



Multilevel Governance and Sustainable Development: The Case of Biodiversity in the Amazon Rainforest

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ABSTRACT

This article is aimed at summarizing the results of the fieldwork research conducted by a group of researchers from the University of São Paulo within local communities in the municipalities of Salvaterra, Bragança and Breves, which are located in the state of Pará in the Northern part of Brazil. The object of analysis is the production chain of oleaginous seeds obtained through the extraction activity that are used as inputs in the processing food and cosmetics industries. The main hypothesis is that it is possible to go beyond the trade-off between welfare gains and the preservation of the environment, and thus contribute to the rational use of the natural resources. The major findings of the research are empirically discussed in order to provide evidences regarding the social and environmental impacts of the activity to local families and ecosystems. This article also seeks to understand the role of non-state actors in sustainable development and biodiversity regulation at the local level. It is argued that the whole process is subjected to a multilevel context in which actors and arenas interact through 'authoritative mechanisms'. In order to approach this issue, the impacts of the extractive activity on income generation, local development and the local environmental externalities caused by market incentives are addressed. These are related to the Sustainable Development Goal (SDG) 15 that considers the sustainable use of biodiversity as a strategy to environmental conservation and poverty alleviation. The article is a case-based study and was built on quantitative and qualitative data collected through surveys conducted among local families living in the region.

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1.0 Introduction

The scarcity of natural resources - Common Goods - is a prominent issue in the global environmental agenda. Garrett Hardin (1968) predicted that the use of natural resources combined with population growth would lead to what he called the "Tragedy of the Commons". The solution to avoid it would come through external coercion promoted by the State and/or the privatization by either imposing limits on extraction of a given resource or by the delineation of areas in accordance to a determined property rights. The metaphor of the Tragedy of the Commons was taken up by Elinor Ostrom in the 1980s to the design of a new solution to the problem: the natural resource users themselves should determine the extraction levels through informal rules that create

informal institutions in a bottom-up context (Ostrom, 1990). Elinor Ostrom (1990), with the publication of *Governing the Commons - The Evolution of Institutions for Collective Action*, claimed that users of Common Pool Resources (CPRs) would keep their autonomy and independence from the State and market incentives. Those are able to promote collective action to address the shortage of a CPR on which they depend to survive (OSTROM, 1990; OSTROM et al., 1994; Agrawal, 1998).

The concept of CPR was gradually shifted from the discussion of collective action of individuals in isolated communities to the discussion of public policies and the environment (Moran & Ostrom, 2009), the institutional design analysis of rules and norms (OSTROM, 2005), property rights and the transaction costs involved (Schlager & Ostrom, 1992), and the Political Science and International Relations approach with the adaptation of its original concept to the so-called Global Commons (Keohane & Ostrom, 1995; Buck, 1998). The argument is that local communities are also capable of producing Common Goods, but they don't do it alone. Local communities are part of a complex and diffuse co-governance system between public and private actors that are vertically and horizontally organized with different incentives. The promotion of welfare to local communities and the positive environmental externalities of Common Goods depend on the community's responses to the incentives provided in different levels. International multilateral organizations source the public regulation which must be enforced at national level. National governments must comply with them and a complex set of private and public actors would create the instruments to implement norms and rules within local communities.

The Convention on Biological Diversity (CBD) was open to the signature of the Parts in the Conference 'Rio 1992'. The convention not only promotes biological diversity conservation, but it also emphasizes the sustainable use of its components and the fair and equitable sharing of benefits acquired from the genetic resources. In this sense, The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) was introduced in 2010 as a Protocol to the CBD that attempts to create a legal framework for both providers and users of the genetic resources. Brazil's public regulation on biodiversity is focused on the management of forests and timber products from the perspective of biopiracy. For this reason, laws such as *Medida Provisória nº 2.186-16 (2001)* are not effective to promote the use of biodiversity by private actors, for example. Given this gap in the public regulation, transnational private authority has attempted to regulate the issue at local level through firms, NGOs and local communities at the same time it calls attention to the need to respect the resilience time of the ecosystems and the related traditional knowledge.

