Other papers

Property rights for biodiversity conservation and development: an analysis of extractive reserves in the Brazilian Amazon

Timo Goeschl
Department of Agricultural and Applied Economics, University of Wisconsin at Madison
Madison, WI 53706
USA

Danilo Camargo Igliori
Department of Land Economy, University of Cambridge,
Cambridge CB3 9EP
UK

Abstract

The economic literature of property rights has been assessing the impact of different community based arrangements on the efficiency of natural resource management of specific areas. Differently, other strands of development economics and policy-oriented research have been concerned with issues such as poverty alleviation, technological progress and the capability to compete in market economies, which go beyond the local areas where traditional communities live and include the wider economy. The extractive reserves in the Brazilian Amazon offer perhaps one of the most interesting cases for investigating the connections between these two approaches in the context of tropical forests. It is based on the idea that the combination of public property with collective use in particular forest areas can generate competitive and, at the same time, sustainable exploitation of its natural resources. This paper aims to analyse whether the existing property rights support the joint objective of conservation and development. Our main result is that current property rights systems are efficient only with respect to competition in markets for existing extractive products. This finding points out to a fundamental contradiction between the static structure of the property rights systems and the dynamic nature of two most promising development paths, namely the discovery of new products and the supply of biological inputs for plantations. The current model of extractive reserves based on the design of internal property rights fails to taken into account the broader economic context where the reserves must generate a viable revenue stream. We conclude therefore that under the current set of institutions, the development objectives inherent in the extractive reserves model are likely to face probably considerable challenges to be accomplished in the future.

Keywords: *Property Rights, Extractive Reserves, Environment and Development* (JEL Classification: O13, Q23)

1 Introduction

Since the seminal work by Hardin (1968), the role of property rights for balancing the conservation-development trade-off has been discussed in the economic literature. The research on property rights has been mainly concerned with the assessment of different community based arrangements in promoting efficient management of natural resources. In several studies a particular emphasis has been placed on property rights internal to the study area or the theoretically conceived community area (Baland and Platteau, 1996; Bardhan, 1993; Seabright, 1993; Ostrom, 1990).

However, economic theory and empirical evidence provide mixed insights regarding the adequacy of choosing between private property, public ownership or communal property as optimal resource management systems (Baland and Plateau, 1996; Seabright, 1993). Indeed both approaches show that it is not possible to rule out situations where none of the single alternatives individually provides a viable solution. A natural response to the difficulty of choosing a single property right regime can be found in combinations of 'pure' categories, i.e. by building the so-called co-managed systems. It can be argued that in particular, the combination of state-based with community-based modes of regulation might be effective in reducing informational asymmetries and monitoring costs (Baland and Plateau, 1996). An added benefit is that the government can provide legal frameworks enabling rural organizations to claim their rights against external intruders. Finally, co-management systems can avoid resistance from the communities with respect to regulations coming from the central government.

While the property rights literature has been mainly focused on optimal resource management within specific areas, other strands of development economics and policy-oriented research have been concerned with broader development issues (see Sadoulet and de Janvry, 1995 and Bardhan and Udry, 1999 for an introduction). For the latter, questions regarding poverty alleviation, technological progress and the capability to compete in market economies pose challenges that go beyond the local areas where traditional communities live and include the wider economy (Angelsen, 1999; Lipton and Ravallion, 1995; Aghion and Bolton, 1997; Foster and Rosenzweig, 1995; Keller, 1996; Rodriguez-Clare, 1996). The interface of these two bodies of research becomes important when traditional communities managing complex natural resources interact to the outside world by trading products. The need to remain competitive in a market economy where heterogeneous players operate with different production systems creates an inexorable link between internal property rights and wider development processes. Traditional communities must be able not only to manage their resources optimally but also to improve their production systems and technologies, offering products at competitive prices and deriving comparative advantages.

The extractive reserves in the Brazilian Amazon offer perhaps one of the most interesting cases for investigating the interface between property rights and development in the context of tropical forests. In these reserves, the combination of public property, community management and private resource use of designated forest areas are expected to generate competitive and, at the same time, sustainable extraction of non-wood forest products (NWFP) [1]. Therefore, not only the internal property rights assigned to the reserve matter but also the broad set of property rights upon the wider economy is structured.

In their first 10 years of existence the extractive reserves have been attracted the attention and investments of a number of institutions and have been considered by some as an important element for a development strategy to the region (Allegretti, 1990, 1994; Menezes, 1994). Nevertheless, the economic reality of these reserves poses serious doubts and motivates scepticism about their capacity to fulfil its economic development objectives (Southgate, 1998; Brown and Rosendo, 2000; Assies, 1997; Almeida, 1994; Homma, 1992; Goeschl and Igliori, 2003). Only a very limited number of products are commercially exploited so far and the majority of their population remains poor. The threat posed by cultivated substitutes is eminent and the extraction of NWFP still depends on external support.

