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Fragile Social Norms: (Un) Sustainable Exploration of Forest Products

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ABSTRACT

The exhaustion of natural resources is a central problem in the international agenda. The particular case of Amazon forest is at the top on the international environmental debate. Two related problems are keys to be considered in the discussion of sustainable development in this region. First the predatory use of the natural resources of the forest mainly timber and genetic resources. Second the recognition of the existence of a population of around 20 million inhabitants in the region defined as "Legal Amazon Area", aiming the improvement on the living conditions, enhancement of income level and acceleration of development. How to match both objectives is a puzzle faced by the present generation.

The region is populated by initiatives of international non-governmental-organizations, most of them carrying good intentions but lacking the necessary knowledge on local formal and informal institutions to find ways to reach sustainable development. The result is the accelerated process of natural resources depletion, and social disorganization. The case of the production of Brazilian Nuts stands as a corollary of the lack of an institutional structure of property rights that does not provide incentives for sustainable development. The opposite effect is being observed as a result of the fragility of observable institutional arrangements.

The case provides the counterfactual for the analysis of Ostrom (1990; 2008), where she presents virtuous cases of sustainable exploration of natural resources, mostly based on informal but solid institutions.

Keywords: sustainable exploraiton of forest recources, social norms and sustainability, common pool resources

1 Introduction

The exhaustion of natural resources is a central problem in the international agenda. The particular case of Amazon forest is at the top on the international environmental debate due to the observed scenario of devastation of the forest. The frontier of human production activity as described by Braudel (1979) suggests that in the XV century the tropical forest was practically untouched by human hands, serving as an example of non accessible areas, as well as the mountains, deserts and deep oceans. This is no longer the case in the XXI century. Natural resources in deep oceans are being disputed by several nations, so are the resources from tropical forests.

The case of Amazon forest shows two related problems to be considered in the discussion of sustainable development. First is the search for institutional arrangements and governance mechanisms to support the sustainable exploration of natural resources of the forest, mainly timber, other products from the

forest and genetic resources[1]. Second the recognition of the existence of a population of around 20 million inhabitants in the region defined as "Legal Amazon Area", aiming the improvement on the living conditions, enhancement of income level and acceleration of development. How to match development and forest resources preservation objectives is a puzzle faced by the present generation.

The region is populated by initiatives of international non-governmental-organizations, most of them carrying good intentions but lacking technological tools, and knowledge about local formal and informal institutions. The result is the accelerated process of natural resources exhaustion, and social disorganization. The case of sustainable production of forest products stands as an experiment of different institutional arrangements of production, that differ mainly in the way property rights on natural resources are allocated. The imperfections of the formal institutional structure of property rights on land, the weak enforcement of rules imposed by local governments and the absence of informal institutions, as observed in the beginning of the XXI century, does not provide a platform of incentives for sustainable development.

The exhaustion of natural resources is being considered as a result of the fragility of institutional environment. The cases of traditional exploration of products from the forest provide examples of common pool sustainable exploration systems, at the edge of exhaustion. Examples of rubber, Brazilian nuts and timber exploration provide the counterfactual for the analysis of Ostrom (1990), where she presents virtuous cases of sustainable exploration of natural resources, rooted on formal and informal institutions. She also presents cases of failures, always associated with institutional weaknesses.

In addition to Ostrom´s treatment of common pool resources exploration, this paper adds a supply system analysis dimension. Basically it expands her model by placing the institutional arrangements and institutional environment on the expanded organizations represented by the "strictly coordinated supply system" of production[2]. The concept of SCSS was developed to explore the role of institutions and transaction costs to explain the incentives structure embedded in complex institutional arrangements observed in food, fiber and energy chains (Zylbersztajn, Farina, 1999). It has recognized the relevance of institutions to explain the vertical coordination of complex production arrangements[3]. In this paper a conceptual model is proposed to explain the case of sustainable exploration of natural resources, placing the concept of "limit of rupture" of the common pool resource system (CPR), seen as an expanded and complex institutional arrangement.

