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The Driving Forces Behind Collective Action in a Community in the Lower Amazon (Santarém, state of Pará, Brazil)

Stream: Aboriginal
Discipline: Institutional Analysis

Introduction

Studies on local management of common-pool resources (CPRs) usually emphasize analysis at the community level. However, empirical data have shown that the fact of considering community as a homogeneous social group overlooks important social dynamics among actors which may lead to different outcomes (Schlager and Blomquist 1998). The analysis of local and external factors which affect individual's incentives may uncover such heterogeneities within a community. Edwards and Steins (1998) argue that such contextual factors are crucial to reveal "hidden" factors that may affect collective decisions. Factors such as governmental policy (at the regional level), and household structure and ecological features (at the local level) may affect the opportunities and constraints to use a given resource.

Perhaps the main difficulty in identifying the primary driving forces to join a collective action is because most studies of successful collective action have focused on groups who organized themselves at a time substantially prior to the fieldwork conducted by the researcher (Bromley *et al*. 1992; McCay and Acheson 1990; Netting 1973; Ostrom 1992a; Wade 1988). In this regard, the analysis of a collective action in formation may provide information which better reveals the driving forces behind individuals' decisions concerning natural resources. It may, for example, reveal if the reason of a collective action is conservation, or if it is embedded in a "hidden" agenda that is not directly related to the managed system (Steins 1997). Likewise, it may explain why some individuals are more prone to participate than others (Gibson and Koontz 1997).

The study analyzes a collective action that recently took place in a traditional riparian community in the Lower Amazon. The settlement is located between the floodplain and upland ecosystems, but only one-third of the residents joined a common property of the floodplain area. This paper tries to answer two questions: (1) why have only one-third of the households initiated collective action in the floodplain forest? and (2) how is the collective action in the floodplain related to the upland ecosystem?

Study Area

Patos do Ituqui (Patos hereafter) is located 55 km east of Santarém (State of Pará, Brazil), the most important urban center in the Lower Amazon. Transport to the city is available by bus (six hours) or by boat (three hours). The community is part of a government sponsored settlement project established in1987 (*Gleba Ituqui*) which covers 16,589 ha and encompasses seven communities (Figure 1). The Patos community has 39 households with approximately 200 inhabitants. The residents are non-Indian Amazonian natives who have inhabited Patos since the early 1900s. Patos has experienced three main phases in its social organization history. In the 20s, a few families came from floodplain areas nearby and settled in individual houses in the region. During the 60s, the Catholic Church developed a local political structure by transforming the cluster of families into a community-based settlement. Finally, in the mid-80s, the settlement was officially recognized by the government as part of a settlement project (*Gleba Ituqui*), which marked crucial sociopolitical changes in Patos.

Ecosystem Types and Institutional ArrangementsEcosystem Types and Institutional ArrangementsTypes and Institutional Arrangementsand Institutional Arrangements

The region is characterized by a high but extremely variable annual rate of precipitation with 1,000-3,000 mm of rainfall mainly in March (358 mm) and April (361.9 mm) and an average temperature of 26EC (Junk 1984; RADAMBRASIL 1976). The river level fluctuates within a range of five meters between the dry season (July to December) and flood season (January to June). The two dominant ecosystems in the region, upland and floodplain, differ not only in physical and biological aspects but also in institutional arrangements and land use patterns.

The upland forest is characterized by moist dense forest with numerous valuable wood species (Pitt 1969; RADAMBRASIL 1976). The soil is predominantly yellow latosol, i.e., highly acidic, nutrient-poor soils, which is unsuitable for intensive farming (RADAMBRASIL 1976). In Patos, the upland forest can be divided into bottomland and plateau, which differ in terms of access, land use, and vegetation cover. The *bottomland* is a 600 hectare (ha) strip of land 1,200 meters (m) wide and is located along the river contiguous to the floodplain ecosystem. It is where the villagers live, and is dominated by secondary forest due to its older land-use history. The *plateau* is 1,700 ha and is located southward, at 200 m above the bottomland. It is linked to the bottomland by a steep slope (~ 50°), which makes access relatively difficult and, in turn, the land is less intensively used. The plateau is dominated by mature forest, with a few areas of recently established farmland and a few areas from which timber has been removed (Figure 2).