Building on previous research on the spatial economics of extractive reserves (Goeschl and Igliori 2003), this paper investigates the relationship between property right regimes and the development perspectives of

extractive reserves to contribute to the bodies of literature above-mentioned. To do so, we first explore three possible development pathways that the extractive reserves production system can pursue. We then confront these pathways with the property rights in place both within and outside the reserves in order to assess the capacity of these property rights to support each of the development pathways.

Our main result is a negative one: The current system of property rights properly supports only one of three principal development pathways, namely the extraction of established NWFP. We argue that this development pathway has very limited capacity to serve as a growth engine for the communities living in extractive reserves. On the other hand, the current property rights structure generates no or very limited rents for the inputs required to access the other two pathways, diversification into newly discovered NWFP and supply of biological inputs into the intensive production of NWFP.

These findings point to a fundamental tension between the static structure of the internal property rights system and the dynamic nature of the two more promising development paths. The current model of extractive reserves, based on the design of internal property rights, fails to take into account the broader economic context where the reserves must generate a viable revenue stream. We conclude therefore that under the current set of institutions, the development objectives inherent in the extractive reserves model are likely to face probably insurmountable challenges.

This problematic conclusion has implications for policy-making and provides material for further research. On the one hand our analysis suggests that policies aiming to enable indigenous communities to develop viably should go beyond the design of internal property rights and address the issues regarding the ways these communities interact economically with the outside world. On the other, the results also indicate that there is a clear need for further research exploring in greater detail the link between internal property right systems and broader development strategies rather than merely the optimal management of a given resource.

The paper is structured in four sections. The following section characterises the NWFP production and explores the long run perspectives of extractive reserves through its alternative development pathways. The analysis of property rights internal and external to extractive reserves is the topic of the third section. The fourth section discusses to what extent these property rights are conducive to alternative development pathways. We then summarise and conclude.

2 NWFP production and development pathways

2.1 Capital stock and cost dynamics

In this section we characterize the main features of NWFP production systems. To capture the peculiarities of the NWFP production, Goeschl and Igliori (2003) developed a dynamic model of spatial competition between an extractive reserve and a plantation. Here we discuss the motivations underlining the model and its main results without going into the mathematical set up and propositions.

The production of NWFP involves the harvesting of products generated by trees or shrubs. This makes clear that the production process relies on an underlying stock of biological capital. This capital stock differs from the standard physical capital used in conventional production systems in that the composition and size of the capital stock are directly linked to the rate of capital depreciation. Take the rubber tree as an example. Prior to the development of rubber plantations in Brazil, incidence of leaf blight was limited due to genetic variability in natural tree populations from which rubber was extracted. Early rubber plantations using intensive methods were devastated by the impact of leaf blight epidemics that made Brazilian rubber permanently uncompetitive on world markets while South-East Asian plantations evaded the disease through mere serendipity at the time when rubber saplings were smuggle out of South America (Kloppenburg, 1988). In all, there are about 90 species of fungi known to attack *Hevea* trees, two species of bacteria, and various nematode and insect

pests (Duke, 1983). These pathogens seriously impact on the costs of intensive production development since they require continuous investment into the protection of the biological capital base, mostly significantly through breeding (Goncalves, 2002; IRRDB, 1998; Rubber Board, 2002). On the other hand, intensive production in plantations benefits in a static sense from lower harvesting costs and in a dynamic sense from productivity gains in complementary inputs (physical capital, human capital) driven by technological progress and knowledge (FAO, 1995).

The general dynamics of an industry dependent on a biological resource stock imply that production costs of a NWFP producing enterprise will vary over time depending on the productivity of its capital stock: The productivity of the biological capital stock will be negatively affected by increases in the size of production that can be mitigated through simultaneous investments in biological resources. A conventional enterprise will be able to optimally choose price and output as well as the path of its production technology.

By contrast, extractive reserves combine a severe restriction with regard to the choice of production technology with an abundance of biological capital. With respect to NWFP production, extractive reserves are peculiar because not the community, but the government is the owner of the biological capital stock. It grants the community free use of that stock subject to that stock not being depreciated. Implicit in this use condition is also a restriction of the production technology that limits the marginal productivity of physical capital (Browder, 1992). These restrictions together with the intrinsic difficulties in operating within the forest, low capital intensity, little access to capital and the persistence of traditional methods suggest that the depreciation of the biological capital stock in NWFP production in reserves is negligible. Conversely, the rate of cost reduction driven an existing physical capital stock will be extremely low in the reserves because labour intensive production involves little physical capital. With this configuration, the cost dynamics are not relevant to the intertemporal management of an extractive reserve. What will matter for the profitability of NWFP production, however, is that the level of unit costs will be at a level commensurate with the constrained production conditions in the reserve.