The paper is organized as follows. Following this introduction, part 2 presents the theoretical elements that support the analysis. It is based on Ostrom (op. cit) and Zylbersztajn and Farina (op. cit) and basically proposes that sustainable exploration of common pool might reach its limit of sustainable exploration when the chain connects to markets on non traditional ways. The supply chain of products collected from the tropical forest is studied as an expanded institutional arrangement of production shaped by the institutional structure of property rights. Part 3 places the case of production of Brazil nuts in the Jari Valley as an example of a fragile production system based mostly on informal property rights, at the edge of rupture. Part 4 matches the case and the theory, showing that the observed institutional arrangements are aligned with a case of tragedy of commons. Part five concludes and discusses alternative scenarios for the evolution of the property rights structure and the institutional arrangements.

2 Theoretical foundations

The present study is funded on the relation between institutional environment and institutional arrangements (North, 2005; Barzel, 1997). Two theoretical elements are jointly utilized. First the property rights approach as it relates to the institutional structure of production. Second the concept of strictly coordinated supply system, where the production chain and its interactions with the institutional environment are seen as an augmented Coasian firm.

Institutional environment is a concept developed by Nobel Douglass North (1990), and represents the matrix of formal and informal institutions that bound the human activity. The first is composed by the set of formal rules as expressed in constitutions and legal codes. The second is represented by informal rules as expressed in taboos, traditions and informal ties. The relevance of institutions is connected to the

[1] Water resources are also relevant. The abundance of clean water is being severely affected by illegal mining activities and lack of investments in sanitary equipment at the cities and villages along the rivers.
[2] From now on SCSS.
[3] The relevance of institutions for agri-chain analysis was mentioned in the pioneer work Goldberg (1968, p.3). However his subsequent work did not adopt an institutional approach. For details see: Goldberg,R.1968. Agribusiness Coordination: A System´s Approach to the Wheat, Soybean, and Florida Orange Economies. Harvard Graduate School of Administration.

observation that by bounding the human behavior they provide the structure of incentives to the social actors to perform their activities.

Institutional arrangement is a concept presented by Ronald Coase and adopted by Oliver Williamson, to refer to the alternative architectures adopted by specialized agents to organize the production. Behind the concept of institutional arrangement lies the Coasian concept of contractual firm. A firm is defined as a nexus of contractual relations being designed to govern the production.

Both theoretical constructs are connected. As a result of institutional changes, we expect that the incentive structure is re-shaped resulting in different institutional arrangements.

Institutional environment and institutional arrangement are relevant concepts for the present study in two different and complementary dimensions. First the contribution of Elinor Ostrom (1990) relies in the concept of formal and informal institutions. Second, the work of Zylbersztajn and Farina (op. cit.) brings institutions to the food chain analysis, considering the strictly coordinated supply system as an expanded Coasian firm.

2.1 Property rights approach

The institutional environment is the set of formal and informal rules that shape the governance of production systems. It is mainly related to how economic agents allocate property rights. Institutional arrangements represent how the production organizations are governed, including how enforcement mechanisms are shaped (Libecap, 1989). The institutional structure of production is the observed result of the joint effects of formal and informal institutions. Informal institutions are related to the allocation of economic rights, shaping part of the incentives necessary to handle simple, personal and usually local institutional arrangements. Reputation mechanisms of exclusion and enforcement of informal rules are at the core of the functioning of informal institutions, when courts are not the only mechanism to solve disputes. Formal institutions emerge when the state and the courts play a role to maintain the structure of property rights. Formal institutions define the legal rights that provide incentives for agents to perform transactions without necessary personal interaction.

The protection of property rights and the control of transaction costs reflect the incentives that result from the interaction of formal and informal institutions. Formal and informal mechanisms that protect property rights might be sufficient to provide incentives for organizations to produce and promote changes in the economic environment. As stated by Ostrom (2008), no general panacea solution is expected.

2.2 Theoretical model

Transactions are exchange of a bundle of property rights. In a SCSS, simultaneous transactions are performed involving many agents. In this study I assume that we can devise a property rights index PRi that represents the quality of property rights allocation to the players, resulting from both, formal and informal institutions. The range of the index is defined as being; 0<PRi< 1, where zero represents that property rights are not defined nor enforced. The closer to 1 the better the institutional environment in terms of promoting exchange at lower transaction costs.