The floodplain is lowland of high soil fertility due to the continuous provision of sediments from recent geological formation from the Andes during the flood season (Junk 1982). In Patos,

the floodplain covers 200 ha and it is annually covered for seven to eight months with two different types of vegetation: flooded forests and natural grassland. The *flooded forest* is dominated by *açai* palm trees (Euterpe oleracea), a fruit consumed in great quantity in the community. Some economically valuable trees such as Carapa guianensis (seeds for medicinal purposes) and Mora paraensis and Virola guianensis (for timber) are also represented. The *Grassland* has no trees and is dominated by grass species such as Echinochloa polystachia (*canarana*), Paspalum fasciculatum (*muri*), Leersia hexisandra (*arroz bravo*) and Hymenachne amplexicaulis (*canarana da folha miúda*) that are used to feed cattle during the dry season (Junk 1984). Despite its high soil fertility, farming is not practiced in the floodplain ecosystem due to its long period of inundation.

The upland and floodplain ecosystems have undergone institutional changes with regard to property rights. The upland forest was privately owned by a series of four single landowners from the 19th century, when the Portuguese government issued the title of land, until 1987, when the Brazilian government established the settlement project (*Gleba Ituqui*). Patos' villagers lived in the area between the1920s and 1987 as squatters. In the mid-60s, a large ranching company (SOBOI) bought the land and had a plan to cut down the whole forest to sell the timber and plant pasture for cattle ranching. The plan of SOBOI to empty the area triggered a land conflict between local residents and the cattle company. The Union of Rural Workers (STR) and the Catholic Church gave support to local residents. After two decades of battle, INCRA (the governmental office in charge of agrarian reform)[1] finally expropriated the land in 1987 as part of a large settlement project in the region.[2] The Patos' upland forest was divided into 28 parcels of 50 ha, and every family or single male older than 18 years was permitted to occupy and use the land. INCRA has not yet conferred definitive land titles, which give the owners rights to sell, pass down, monitor and/or govern the landhold. But some parcels have been transferred through informal contracts.

The floodplain ecosystem has undergone changes in ownership as well. Despite the fact that it has been a legal state property since 1934 (Vieira 1992), the floodplain presents an informal multiple system of property rights in the region due the inefficient governmental monitoring (De Castro 1998). In Patos, the floodplain ecosystem had long been privately held by large ranchers who used the grassland during the dry season, whereas the local population always had free access to products in the flooded forest such as fruits, timber, and medicine. In 1993 the floodplain owner put the landhold on sale and another rancher who had just moved to Patos wished to buy the land for ranching purposes. Despite his interests, which were similar to the former ranchers, some local villagers believed that the new rancher would choose to have exclusive rights to the system. This perception of a threat led some local residents to organize a group to purchase the land. Although all the residents were invited, only one third of the community joined the group (12 households). Each household paid US$250.00 for a share in the

[1] INCRA - National Institute for Colonization and Agrarian Reform.

[2] The settlement project (*Gleba Ituqui*) was created by decree number 94.169 on September 19, 1987 and encompasses seven communities: Patos do Ituqui, Pau D'Arco, Cabeceira do Marajá, Serra Grande, Santana do Ituqui, Nova Esperança and Núcleo (INCRA 1994).

200 ha of land.[3]

Summing up, both ecosystems were privately held until the 1970s but the local population has always had free access to both of them. When villagers perceived threat to resource access, they organized themselves to keep their property rights. In the upland, they were able to change their status of squatters to a private owner. In the floodplain, an ongoing change is taking place from a single private owner to a common property. Yet, the collective action towards the floodplain forest has attracted only half of the previous group who participated in the upland forest. In the next sections we will discuss three sets of factors which have affected individuals' decisions regarding whether or not to join the common property of the floodplain: 1) source of income; 2) value of floodplain resources; and 3) ecological and social conditions for floodplain resource use.

Methodology

In order to analyze how individuals decided to join in the common property of the floodplain, we assumed that a household takes into account the expected costs and benefits of obtaining and investing cash to cooperate with the group. Figure 3 presents the hypothetical decision making tree towards participation in the common property of the floodplain ecosystem. Since the collective action was based upon the land purchase, we hypothesize that money income is the first constraint in the decision. This level of decision, for example, explains why landless individuals did not join the collective action (a). Once a money source is available, we hypothesize that the value of floodplain resources encourages participation in the collective action (b). Finally, a resource may have a potential value, but individuals may be constrained to use it. We hypothesize that ecological and social factors may constrain households from exploiting the potential resources in the floodplain ecosystem and, in turn, from engaging in a collective effort. On the other hand, individuals who have conditions for using resources are the ones geared toward collective action. Table 1 presents the rationale of the set of variables used to test our hypotheses.