While constrained in the choice of technology, the abundance of biological capital means that extractive reserves have direct and inexpensive access to a critical input in the NWFP production process. This stock potentially allows a diversification of NWFP production into the various extractive activities (rubber, nuts, fruits, oils, fibres) thus reducing the reliance on each individual product. It also opens up the interesting perspective of extractive reserve potentially benefiting from the demand for biological inputs from other NWFP producing enterprises subject to cost dynamics. This demand could be met in accordance with the use restrictions as long as the reserve can supply these inputs at a price lower than the cost of bioprospecting to the enterprises.

The peculiar production conditions in the extractive reserves present both a set of constraints for each NWFP production process by virtue of not being able to choose the first-best technology and a set of opportunities through the free access to an abundant biological capital stock that allows both diversification of output and sale of biological inputs. In terms of biodiversity conservation, these production conditions have clear benefits as they secure land use rights for activities that do not rely on land conversion. Economically, these conditions represent a significant improvement in terms of social equity compared to the traditional 'aviamento' system of rubber 'barons' and quasi-indentured labour[2]. However, it is less clear whether this constrained production system offers viable pathways to development through sustainable income flows for their populations.

2.2 Markets for existing NWFP

NWFP enterprises generate revenue through sale of their products on markets where they interact with other producers of NWFP. Following Goeschl and Igliori (2003) we focus on two peculiar features of this market for NWFP: The first is the spatial structure of enterprise location in the NWFP sector. Due to the considerable distance involved in the domestic market and resultant transportation costs, space is an important determinant of the profitability of operations. At the same time, production depends on peculiar local characteristics that are not present everywhere, thus limiting the choice of production sites. The second peculiar feature is the

heterogeneity of enterprises competing on the market. What is expected of extractive reserves is that they are able to generate revenue on output markets where they will be competing with other producers that are operating using different technological choices and resource bases.

The combination of spatial considerations and producer heterogeneity is not only analytically interesting, it is also empirically relevant: Extractive reserves and potential plantations are usually localised in different parts of the country (in rubber production most of the plantations are localised in the South East of the country). Wunder (1999) shows that NWFP production outside extractive reserves is very concentrated and 18 municipalities account for 25 per cent of the total extraction values.[3] These product belts are mostly characterised by proximity to market areas and by previous intervention or degradation in current sites of extraction. These environments are now dominated by the commercial species, sometimes up to the point of forming 'quasi-plantations', as a consequence of natural re-growth combined with management practices to deliberately eliminate competitive vegetation (Wunder 1999).

Goeschl and Igliori (2003) show that, given the constrained production conditions, the development of the market share for extractive reserves even under most favourable assumptions, is likely to lead to a declining revenue stream. This is on account of the unconstrained producer being able to reduce costs through investment. This investment is justified because it allows the producer to capture a higher market share from the reserve in the spatially differentiated market. If eventually the cost difference reaches a threshold the low cost firm takes over the whole market. This implies that there is only a limited time period over which production of a NWFP will generate significant revenues for the reserve. This limitation is exacerbated by the fact that the more revenue potential that product has, the greater are the incentives for the unconstrained producer to reduce costs quickly, and consequently the shorter the time period of profitable operation for the reserve.[4]

This rather pessimistic view regarding the revenue prospects in established markets for NWFP is supported by various empirical observations. Homma (1992), analysing the historical development of extractive activities in the Amazon, characterises the dynamics of NWFP as an economic cycle composed by 4 phases: expansion, stabilisation, and decline of the extraction, followed by cultivated plantations. The expansion phase is characterised by the existence of large reserves of resource and by the monopolistic position of the extraction region in the product market. The stabilisation occurs when the market tends to equilibrium close to the maximum capacity of extraction. The decline starts with the reduction of the resource base and with the increase in the extraction costs. Finally, the domestication phase begins during the stabilisation phase as long as technological and substitution constraints are not high enough and the demand remains reasonably stable. This theory of a revenue cycle is also supported by more recent empirical evidence for current NWFP produced in extractive reserves, most strikingly in the case of rubber over the last ten years. Although rubber is still the main product of extractive reserves, its production has been constantly declining since their creation. The rubber production in Brazil started the 1990s with almost 25 000 tons a year and finished the decade with less than 6 000 tons, facing a decline of more than 75 per cent (IBAMA, 2001). In addition, rubber plantations are increasing in other regions of Brazil, particularly in the state of Sao Paulo. Similar developments have been observed for nuts and other NWFP.

Both the industrial analysis and the empirical evidence suggest that over a longer time horizon, extractive reserves are able to compete with plantations in the NFWP markets only under very restrictive conditions. According to Goeschl and Igliori (2003), these arise when (1) technology-induced cost savings in the NWFP industry are limited, (2) biological inputs are sufficiently expensive, and (3) there is spatial differentiation.

