal dialogue between communities and authorities at different levels.

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