It is at the local level where market and public incentives find the pathways towards social welfare and environmental sustainability. In municipalities from the Brazilian rainforest, dealing with the local rural communities as if they were isolated from a broader political context and the market incentives is a huge mistake. Furthermore, the communities do not uniquely depend on the natural resource to survive, and those are not providers of information regarding the extraction units considered to be sustainable (Ostrom, 1990). In the Brazilian Amazon, there are private firms which are suppliers of global multinationals that developed sophisticated instruments to pay and organize local communities and foster collective action in order to deliver seeds and oil in small amounts. Cooperatives were created to incentive the families in seeds collecting. Public cooperation agencies from developed countries provide technical expertise and human resources. NGOs use traceability tools and certification schemes in organic, labour and environmental standards and multinational firms foster the value chain by selling 'sustainable' products.

Since there is no authority and/or leadership that can predefine what the developed activities should be, families respond to incentives from the government (at local and national levels) and from the companies in order to capture the generated welfare gains according to a certain level of information. The transaction costs involved in each decision-making of the families and the multilateral synergistic gains captured in the form of economic, social and environmental value, explain the success or failure in the sustainable use of a Common Good, considered as an externality of the income generating activity (extraction and/or agriculture).

This research also investigates the impact of the extractive activity on income generation, local development and local environmental externalities caused by market incentives. The research question concerns the possibility of market incentives to promote synergies between different income generating activities (agriculture and extraction) through the collection of oleaginous seeds. The hypothesis of this work is that it is possible to go beyond the trade-off between welfare gains and the preservation of the environment, and thus contribute to the rational use of CPRs.

Interviews were conducted through semi-structured questionnaires among 232 families of rural producers in Salvaterra, Bragança and Breves. Information on income, living costs, social inclusion, participation in collective action and social organization, activities, environment, demographics, labour safety and access to basic health

conditions form the database that is part of a greater purpose of research involving different researchers from the University of São Paulo. For the present study, only the information on the composition of households' income and environmental externalities were considered.

The article continues with a bibliographical revision that relates the research object to a theoretical framework that connects theory to the empirical data collected in the fieldwork research as discussed in the social and environmental impacts section. Finally, the conclusion summarizes the main ideas developed throughout the text and answers the research question regarding the trade-off between welfare gains and the preservation of the environment.

2.0 How do theories interpret the research object?

The proposal is to explicitly overlap what Keohane and Ostrom suggested in 1995: "This convergence between analytical orientations of work on local CPRs and international regimes is matched by the fact that in various domains people seek to create rules to enable them to cooperate." (Keohane and Ostrom, 1995, p. 2). Two major arguments were developed: 1) the issue of the rise of private authority (Hall and Biersteker, 2002; Cutler, 2003; Börzel and Risse, 2010; Büthe, 2010; Green and Colgan, 2013) is still underdeveloped both in the academic research agendas and in the theoretical frameworks available. The authority of the State as the legitimate power and non-state actors operating in the 'shadows' (Börzel and Risse, 2010) contrast with the role of private actors that operate in transnational arenas; the term 'authoritative' is used to design a diffuse and hybrid authority at local level (Hall and Biersteker, 2002, p. 6) and 2) it is necessary to 'merge' the rise of public-private and global-local cooperation in political science and international relations approaches through bottom-up perspectives from sociology and institutional economics (Van Kersbergen and Van Waarden, 2004).