2.3 Markets for new NWFP

While the probability that extractive reserves can generate a long-run revenue stream in existing NWFP markets is limited, the empirical evidence points to temporary monopolies for extractive reserves in early stages of the market. Particularly in rubber[5], but also more recently in various nuts, fruits and oils, it has been observed that the initial phases of the NWFP market generate significant profits (Homma, 1992). There are various reasons to believe that such transitory periods of abnormal profits will generally exist: (1) Competitors

face fixed costs of market entry; (2) initial production costs for competitors may be higher while cost reduction will not occur instantaneously, and (3) the demand for products may be partly endogenous and hence initially clustered around the reserve where it enjoys a location advantage over competitors even when its unit costs are higher.

This potential of a temporary monopoly in a specific NWFP market raises the possibility of a development pathway for extractive reserves that builds on the abundant biological capital available therein. If reserves are in a position to generate a sequence of novel NWFP, they are rewarded for this activity with a sequence of temporary monopolies in the markets for these new products. Whether this strategy is economically feasible depends on the returns to product search activities carried out in the reserve. Two factors need to be considered: One is the cost of product search carried out in the expectation of discovering a new NWFP with market potential; the other is the pool of potential products over which this search can be conducted. These factors will determine the returns to the search activity.

2.4 Markets for biological inputs

Additional to pursuing a strategy of product discovery, the inexpensive access to a biological capital allows for a third strategy available for extractive reserves. This is to supply the biological inputs that its plantation competitors will be demanding in order to control the cost function dynamics.

A key variable is the price of biological capital. The plantation has a reservation price, which corresponds to the cost associated with setting up an enterprise to collect natural resources in the Amazon region. However the plantation can alternatively pay the price charged by the reserve to supply biological resources. If the latter is lower than the former, there are incentives for the plantation to buy biological inputs from the reserve. It is not unreasonable to assume that this inequality will be fulfilled given the labour-intensive production methods in the reserves. The methods allow those involved in the extractive activities to observe the traits of various tree varieties with respect to yield, disease resistance, quality of output etc. It is plausible, therefore, that extractive reserves will be able to identify characteristics valuable to plantations at a lower cost than a search process not relying on this prior information.

From the reserve's point of view, the most attractive feature of the supply of biological inputs to competitors is that it establishes a negative link between the development of the reserve's share of the market for NWFP and the revenue generated by the sale of inputs into NWFP production. Goeschl and Igliori (2003) show that to the extent that reserves can supply these biological inputs, some mitigating compensation for the revenue loss on the NWFP market is available.

3 Property rights

3.1 Property rights within the reserve

Extractive reserves have an innovative and idiosyncratic internal property rights regime. It has a triple structure and can be seen as a co-management system involving the government, the community, and the individuals:

a. The state owns the land and regulates the exploitation of the resources, giving the concessions to the communities and approving a use plan, and monitoring its compliance.
b. The communities write the use plan, receive the long-term use concession of the natural resources, and are responsible for the full application and respect of the use-plan. Communities also negotiate with the government the construction and management of health and education facilities in the reserves.
c. The exploitation of the resources is made within individual land plots ('colocações'). Each household

organizes his/her extraction activities and cultivation of subsistence crops. Co-operation between households is more or less frequent depending on the particular case, but the results are privately appropriated.

The external property right structure includes only the NWFP. The households can sell and fully appropriate the value of their production of extractive products. They cannot sell neither the land nor the use of exploiting the land. Diagram 1 illustrates the property rights structure in a typical extractive reserve.

Rather than been a top-down measure elaborated within government's offices the creation of the extractive reserves were originally proposed by the rubber tappers themselves. Potentially, this fact contributes to the compliance with respect to the constraints in resource exploitation prescribed by the use plan. Boundary definition also contributes to avoid conflicts, as they are determined in accordance with the already established exploitation methods and geographic coverage. The communal design of the reserve boundary preserve access to all members of the community to natural resources such as rivers and lakes, and avoids cost with fencing. Communal facilities for storing and processing products can also be built without promoting disputes regarding land allocation.

As mentioned above the ultimate economic incentive is allocated to the individual who will be benefiting from his/her own production. Thus, it is possible to say that the standard efficiency mechanisms associated with private property structures are present in the property design of the extractive reserves. Since members have no rights over the other members' production there is no possibility for free riding and consumption possibilities are connected with individual efforts. One the other hand the households can benefit from collective initiatives to store, process, and market the products.

In order to assess the possibilities of a community to cope with the challenges of managing local natural resources based on collective action, Ostrom (1990) has elaborated seven 'design principles' that characterize robust institutions, present in several cases of common property resources she studied. By 'design principle' she means 'an essential element or condition that helps to account for the success of these institutions in sustaining common property resources and gaining the compliance of generation after generation of appropriators of the rules in use' (Ostrom, 1990, p.90). Table 1 presents the Ostrom's principles.