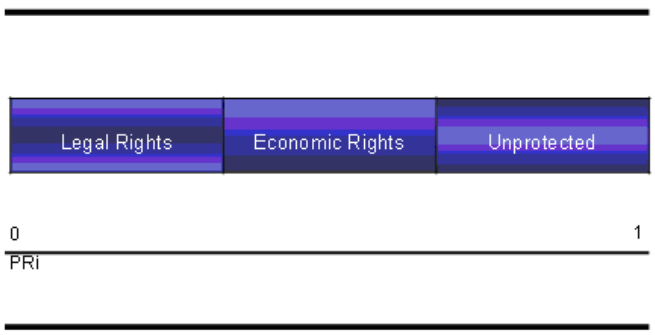

Figure 1.
Property rights index model

Based in Barzel (1997), Figure 1 considers the property rights structure based on formal institutions, as related to economic rights and the proportion of property rights defined by informal norms as related to economic rights. The model leaves room for that part of property rights which is unprotected therefore part of the value is subject to capture.

I propose that a limit level of protection of property rights can be devised, which is sufficient to shape incentives for the parties to engage in the transaction. I define this level as Pr_l.

In the present study, two dimensions are considered. The *first*, is the scenario where the institutional arrangement is observed. In remote areas as is the case of the Brazilian Amazon tropical forest, formal institutions are weak and imperfect to offer and protect property rights demanded by the society. Previous studies have shown that in areas of expansion of economic activities, informal rules play relevant role to handle transaction costs (Anderson, Hill, 2004). However, in the presence of external impacts, informal rules might evolve rapidly, leading to the rupture of the institutional structure of production. When traditional systems are connected to markets the value of resources increases and the demand for property rights changes not always matched in a dynamic way by the reorganization of the formal and informal institutional structure of production (Demsetz, 1979; Ostrom, 1990; Libecap, 1989).

Ostrom (2008) reshaped the traditional simplistic models of natural resources exploration, by introducing the role of formal and informal institutions. When local actors are able to implement rules that are monitored and enforced, they might succeed in maintaining sustainable exploration of open access resources. The model relies strongly on: first, the existing institutional matrix, second the existence of credible commitments among the players, and third, the mutual monitoring system.

Ostrom (ibid p.90) presents eight principles associated to the survival of complex production systems based on CPR. First is the definition of the system boundaries. Second principle relies on the controlled balance between resources appropriation and resources provision rules. Third are the collective action arrangements, and the fourth are monitoring systems. The fifth principle is the incentive system, basically sanctions and penalties related to property rights expropriation. Sixth principle is the system of property rights definition and enforcement. Seventh, is the conflict resolution mechanism and finally, in the case of large systems, a structure of nested enterprises.

2.3 Strictly coordinated supply system

The *second* dimension introduced in this study explores the concept of "strictly coordinated production systems" (Zylbersztajn, Farina, 1999), here used to explore the limits of the equilibrium reached by observable institutional arrangements. Herbert Simon in his paper on the architecture of complexity developed the concept of nearly decomposable system. He recognized that …"the fact that many complex systems have a nearly decomposable hierarchic structure is a major facilitating factor enabling to understand, describe, and even see such systems and their parts" (Simon, 1962).

The SCSS model suggests that the traditional supply chain analysis in food, fiber and energy production can be treated as a nearly decomposable complex system. In fact the existence of one predominant governance form in those systems with many variations pictured by each particular arrangement organized hierarchically, served as the basis for the concept of SCSS. The concept of SCSS suggests that an augmented Coasian firm provides useful elements to analyze agricultural related production arrangements. The concept amplifies the traditional analysis of food, fiber and energy production based on local institutional arrangements, placing the problem on a wider and surely more realistic but complex frame. The food supply system is described as a series of interconnected transactions bounded by the formal and informal institutional frame. More than a collective action problem, as pictured by Ostrom, it is seen as a problem of vertical coordination. The model recognizes that production chains are not homogeneous, instead one can observe several institutional arrangements that compete at both ends, i.e., competing to obtain resources and competing at the market.