The article is anchored in the idea that local public-private governance matters, as embedded in the domestic networks (private sector, NGOs and local authorities) where the primary driver is the market incentive. We test the hypotheses of public-private cooperation at local level based on shared knowledge and expertise among firms, civil society and State authority dealing with a natural resource which comes from Brazilian biodiversity. The verified empirical outcome provides environmental protection and social welfare in three different municipalities at the Amazon rainforest. Our analysis of cooperation among private actors in transnational arenas is largely based on a recent academic literature on public-private governance (Pattberg, 2007; Held and Hale, 2011; Link and Link, 2009; Green and Colgan, 2013; Büthe and Mattli, 2011; Abbott and Snidal, 2010). Embedded in the international relations theories of cooperation, the approaches argue that the public-private partnerships are the best solutions to increase legitimacy, to provide expertise and to keep the State not as the traditional authority, but as a supplier of public good through regulation and the provision of information. This is a major positive scenario where public-private partnerships fill the gap of intergovernmental agendas and/or States and international organizations (IOs) delegate competencies to private/hybrid actors (Büthe and Mattli, 2011).

Table 1 demonstrates the arenas and the processes in which the 'authoritative mechanisms' operate. The argument is that actors operate in multilevel arenas and that processes are 'authorized' by the upward levels. In other words, the global connects to the local in a complementary dynamics that reaches the local arena that is affected by all actors and processes. That causes a certain level of competition as the sources of regulation are present along with non-state actors.

Table 1: Arenas in 'authoritative governance'

ARENAS	WHO 'AUTHORIZES'?	RESULT
Multilateral Intergovernmental	Treaties, Conventions and Protocols	
Transnational	NGOs, Multistakeholder Initiatives, Corporate 'Good Practices', Transnational Institutional Arrangements	Complementarity
National	Public Regulation	
Sub-National	Public Regulation	
Local	Local Communities	Competition

Source: elaborated by the authors.

It doesn't mean that the State is fading away or imply the idea of its obsolescence or weaknesses. Abbott and Snidal (2010) and Büthe and Mattli (2011) preserve some core assumptions of international relations approaches: 1) the 'focal point' authority of the State (specific body or agency) in the contest of competition; and 2) the legitimacy of the State as a final resort (and IOs as agents). States and IOs must have some degree of recognized authority in orchestration and the capacity to coordinate non-state actors (NGOs and firms). The

authors consider that there is some hierarchy between the public and private spheres, e.g. traditional top-down command, as well as enforcement mechanisms.

Another perspective must be addressed. The complexity of governance at local level demands different explanations. A bottom-up approach is based on economic sociology (Cashore, 2002; Gereffi, 2011; Bartley, 2007; Reynolds, 2009; Abramovay et al., 2010) and institutional economics approaches (Coase, 1937; Keohane, 1984; North, 1990). A more verticalized and inclusive approach at local-global level is necessary in order to detect latent 'conflicts of interests', and the 'learning process' among stakeholders (Cashore, 2002). Institutional economics and the seminal definition of North (1990) are the starting points: institutions are 'rules of the games' and the source of incentives "in human exchange, whether political, social or economic" (North, 1990, p. 3). The idea of market failures is added as the asymmetry of information and transaction costs to explain public-private cooperation among local stakeholders. Monitoring and enforcing social and environmental standards at local level can be costly and will demand strict functional capabilities which can overlap the traditional local authority of State. The concept of Governance Structures and transaction cost from economics is used to explain the choices of the collective action at local level.

It is argued that the co-governance of public and private cooperation at local level can be at the same time: 1) 'voluntary' enforcement of standards and regulation from intergovernmental and multilateral decision-making in the form of Conventions and Protocols based on the United Nations system; 2) providers of technical expertise set up through 'know how' are jointly developed with local stakeholders (rural communities, NGOs as monitors and standard-setters, private sector and public authorities); and 3) providers of legitimacy to respond to global civil society demands (eventually through certification and labelling schemes from labour, environmental and organic standards) (Graeme, 2014).