In principle, extractive reserves have most of the necessary institutional characteristics, proposed by Ostrom in her design principles, to enhance the chances of a successful management of natural resource with an

Table 1. Design principles illustrated by long-enduring CPR institutions.

1. Clearly defined boundaries. Individuals or households who have rights to withdraw resource units from CPR must be clearly defined, as must the boundaries of the CPR itself.
2. Congruence between appropriation and provision rules and local conditions. Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labour, material, and/or money.
3. Collective choice arrangements. Most individuals affected by the operational rules can participate in modifying the operational rules.
4. Monitoring. Monitors, who actively audit CPR conditions and appropriator behaviour, are accountable to appropriators or are the appropriators.
5. Graduated sanctions. Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offence) by other appropriators, by officials accountable to these appropriators, or both.
6. Conflict-resolution mechanisms. Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7. Minimal recognition of rights to organize. The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

Source: Ostrom (1990, p.90)

active role for the rural community:

a. Boundaries and population with use rights are clearly defined;
b. Although approved by the government, everyone involved in the community designs operational rules;
c. Monitors are the appropriators themselves;
d. There is an association, which is a local forum for conflict resolution. For more serious or complex problems there is also the National Council of Rubber Tappers, which congregates the associations of all reserves. The government also provides a institution structure which represents the communities called the National Centre for the Sustainable Development of Traditional Populations (CNPT) based on the Ministry of the Environment;
e. Governmental authorities do not challenge autonomous institutional building. On the contrary there is a number of initiatives, sponsored by the government and NGOs focused on governance and institution building within the extractive reserves.

Overall therefore, the structure of property rights within reserves creates incentives that are compatible with a conservative use of the biological capital base and provides incentives for the extraction of a defined set of NWFP in the extractive reserves. This structure ensures that contributions from members of the community to the specific extractive activities in the reserves will be rewarded in congruence with the local production conditions.

How well does this structure works with respect to contributions of members that are not related to the pre-defined set of NWFP? There is little evidence that the appropriation and provision rules reward two critical inputs required to access the development pathways of diversification and biological input supply. The critical input into accessing the pathway of diversification is search activity directed towards the discovery of new NWFP with revenue potential. However, as individuals in the reserves cannot exclude others within the reserve from benefiting potential discoveries, there are few incentives for putting efforts in research and development activities. In addition, the human capital base formed by the traditional populations not necessarily aggregates the necessary expertise to carry out systematic research and product development.

The critical input into biological input supply is knowledge about production-relevant characteristics of the local biological capital stock. However, there is currently no mechanism to reward the information an individual has with respect to the biological characteristics, productive properties and resistance to diseases, the different varieties might have. Neither one of these inputs is therefore considered under the use plan or included in the quasi-contractual relationships between households and the wider community such as the ones that govern the benefit sharing over revenues from the marketing of NWFP.

3.2 Property rights in the wider economy

A related, but separate issue is the property rights structure over the commercial outputs generated by the extractive reserve in the wider economy. One factor that supports the functioning of the property rights regimes within the reserve with respect to existing NWFP is the fact that the property rights over the output of the production system can be easily defined and are well established both within and outside the reserve. The reason is that the existing NWFP produced such as rubber and nuts have the classical characteristics of private goods: They are both excludable and rivalrous in consumption and protected by adequate legal titles.

This rights structure over NWFP in the wider economy facilitates the definition of boundaries and helps ensure congruence between input provision and share of benefits from the output within the reserve. However, with respect to the discovery of new marketable NWFP and the supply of biological inputs, the property rights structure in the wider economy is less supportive. In the case of discovery, since the search procedure does not involve the 'creation' of a novel product, extractive reserves are not protected from imitating companies. However, the property rights in the new NWFP itself are again compatible with rewarding inputs. This contrasts with the case of biological inputs. Although the Convention of Biological Diversity has motivated systematic discussions about legislative proposals aiming to protect indigenous rights related to biological diversity, the property rights over biological inputs and most importantly over genetic resources are currently

in the public domain[6]. This means that no property rights in the local biological capital are assigned to the community living in the reserve. The obvious consequence is that the supply of biological inputs in a narrow sense cannot generate economic rents for the reserve under the current set of property rights.

4 Discussion

Theoretical and empirical studies indicate that pure property rights arrangements (open space, common property, private property, public property) cannot generally guarantee efficient management of natural resources. Therefore they call the attention for case-by case analysis and suggests that co-managed structures might offer alternatives for balancing the development-conservation trade-off.

Extractive reserves combines public, common and private property rights with the aim of providing incentives for achieving the joint objective of biodiversity conservation and economic development for populations selling NWFP in a market economy without converting the designated forested areas. The analysis presented in this paper suggests that the current set of property rights in extractive reserves is primarily based around the continued extraction of established NWFP. Within this narrow domain, the property rights structure represents a very effective response to the competing objectives of conservation and income generation.