A vast amount of literature has emerged after 2000, dealing with complex institutional arrangements in food, fiber and energy systems (Menard, Klein, 2004). The SCSS in the present study is used to analyze how competing incentives at the supply system, impacts the observed institutional arrangement located at the origin, where the CPR is explored.

The observed supply system can be decomposed in individual SCSS characterized by some degree of hierarchy, as pictured in Figure 2. Each sub-system is seen as a complex institutional arrangement, composed by a variable number of interconnected agents in which the hierarchy is identifiable. Usually the systems rely on the supply of raw materials originated from agriculture and compete, at the other end, at the markets. Each SCSS represents a particular institutional arrangement, resulting from the interaction of formal and informal institutional rules. In some cases supply systems are very homogeneous with one or a few sub-systems. In other cases many systems are observed, each representing a particular strictly coordinated institutional arrangement. The systems present a dynamic pattern of convergence when the determinants of complex institutional arrangements diffuse or are copied. In other cases, the differences persist through time.

Each nested sub-system is seen as a complex institutional arrangement bounded externally by the institutional environment, composed by formal and informal rules that limit the action of actors. Additionally each system is governed internally by informal rules of property rights allocation that disciplines the series of simultaneous transactions each presenting a particular governance characteristic. A particular type of hierarchy structure is observed within each sub-system, governing the use of resources, the generation and distribution of value among the different actors of the system.

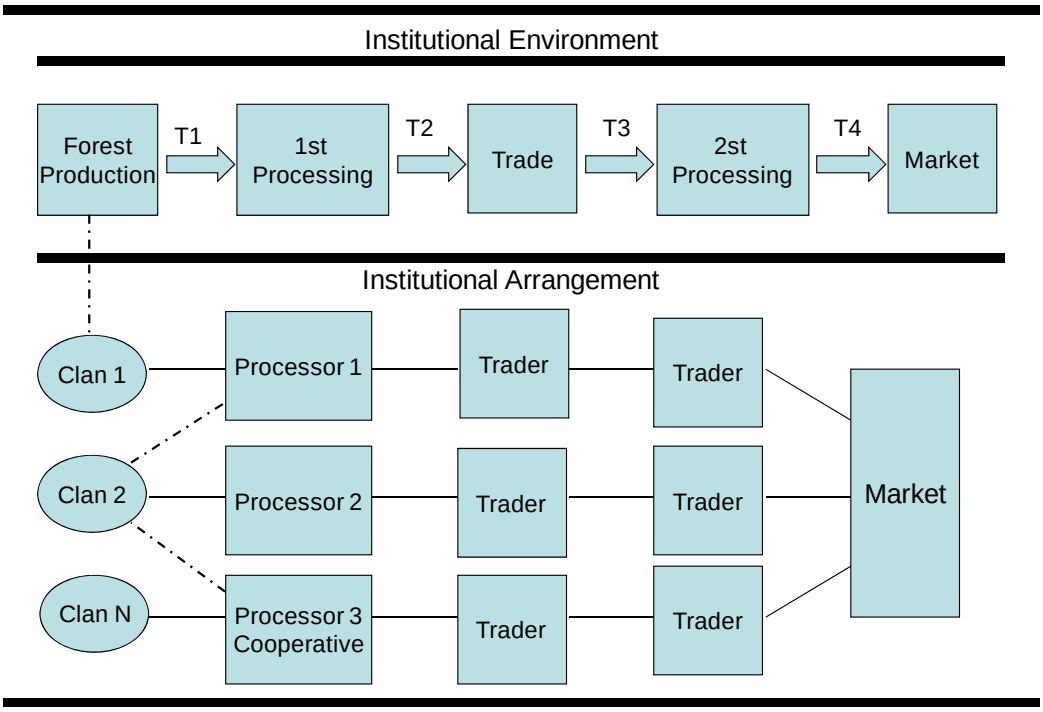

Figure 2.
Strictly coordinated supply system

2.4 Linking CPR and SCSS models

The analysis of the production system of Brazilian nuts is carried based on both constructs. First the system is described as a SCSS, with a number of sub-systems that differ in terms of governance mechanisms. Second, we describe the transactions carried through the chain, focusing the attention at the transaction T1, related with the production based on CPR, and the transactions with other players in the vertical system. Then the Ostrom´s model for open access problem is considered.