3.0 Non-timber forest products as common natural resources

Collection systems based on non-timber forest products (NTFPs) are of a relatively recent academic literature from the 1980s. The most developed analytical approaches begin with a methodological discussion (Hall and Bawa, 1993; Wong and Godoy, 2003; Rizek and Morsello, 2012), and highlight the trade-off between social and environmental impacts (Kusters et al., 2006). In most cases, the specialized literature recognizes the welfare gains, but does not evaluate the environmental impacts or examine the conditions for the preservation of NTFPs without worrying about the social impacts. The specialized literature does not clearly recognize the interdependence between the social and environmental dimensions and does not indicate the simultaneous possibility of sustainable use of CPRs and the welfare gains from income increase.

The report of the Brazilian Institute of Geography and Statistics - Sustainable Development Indicators (2010) - ranks Brazil as one of the countries hosting the so-called mega diversity for being part in the group of 12 countries that have 70% of the total biodiversity of the planet. This has implications both from the theoretical literature that studies biodiversity and from the empirical research agenda that deals with biodiversity usage patterns, particularly in the case of the non-timber forest products (NTFPs). NTFPs are considered to be nuts, seeds, leaves and roots (Ticktin, 2004).

The empirical research agenda regarding the NTFPs began in the late 1980s as a preservation strategy, especially in developing countries with high rates of deforestation. The first major study in this regard opened a new research agenda. In sum, the study published in Nature concluded that NTFPs were more valuable than the timber (Peters, Gentry and Mendelsohn, 1989), according to the survey of two biologists that delimited a forest area in Peru, near Iquitos. In 25 years, the NTFPs have become a new paradigm as they represented an alternative to deforestation of tropical forests since there was a market incentive which was more valuable than the wood itself. Since then, the preservation bias began to direct the research agendas around the NTFPs (Hall and Bawa, 1993).

Nowadays, collection systems and the measurement of NTFPs have a varied academic literature. The main methodological approach is inductive, based on case studies involving different Common-Pool Resources – CPRs (Ros-Tonen et al., 2003; Stem et al., 2005; Poteete, Ostrom and Janssen, 2011), such as fruits like *açaí* and *buruti* (Weinstein et al., 2004), seeds such as *andiroba* and *pracaxí* (Plowden et al., 2004), fibers and seeds of native palms as *tucumã* (Runk et al., 2004), or the known Brazilian nuts (Richards, 1993), among others. These studies deal with cases in which the NTFPs are considered as an alternative to the exploitation of forest products as opposed to traditional logging that is the cause of the depletion in various forest ecosystems in Brazil and other countries. Given that, it is possible to connect the purpose of the collection of the NTFPs to the SDG 15: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss".

Only a few articles discuss the positive and negative externalities that involve the exploitation of NTFPs in different localities and ecosystems (Ros-Tonen et al., 2008; Guariguata et al., 2010; Illukpitiya et al., 2010). The authors conclude that the commercialization of NTFPs generates more positive externalities compared with the commercialization of timber products and emphasize the trade-off between social and environmental impacts generated by NTFPs in traditional or indigenous local communities. In other words, most studies indicate that the exploitation of NTFPs is beneficial for collecting families with welfare increase due to the increase of families' income, but that does not necessarily bring positive environmental impacts. Similarly, most studies indicating benefits to the forest points that there are not positive social externalities (Arnold and Ruiz-Pérez, 2001; Ruiz-Pérez et al., 2005; Hiremath, 2004; Belcher et al., 2005; Shone and Caviglia-Harris, 2006; Belcher et al., 2007).

Another part of the literature discusses studies based on comparative analysis with medium/large N in at least two developed countries or in specific regions in different countries or even in a single country with different ecosystems (Wong and Godoy, 2003; Shahabuddin et al., 2004; Figueiredo and Morsello, 2006; Kusters et al., 2006; Morsello, 2006; Ndangalasi et al., 2007; Rizek and Morsello, 2012). These studies demonstrate that the success or failure of the commercialization of NTFPs is also linked to the institutional capacity of governments to interact with local communities and establish environmental preservation and development strategies that incorporate social and environmental dimensions.