However, considering a wider choice of development pathways, the adequacy of the current property rights structure is less apparent: Rewarding contributions to an expansion of products that the community markets is conducive to a pathway directed towards diversification. Likewise, rewarding the supply of biological inputs and knowledge about the characteristics of these inputs contributes to a development process built around biological input supply. The current property structure both within and outside the reserves presents considerable deficiencies to provide incentives for these two possibilities of turning the extractive reserves economically viable. Table 2 summarises the contribution of the property right structures within the reserve and external to the reserve with respect to the three development pathways discussed in the paper.

We can see that only the currently pursued development pathway, which relies on the extraction of existing NWFP, is fully supported by the property rights, both internally and externally. A strategy involving diversification is discouraged by a lack of rewards for the input supporting that strategy, specifically the activity of product search, but has partial support in that the new NWFP themselves are covered by the current property rights over outputs. Lastly, the pathway involving the supply of biological inputs is supported neither by rights over input nor over outputs.

Property rights:	Existing NWFP	Development pathways: Diversification	Biological input supply
Internal	Effective	Deficient	Deficient
External	Effective	Effective/Deficient	Deficient

This finding is problematic when set into the context of section 2: The current property rights structure encourages the reliance on only one of the three possible pathways. This limits the width of the revenue base at any given point in time on which economic development of the extractive reserve could be based. Over time, this limitation is even more problematic since the analytical and empirical evidence suggest that revenues from existing NWFP production will be maintained only under very restricted conditions. The current property rights regime also contains features that in themselves undermine the development objective of the extractive reserves. One example is that because no functioning property rights exist for biological inputs at the same time as the government conserves biological capital on public land (notably extractive reserves), plantations benefit from an inexpensive supply of these essential inputs into NWFP production. This reduces plantations'

expenses for inputs, enabling them to compete even more effectively with extractive reserves on the NWFP markets that are supposed to generate the revenues to develop reserves economically. In such cases, the conservation and development objectives are clearly in conflict and require adjustment.

These rather discouraging conclusions raise questions regarding the challenges ahead the extractive reserves. Firstly, as the difficulties regarding the establishment of property rights over biological capital evidenced by the discussions in the Brazilian congress might suggest, it is not clear whether property rights can be changed to enhance the chances of extractive reserves to survive in the long run. Moreover, confronting previous studies with the case of extractive reserves we see the limitations of assigning property rights for solving efficiency problems of natural resources management. Particularly, when communities operating a constrained production system must compete with unconstrained firms in a market economy. Then, the dynamic processes of product discovery and the creation of markets for biological inputs set in a broader context must be taken into account, which go beyond the static context of mixed property rights assigned to extractive reserves. These questions conform a fundamental contradiction posed by the static nature of property rights in the reserve as opposed to the economic dynamics of competition to the outside world. As the property rights structure in extractive reserves was based on the previously established extraction system exploited by the rubber tappers, it not contemplate the necessary features the two other more dynamic development pathways would require to be accomplished.

5 Conclusion

The instrument of extractive reserves has been advertised as a novel approach to reconciling biodiversity conservation and economic development. It is on the basis of this claim that their number and size is currently undergoing expansion in the Brazilian Amazon.

In this paper, we characterise the peculiar production conditions for NWFP that exist in extractive reserves and assess the development pathways that these conditions offer to the communities living there. These pathways are the marketing of existing NWFP, the diversification into new NWFP and supply of biological inputs to other NWFP producing companies. The pathways are then set against the current property rights structure within the reserves and in the wider economy. The extractive reserves in the Brazilian Amazon have an innovative structure of property rights combining elements of public, communal and private ownership and use rights. As the literature on property rights indicates, this idiosyncratic combination seems to produce the appropriate incentives for efficient conservation and economic exploitation of existing NWFP. However, the analytical and empirical evidence suggests that the revenue potential in existing NWFP is very limited. On the other hand, the existing property rights structure does not facilitate accessing the remaining two development pathways. The difficulties involving significant changes in the current set of property rights particularly with regards to the wider economy anticipate considerable challenges for fulfilling the development objectives of extractive reserves in the future. This problematic conclusion points out that policies aiming to enable traditional communities to undertake long-run development must take into account the relationship they ultimately have with competitors outside they internal remit. It also indicates the need for further research on the links between optimal property right design and broader development policy.

References

Aghion, P. & Bolton, P. 1997. A Theory of Tricke-Down Grown and Development. Review of Economic Studies 64(2): 151-172.

Allegretti, M. 1990. Extractive Reserves: An alternative for reconciling Development and Environmental Conservation in Amazonia. In: Anderson, A. (ed.) Alternatives to Deforestation: Steps Toward Sustainable Use of the Amazon Rain Forest, Columbia University Press, New York.