Each one of the principles proposed in the CPR model is analyzed based on the SCSS perspective. Considering that each SCSS can be considered as a nested complex enterprise, some basic questions are considered:

1) How the boundaries of the resource exploration as well as provision and appropriation rules are affected if many sub-systems are in operation competing for the resource? How general rules evolve to govern the sub-systems?

2) Collective choice arrangements are easier to be observed within each sub-system. How do they subsist in the case of many sub-systems?

3) How SCSS inter-monitoring devices evolve?

4) Are sanctions and conflict resolution mechanisms amplified to cover different SCSS?

5) How property rights are defined among different SCSS?

The stability of the SCSS depends on three aspects:

a) The characteristic of the resources being explored.

b) The competences of the social group to implement informal rules and enforcement mechanisms in a dynamic way offering incentives for members and exclusion of non-members.

c) The capacity of the State to enforce formal institutions to maintain the protection of property rights at a desirable level, lowering transaction costs.

One possible reason for the failures of CPR sustainable explanation is based on two dynamic elements. First, if and how the institutional arrangement adapt to external impacts, under the coeteri paribus institutional environment. Second, how the institutional environment, or, the set of formal and informal rules evolve to deal with changing conditions? Both points are relevant to our analysis of SCSS and generate some research propositions;

External interventions in traditional CPR arrangements are usually aiming to facilitate access to markets. Good intentions are usually the leitmotif but the links with markets introduces variability in prices, and new demands for quality attributes. Increased exposure to external shocks might challenge the existing institutional arrangement, in some cases approaching its "limit of rupture". This concept is defined as the capacity of an open system based on CPR exploration, is able to absorb external impacts while keeping the property rights structure compatible with sustainable resources exploration.

Proposition 1: As the SCSS connection to markets is implemented, more transactions with outside agents are performed. Since no informal rules exist among the new players, the proportion of legal rights on the total PRi should increase in order to maintain a feasible structure of property rights.

Proposition 2: Informal rules tend to loose efficiency to deal with impersonal markets exposed to rapid and frequent external shocks, being replaced by formal institutions.

Next session explores the case of the production of Brazilian nuts based on a CPR institutional arrangement.

3 The case of CPR in Brazilian Amazon

The production of Brazilian nuts is a traditional activity carried in different areas of the Amazon region. The activity is characterized by the collection of the fruits from the "castanheira" tree (Bertholletia excelsa), which population is dispersed in the natural forest. Very few activities of intervention in the production area are observed, but some cleaning of the surrounding area to facilitate the harvest. After harvest a first processing is done consisting in opening the nutshells, drying and packing the nuts. The trees represent a common pool resource and harvesting rights are defined informally and are not connected to the land ownership. The harvest of the nuts is an important source of income for many families living in the area.

This study focuses the activity as it is organized in the region of the Jari Valley, located in the Eastern Amazon at the left margin of the Amazon River. The information comes from three visits made to the region, visits to the areas and interviews with local players. Secondary data is based on the results of a study of local development project which gave origin to a plan of communal development. (Natura, 2004). The economic production of Brazil nuts in the region is reported to exist since the end of the XIX century. A Brazilian entrepreneur and local political leader[4], Mr. José Julio de Andrade, organized the commerce and introduced a classical system of production based on semi-slavery labor relations. Families of collectors received food and equipment as payment for the collection of nuts. Most of production was carried as barter trade and strong dependence of the families was generated. Mr Andrade managed all the chain connections towards the market. Information about prices usually did not reach the clans of collectors.

Land was claimed by Mr. Andrade, who set the limits of his domains in 1924 (Lins, 2001). He became the legal owner of a large area of land, which is until today the largest farm area in the country, mostly covered by tropical forest. The land was sold to a group of Portuguese investors in 1948. From the 50´s until 2000 several owners claimed the area giving room for the emergence of ownership conflicts. In 1967 Mr. Ludwig, a US entrepreneur bought the land and build a cellulose plant at the banks of Jari River. Due to problems related to legal ownership of land by foreigners, he was pressed to leave the area, selling the

[4] Local leaders in remote regions usually held power and explore the resources based on violence. There is a vast literature in sociology about the "coronéis"', an informal title with military origin.

company to a Brazilian economic mining group, who did not succeed in maintaining the activities as originally planned. Finally in 1999, after many trials to keep the project moving on, the Brazilian Development Bank intervened and sold the project, including the land, to a Brazilian owned paper company - Grupo ORSA - who started then a work towards the technical and economic recovery of the company as well as a project to enhance the living condition of local population.