Finally, there is a literature that specifically discusses market incentives as an explanatory variable for collective action and the welfare of local people. In this case, a number of interested parties such as public and private, national and transnational companies and non-governmental organizations (NGOs) are considered. In all these cases, the social and environmental impacts occur from market incentives related to the commercialization of NTFPs in a globalized value chain. This means understanding how market incentives that promote collective action between public and private actors in local arenas are projected on the organization of a complex value chain coordination in transnational arenas (Mayer et al., 2002; Shanley et al., 2002; Dos Santos, 2003; Menzies, 2004; Morsello, 2006; Morsello and Adger, 2007). It is argued that this dynamics produces positive outcomes in terms of environmental sustainability and it also regulates a vital issue to achieving SDG 15 which is the use of biodiversity.

4.0 Social or/and environmental impacts: trade-off or sustainability?

The comparative analysis of the three case studies using the concept of governance structure (Williamson, 1985) allows us to discuss the influence of transaction costs from the number of activities that each family chooses to devote from one set of incentives (public and private). There are fundamentally two governance structures: one that includes all extractive activities (collection of oleaginous seeds and fruits, fishing, wood etc.), and the governance structure linked to agriculture that, in the cases, also consider trade and the provision of services in the same group to simplify the analysis.

From an analytical point of view, there are three key issues: (1) families with income gains divided into different governance structures and distributed in many activities may have a high aggregate income, but the choices of engaged activities may not be the most efficient; (2) the large concentration of activities in the same governance structure is not itself an indicator of efficiency because depending on the activities, migration among them can also be costly; and (3) the correlation between welfare and environmental externality presents two contrasting results: the trade-off between the social and the environmental, and sustainability, in which the welfare gains can be compatible with environmental preservation. This 'model' is tested in the three case studies and some preliminary conclusions are drawn.

Table 2: Governance structures and number of activities

Distribution of activities	Salvaterra Collector (4)	Bragança Collector (3)	Breves Collector (6)
Oleaginous seeds collection	Non-Collector (1)	Non-Collector (2)	Non-Collector (2)
Agriculture	Collector (8)	Collector (12)	Collector (3)
Trade			
Services	Non-Collector (8)	Non-Collector (12)	Non-Collector (2)

Source: primary data, elaborated by the authors.

The market incentive to collect oleaginous seeds of biodiversity is the 'driver' by which we build the analytical model. As there is information asymmetry, families try to answer to all incentives (public and private), without

worrying about efficiency gains. Because they do not depend on any CPR in particular, the families do not necessarily promote collective action towards its sustainable use. As mentioned before, there are many incentives, not less. Families try to meet earnings expectations from incentives. As each activity has a different transaction cost, families gain efficiency if they can easily develop mobile activities, in other words, the migration among them has a low cost because they demand similar skills to be executed.

In the case of Breves (Table 1), extractive families harvest *açaí*, *palmito*, shrimp and fish, oleaginous seeds, fruits and wood, totalling six different activities. All these activities added totalling R\$ 104.000,00 (R\$ - Reais). The non-collectors are dedicated to three activities: logging, *açaí* and shrimp. However, they have an income of R\$ 87.000,00 which is more concentrated and more efficient because the extraction of non-collectors is based on logging (R\$ 57.000,00 or 65 % of the total). Non-collectors are engaged in the same activities, a small commerce (sale of fuel) and the provision of services. However, the income of collectors is low (R\$ 13.580,00) compared to non-collectors (R\$ 100.000,00) due to the logging activity in clandestine sawmills (R\$ 45.760,00 or 45.7 % of the total).

An important conclusion of the case is that the market incentive to the collection of seeds is very efficient to reduce or virtually eliminate the provision of services in clandestine sawmills. Families know that migrating from the extraction to the provision of services is costly. For this reason, it is more efficient for families to remain in the extraction and to engage a larger number of activities. It is less costly (and more efficient) to collect seeds, *açaí* and shrimp than devote to other governance structures.