Allegretti, M. 1994. Reservas Extrativistas: Parâmetros para uma Política de Desenvolvimento Sustentável na Amazônia. In: ARNT, R. O Destino da Floresta: Reservas Extrativistas e Desenvolvimento Sustentável na Amazônia. Rio de Janeiro, Relume Dumará.

Almeida, M. 1994. As Reservas Extrativistas e o Valor da Biodiversidade. In: ARNT, R. O Destino da Floresta: Reservas Extrativistas e Desenvolvimento Sustentável na Amazônia. Rio de Janeiro, Relume Dumará.

Angelsen, A. 1999. Agricultural Expansion and Deforestation: Modelling the impact Populaiton, Market Forces and Property Rights. Journal of development Economics. 58 (1): 185-218.

Arcanjo, F. A. M. 2000. Intellectual Property Rights and Biodiversity in Brazil: Conservation, Sustainable Use and Protection of the indigenous rights. Mimeo, Institute of Brazilian Business and Public Management Issues, The George Washington University, Washington DC.

Assies, W. 1997. Going Nuts for the Rainforest: Non-timber Forest Products, Forest Conservation and Sustainability in Amazonia. Thela Publishers, Amsterdam.

Baland, J. & Plateau, J. 1996. Halting Degradation of Natural Resources: Is there a role for rural communities? Clarendon Press, Oxford.

Bardhan, P. 1993. Symposium on Management of Local Commons. Journal of Economic Perspectives 7(4): 87-92.

Bardhan, P. & Udry, C. 1999. Development Microeconomics. Oxford University Press, Oxford.

Brazilian Institute of the Environment and Renewable Resources (IBAMA) / Ministry of Environment of Brazil (2001) [Internet site] http:// www2.ibama.gov.br

Browder, J. O. 1992. Social and Economic Constraints on the Development of Market-oriented Extractive Reserves in Amazon Rain Forests. In: Nepstad, D. C. & Schwartzman, S. (eds.) Non-Timber Products from Tropical Forests: Evaluation of a Conservation and Development Strategy. Advances in Economic Botany 9. The New York Botanical Garden, New York. p. 33-42.

Brown, K. & Rosendo, S. 2000. Environmentalists, Rubber Tappers and Empowerment: The Politics and Economics of Extractive Reserves. Development and Change 31: 201-227.

Duke, J. A. 1983. Handbook of Energy Crops. Centre for New Crops and Plant Products, Purdue University.

Dutfield, G. 2000. Intelectual Property Rights, Trade and Biodiversity. IUCN and Earthscan, London.

FAO 1995. Report of the International Expert Consultation on Non-Wood Forest Products. Non-Wood Forest Products #3. Rome: FAO.

Foster, A. & Rosenzweig, M. 1995. Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture. Journal of Political Economy. 103(6): 1176-1209.

Goeschl, T. & Igliori, D. 2003. Reconciling Conservation and Development: A Dynamic Hotelling Model of Extractive Reserves. Paper presented at the 12th Conference of the European Association of Environmental and Resource Economists, 27-30 June 2003, Bilbao.

Gonçalves, P. 2002. Razões pelas quais Devemos Evitar o Plantio Monoclonal da Seringueira. Informativo Apabor 9(47): 3-4.

Hardin, G. 1968. The Tragedy of the Commons. Science 162: 1243-1248.

Homma, A. K. O. 1992. The dynamics of Extraction in Amazonia: A Historical Perspective. In: Nepstad, D. C. & Schwartzman, S. (eds.) Non-Timber Products from Tropical Forests: Evaluation of a Conservation and Development Strategy. Advances in Economic Botany 9. The New York Botanical Garden, New York. p. 33-42.

IRRDB 1998. Annual Report.

Keller, W. 1996. Absorptive Capacity: On the Creation and Acquisition of Technology in Development. Journal of Development Economics 49(1): 199-227.

Kloppenburg, J. 1988. First the Seed: the Political Economy of Plant Biotechnology 1492-2000. Cambridge University Press, Cambridge.

Lipton, M. & Ravallion, M. 1995. Poverty and Policy. In: Berhman, J. & Srinivasan, T. N. (eds.) Handbook of Development Economics, iiiA, Elsevier, Amsterdam.