Land ownership is still under dispute with the existence of many parties claiming a stake. Today the pulp and paper production is being carried along with sustainable management of the plantation of eucalyptus in a small part of the area, under international certification of FSC (Forest Stewardship Council). The FSC certified timber exploration is also being carried, based on internationally accepted standards of sustainable production. The system allows the harvest of specific specimens in restricted areas, that once harvested will remain untouched for 30 years.

The activity of collection of Brazil nuts did not change too much since the century XIX. The organization of production can be described considering the supply chain of Brazilian nuts and the SCSS that is observed. The following description relates to the Jari Valley area, and some details are reported by the Iratapuru sustainable development project (Natura, 2004).

The local populations has its origin in the immigrant workers that came from the states of Northeast, mainly Maranhão and Ceará, during the rubber cycle. Local indians have been mixed with the immigrants giving origin to the existing populations. We should not expect homogeneous cultural background among the local population.

Traditional Harvest of Nuts: Families or clans organize the activity, based on informal ownership of the trees. Nobody question trees ownership in the region. The common pool resource is the population of 'castanheiras' in a determined area. Castanheira is the Portuguese name of the Brazilian Nut Tree. Clans have informal rights that are inherited and can be transacted with other clans, but not to outsiders. The activity is carried in areas characterized by diverse land ownership structure. No plantations of "castanhas" are observed, since the tree has a biological cycle of many decades that precludes economic artificial exploration. Usually the "castanheiros" plant trees on "his" route, but this is not a systematic and organized activity.

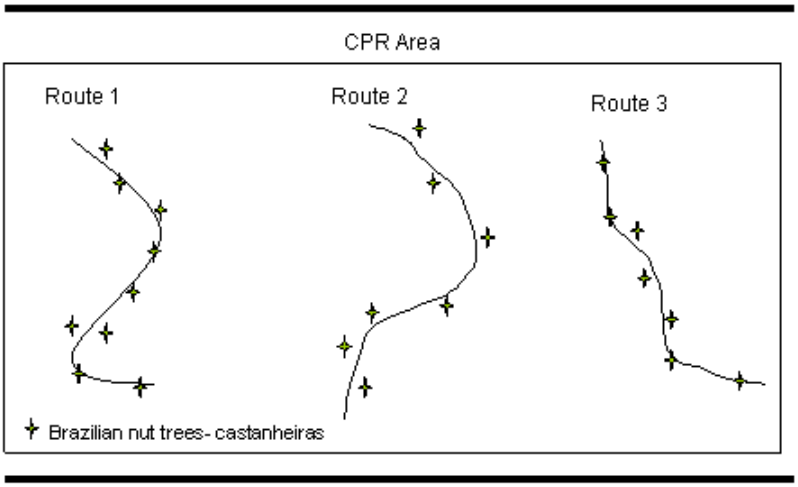

Figure 3.
Sustainable development reservation area

We observe collectors in areas that belong to the Jari Company (Grupo ORSA). The company protects the activity and facilitates the operations. The collection is carried also in areas that have been defined by the government as National Forests, or Sustainable Development Forests, Collective Owned Reservation Areas, and also areas of Agrarian Reform. The total area of forest being explored is of 1,699,834 hectares (NATURA, op. cit). Land ownership is unrelated to the ownership of trees, but only indirectly, in the case of non certified timber exploration. Two types of conflicts have been observed. One involves the "castanheiros" and land owners that are interested to explore timber, mining of other activities. The second conflict is observed among different clans disputing the CPR. A natural competition is observed among the six traders of nuts, that has some control over the production areas.

First Processing: There are 6 buyers (traders) in the region that are the main channels to sell the production. Once harvested the nuts are opened and dried. Two cooperatives are among the six traders.