At the same time, the collection of seeds does not encourage the reduction of logging. Seven collecting and cooperative families extracted R\$ 36.400,00 of wood. How to explain this paradox? In fact, there is a high mobility from one activity to another within the same governance structure. As many have said in the interviews, collecting *açaí*, fruits and seeds and cutting down trees is almost the same activity in the forest. It would take a very large amount of seeds so that the activity of logging could be discontinued. In the case of activity in sawmills, it is the contrary, for each R\$ 1,60 invested in seed collection, there is a reduction of R\$ 4,50 in logging, in other words, the market incentive eliminates the illegal activity because the transaction costs involved in two governance structures are high – provided that all families migrate to the cooperative and keep the other five extractive activities. With the market incentive, families opt for extraction.

In the case of Salvaterra, collectors practice four extractive activities (oleaginous seeds collection, fishing, logging and crab collection), but fishing and the collection of seeds that mainly add up to the extraction activities. Even so the activities related to agriculture (trade and services) that account for most of the income, R\$ 210.000,00 for seed collectors against R\$ 160.000,00 related to the extraction (mainly fishing and seeds collection). Families are used to working in the property of neighbors and acquaintances and receiving a daily payment called *diária*. Some of them have a motorcycle and provide transport services, do carpentry work, work with construction, painting and build boats, some are teachers and municipal employees. The logging and crab capture is marginal and do not add up to R\$ 9.000,00 in total.

There is an important substitution effect between fishing and the collection of seeds. For each R\$ 1,00 from the collection, fishing represents R\$ 1,40 in the case of registered collectors (coop members), and R\$ 2,00 for non-registered collectors (non-coop members). First conclusion: the collection of seeds competes with fishing, there is a substitution effect between the two activities. Second conclusion: the substitution effect is relative because both collectors (coop and non-coop) fish more than collect seeds. That is, those are extractive activities but with high transaction costs, which makes its mobility more difficult. Fishing is a collective activity that requires capital investment (boat), and can be developed almost all year round (except for the period of the reproduction of fishes). In the case of seed collection, it happens at most within four months of seasonality. Provided that families live in a semi-urban environment, they develop a wide range of other activities that limits the dedication to the extraction growth in terms of collected volumes. The efficiency of the market incentive is relative because seed collecting have to compete with fishing and other governance structures in which households draw most of the total income.

In the case of Bragança, seed collectors develop three activities (seeds, *açaí* and wood), and in the case of collectors not only two, the extraction of *açaí* and wood. In fact, *açaí* and wood are marginal activities and represent an income of R\$ 31.356,00 (registered collectors), R\$ 8.744,00 (non-registered collectors), and only R\$ 5.900,00 for non-collectors. Only 16 families collect wood and *açaí* in a sample of 106 families. This means that the only extractive activity is actually seed collection that represents an income of R\$ 116.862,00 (registered collectors), and R\$ 27.532,00 (non-registered collectors). Despite the significant values in absolute terms, they mean almost nothing compared to other sources of income.

Bragança highly depends on agriculture income, with many government incentives. It is the fourth largest *farinha* producer in Brazil, and the seed collectors are the ones who produce more *farinha*: R\$ 826.868,00 (against R\$ 141.110,00 for non-registered collectors and R\$ 365.280,00 for non-collectors). Thus, encouraging extraction in Bragança means competing directly with the production of *farinha*. Moreover, agriculture involves the production of corn, beans and the creation of chicken, all done through the Pronaf (National Program for Family Agriculture), with the cooperation of the local prefecture that buys food to distribute as meals in local schools. *Farinha*, chicken, corn and beans represent together an income of R\$ 1.141.781,00 (registered collectors), R\$ 320.768,00 (non-registered collectors), and R\$ 666.833,00 (non-collectors). In addition to the four activities related to agriculture, families also work in providing services (cleaning fields for sowing) and providing transport services, doing carpentry work, construction, painting, building boats, and are also teachers and municipal employees.