Menezes, M. 1994. As Reservas Extrativistas como Alternativa ao Desmatamento na Amazônia. In: Arnt, R. O

Destino da Floresta: Reservas Extrativistas e Desenvolvimento Sustentável na Amazônia. Relume Dumará, Rio de Janeiro.
Ostrom, E. 1990. Governing the Commons: the Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge.
Rodriguez-Clare, A. 1996. The Division of Labour and Economic Development. Journal of Development Economics 49(1): 3-32.
Rubber Board 2002. [Internet site] http://www.rubberboard.org.in
Sadoulet, E. & De Janvry, A. 1995. Quantitative Development Policy Analysis. The Johns Hopkins University Press, Baltimore and London.
Seabright, P. 1993. Managing Local Commons: Theoretical Issues in Incentive Design. Journal of Economic Perspectives 7(4): 113-134.
SEMA 1988. Plano Nacional de Meio Ambiente, Secretaria Especial de Meio Ambiente. Brasilia.
Southgate, D. 1998. Tropical Forest Conservation: An Economic Assessment of the Alternatives in Latin America, Oxford University Press, Oxford.
Wunder, S. 1999. Value Determinants of Plant Extractivism in Brazil: An analysis of the data from the IBGE agricultural Census. IPEA discussion paper 682.

Footnotes

[1] For a discussion on the creation of the extractive reserves, see Allegretti (1990). For a description of the main features of extractive reserves and their current status see Brown and Rosendo (2000), and Goeschl and Igliori (2003).
[2] See Allegretti 1994 and Brwon and Rosendo for a discussion of this tradional system.
[3] These municipalities form the so-called “assai belt” (Para state) and “babassu belt” (mainly Maranhao state).
[4] Apart from the threat of domestication in plantations, revenues from NWFP produced in reserves are limited by the availability of substitutes. The substitution of natural products by synthetic ones can be triggered either by a shortage of supply or by technological advance.
[5] It is sufficient here to mention the rubber boom in the late 19th and early 20th century.
[6] See Dutfield (2000) and Arcanjo (2000).

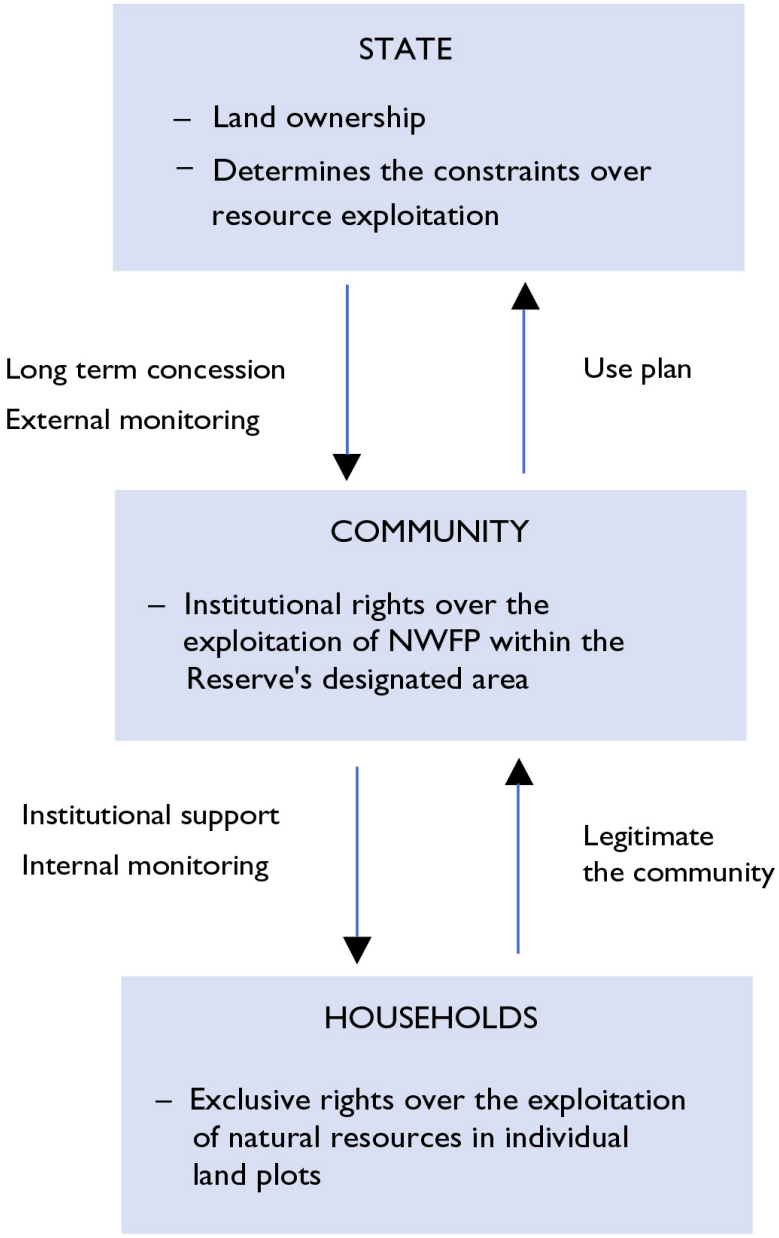

Figure 1. Property right structure in a typical extractive reserve.