Technically the cooperatives belong to the clans of "castanheiros", and they have also some processing structure. A cooperative of 32 families is organized in the "Iratapuru Sustainable Development Reservation", which represents an area of 806,184 hectares. They received funds from international non governmental organizations as well as from local companies that carry private programs of income generation.

Trade: The semi-processed product is then traded with larger companies. The most important is the Mutran family, who exercises a strong control of the commerce of Brazilian Nuts in the region for over two centuries. They are the main suppliers to the local and international markets. New players are observed, some buying on spot to export to Colombia and also smaller traders that try to enter in the business.

The system known as "aviamento" is still observed. The collectors are dependent on the "owner" of the castanhal and receive food, gas, other supplies needed to perform the activity in the forest. After harvest they receive some cash for the product harvested in the season, deducted the costs of equipment and materials.

Conflicts: Many conflicts have been reported in the interviews. We could find no formal data about them since usually conflicts do not reach local authorities. Cases of conflicts reported during the interviews are: (1) one of the six local traders is known as "A Viúva", or "The Widow". Her husband use to have the right over one "castanhal". He was assassinated in a dispute for the informal rights to explore the area. His wife was able to exercise informal power based on reputation (and maybe force) to keep the right to explore the area. (2) In 2007 when the price of the hectoliter of nuts reach Reais $ 140, four cases of violent deaths have been reported, indicating that informal rules are not sufficient to solve disputes for economic rights. (3) The Iratapuru cooperative, received international funds to build a processing plant aiming to add value to the nuts, producing oil and branded biscuits. The increase in product value was followed by severe internal conflicts of leadership that lead to a criminal fire set to the facilities.

The strictly coordinated sub systems are characterized by the domain of each one of the six local traders, since they differ in terms of governance. We observe companies and collective ownership in the form of production cooperatives. There are initiatives to empower the cooperatives, done by external intervention of non governmental organizations.

The question to be addressed in the next part is how transaction T1 will be governed in the future. Next session presents an analysis of the case, based on the theory presented in chapter 2.

4 Case analysis

The existence of CPR explored under efficient norms on a sustainable way, depends on many factors, as presented in part 2. The stability of the system depends on the existence of institutions that protect property rights, offering sufficient incentives to maintain the potential of resources for future exploration. Questions proposed in section 2 are discussed to analyze the existing institutional arrangement.

A minimum level of protection is needed in order to permit the sustainable exploration of the CPR. This level is pictured in Figure 4.

The competition for the natural pool resources has shown to increase. New players, that do not know the informal norms, have been observed trying to enter in the activity at various levels of the chain. Informal appropriation as well as exclusion rules becomes increasingly difficult to apply. Under these conditions collective mechanisms involving several SCSS are more difficult to persist. No new monitoring arrangements have been observed. Informal mechanisms of conflict resolution are not showing to be effective and intensification in the disputes for property rights to explore the castanheiras is expected in the future.

The biological characteristic of the resources suggests that the pool is not expected to increase. Given the diversity of the cultural profile of the local population informal institutions are not showing signals of evolution, or are not evolving at the sufficient velocity to cope with the external shocks. Finally, the competence of the State to offer and protect property rights is not signaling enough progress. The institutional environment is not facilitating natural resources governance mechanisms leading to sustainability.

The proposition presented at section 2 is now revisited and discussed under the lenses of the theory and the case presented in former sections. Considering the model proposed that assumes the existence of a limit level of property rights, the observation suggests that informal property rights are losing effectiveness and are not being replaced by formal institutions. When external shocks hit the system, then

the existing institutions start a process of adaptation. How flexible and how rapid the adaptation process occurs, will set the frame that define the survival of the CPR based system. When traditional communities that explore natural resources are linked to markets, then strong mechanisms of transmission of information are introduced. Variability, that used to be small, might not be handled by informal institutions. As expressed by Barzel (1997), if variability is low, measurement problems are less present and therefore informal norms are sufficient to govern the transactions.