Farinha is a highly liquid market in Bragança. Everyone depends on its production, and families know that producing *farinha* means having an easy and fast money in their hands. The producer cooperative promotes the collective action for the production of *farinha* very efficiently; there are 81 members in total. In this context, the generation of a new governance structure based on seed extraction ends up competing with public incentives (federal and municipal public policies), and the existing institutional arrangement (the cooperative) focused on agricultural production, not to extraction. This institutional structure encourages the expansion of the area planted on already degraded forest areas, in a context where the wood has already been explored and there is practically nothing left.

Table 3 illustrates the outcomes regarding the social and the environmental impacts of the extractive activity observed in the three municipalities.

Table 3: Welfare and environmental preservation -Main outcomes		
Municipality	Social (income)	Environment
Breves	Sustainability - Income increase	reduces logging
Salvaterra	Neutral- Income competition	with minor environmental impacts
Bragança	Trade-off - Income increase	fosters deforestation

Source: primary data, elaborated by the authors.

In the case of Breves, as income from oleaginous seeds increases, logging reduces. It means that the income generated by the extraction of the oleaginous seeds has a replacement effect as families tend to migrate from activities that involve cutting trees down to seeds collecting. In Salvaterra, there was no relevant environmental impact. The extractive activity did not relief the pressure on fishing. In Bragança, the levels of income are associated to the increase in forest deforestation. As families are involved with a series of activities among which *farinha* is the main one, families tend to expand the area in which they cultivate the plant that is used in the production of *farinha*. That is, the extraction of oleaginous seeds is incorporated in a group of other activities that are more traditional and generate higher income returns to families when compared to the oleaginous seeds.

5.0 Conclusion

Multilevel and polycentric governance of CPRs brings along the discussion about whether the incentives and the 'authoritative governance' complement or compete with each other in terms of actors and (public-private) policies. In the case of the biodiversity, there seems to be a vertical complementarity that unites the multilateral intergovernmental to the local level through the transnational arena. That means the 'vertical' axe between international and local arenas is complementary. However, when it comes to analysing the local level itself, the transnational regulatory framework constructed by NGOs and the private sector through market incentives causes competition with the local structures and public policies such as the governmental programs that interferes in the governance structures of the activities presented previously. That means that the local arena can be characterized by competitive forces between public and private authorities which means that there's a horizontal axe.

Market incentives can be extremely effective in promoting income-generating activities with low environmental impact. However, it is necessary that the income generating activity presents high mobility with other similar activities in order to facilitate coordination between family members at a low transaction cost. When these activities are part of the same governance structure, efficiency gains are even greater because there is no competition with other different activities, which require other skills.

Efficiency gains are not so significant when extractive activities are very different, in other words, there is a high transaction cost in migrating to other extractive activities such as fishing and the collection of seeds. Families tend to respond reasonably well to the creation of the cooperative and to the incentives that encourage the collection of seeds, but they do not stop fishing and developing trading activities and providing services in a semi-urban environment as observed in Salvaterra. Efficiency gains are even smaller when the extraction is practically 'swallowed' in an institutional environment with many public incentives through government programs like Pronaf. Creating incentives for the extraction in the fourth largest producer of *farinha* in Brazil (Bragança) is an initiative of extremely low efficiency, despite the fact that in absolute terms, the families manage to collect a significant amount of seeds. However, the gains from the production of *farinha* are extremely high and mean 'quasi-money' because of its high liquidity in the market. In addition, families are totally focused on livestock and agricultural production, which makes the governance structure for the extraction of oleaginous seed totally marginal.

Given that, it is possible to conclude that non-state actors are vital players in regulating local extractive activities that are intimately related to the promotion of practices that affect environmental sustainability given the market incentives. Despite the differences in the governance structures of activities that are present at which of the municipality, the whole discussion brings a direct link to the SDG 15 in terms of policy-making as the activities that families execute cause environmental impacts at the same time it produces social welfare. This study has shed light on important issues that not only reveal impacts at the local level, but also provide evidence on how public policies may be designed and implemented efficiently.

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