Figure 4 shows the external impact on the level of institutional quality. It suggests that the traditional CPR governance offers a level of protection that exceeds PRl. It differs from the new CPR arrangement, pictured as a system that leaves property rights unprotected, below the limit level. Finally the same Figure shows a third situation where formal property rights evolve offering sufficient protection for transactions to be carried on a sustainable way.

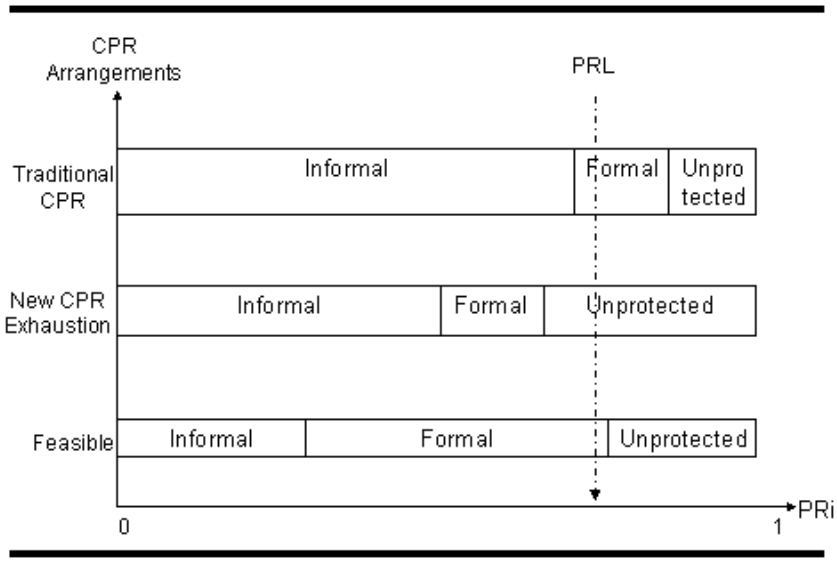

Figure 4.
Property rights model

Considering the model presented in previous section, the ratio Legal Rights/Economic Rights must increase to guarantee the survival of CPR exploration. In other words, more formal norms are needed in order to reach a minimum level of protection of property rights. Otherwise, value will be placed in public domain and the tragedy of commons case will arise.

5 Conclusions

The present study maintains that the observed institutional structure of production is at its limit, showing evidences of rupture. The specific case of production of Brazilian Nuts, illustrates a problem that is also perceived in the exploration of other natural exhaustible resources. The study is based on the case study of the region of Jari valley, a river that is a tributary of the Amazon River, in the Brazilian states of Pará and Amapá. The study is based on three visits to the region and interviews with economic agents that operate the complex institutional arrangement that characterizes the production structure. Two objectives have guided the analysis: the description of formal and informal rules and the description of the complex contractual arrangement to explore the natural resource.

The key conclusion of the study is that external impacts lead to the increase in the natural resources value, turning unlikely the survival of the institutional arrangement that has been adopted for centuries in the region. The interference of international NGO´s increases the disturbance, since their basic agenda is to connect local activities to the markets. Good intentions aside, the increase in the value of resources has known effects on the profile of property rights.

The results suggest that the organization of strictly coordinated supply systems have the intention to link traditional institutional arrangements to formal markets. This process is associated with strong disruptions in the traditional institutional arrangements designed to explore common pool resources. If formal institutions and formal enforcement mechanisms do not evolve, the realistic prediction is that natural resource pools will be exhausted.

The corollary is the need of formal institutions of property of land and other resources to allow for new contractual formats to emerge, otherwise other mechanisms of property rights enforcement, based in power and use of violence are expected to emerge.

How to match development objectives with the preservation of natural resources? This is yet a question to be answered. This paper goes in the direction to reinforce arguments proposed by new institutional scholars, that formal institutions are key to reach the desired goal. In the Amazon area, the population growth, the investments in new roads and the connections of the local activities with international markets, have placed a new set of conditions that outdated the existent institutions.

The conclusion is aligned with other studies of property rights in the same region (Granja e Barros, 2007). Government is expected to invest more in a system of definition, monitoring and enforcement of property rights. Meanwhile, a new generation of better organized local arrangements based on social ties is evolving.

We still do not have a clear idea of how both mechanisms will evolve to serve the institutional environment to CPR based production systems.

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