Data were collected through a household survey, a vegetation inventory in the upland ecosystem, and land use mapping. The Kendall's tau-b test was conducted.

Household Survey

Patos has three categories of households in regard to property rights (Table 2): (1) 15 own no land; (2) 13 households own only private parcels on the upland forest; and (3) 11 own both floodplain land as common property, and private parcels on the upland forest. Henceforth, we will refer to those three groups as Landless, Private, and Collective, respectively. A household survey was carried out in order to evaluate whether there was a relationship between the household attributes and participation in the collective action. Structured interviews were administered in 38 households[4] with questions related to demography, land use, socioeconomic

[3] The group is formed by 16 households but four of them belong to another neighboring community--Pau D'Arco. The four members are not included in the present analysis but they participated in the share of US$ 4,000.00.

[4] We interviewed either the wife, husband, or both when possible. One household was absent at the time of the fieldwork.

activities and institutional arrangements[5]. We focus our analysis on Private and Collective households because they share similar conditions in terms of land ownership and economic opportunities

Vegetation Inventory

A vegetation inventory was carried out to evaluate if the forest characteristics were similar between Private and Collective in terms of woody vegetation. Parcels of five households in each group (Private and Collective) were randomly chosen. A 200 meter transect with 100 meters on each side was measured in the mature forest and 10 (15 m x 20 m) parcels randomly selected were laid along it. We measured and identified all trees greater than or equal to 10 cm dbh (diameter at breast height). We sampled a total of 3 ha (0.01% of the total upland forest area) distributed in 100 plots of 300 m^2 each. In addition, land use analysis in each of those plots was carried out with the owners in the field to map the distribution of each land use/land cover class (pasture, crop and fallow).

Results

Source of Money

Private and Collective groups have three sources of money: credit line, retirement income and trading wood. A larger number of Collective households withdrew credit lines (45%) in comparison to only 15% among Private households (Figure 4a). Similarly, a larger number of Collective households (64%) had retired members than Private (25%) which increased the household income as a whole (Figure 4c). Although almost 100% of both Collective and Private groups have sold wood (Figure 4b), this fact does not reveal the amount of logs removed. Such information can be derived from the forest inventory. It suggests that Collective households have removed more trees for timber than Private. The parcels of Private households have on average a larger number of commercially valuable species (1.41 spp/plot) and tree individuals (1.48 trees/plot) above 45cm in diameter in comparison to those of Collective households (1.04 spp/plot and 1.09 trees/plot). [6] In general, the source of money presents a moderate and positive association with participation in the collective action in the floodplain (tau-b = 0.21) (Table 4).

Value of Floodplain Resources

Açai fruit, grass, and land control are the three main important products in the floodplain ecosystems. In general, the value of floodplain resource presents a moderate and positive association with participation in the collective action in the floodplain (tau-b = 0.51) (Table 4)[7].

[5] Previous knowledge of ecological and institutional features in the region from field experience helped to select the study site and prepare the household questionnaires.

[6] In this analysis we consider only commercially valuable trees above 45 cm dbh. This cutoff value was based on the study on timbering activity in the Eastern Amazon by Uhl and Vieira (1989) who found that the smallest tree removed was of 48 cm dbh.

Açai is a highly prized fruit in the region (Oliveira *et al.* 1994) as in other parts of the Amazon (Anderson 1990; Brondízio and Siqueira 1997). Collective groups allow Private members to collect it for consumption. However, while 45% of Collective households have also collected *açai* for commercial purposes, no Private member has done so (Figure 4d). According to local people, *açai* was a profitable product until two years ago. The Collective group has determined that only its members have rights to harvest *açai* for commercial purposes. The *açai* harvest has become an issue of conflict between both groups since the Collective group deprived the Private of their previous free access to it. *Açai* is also a low-cost extractive activity, which increases the interest among all households to collect it. In short, the collective action has restricted the access, even for subsistence purposes, of non-commoners (Private) to this important floodplain product.

Unlike *açai*, grass is a non-subsistence product, and only the Collective group uses it to feed cattle during the dry season (July-December). Cattle are used as draft animals or as monetary investments. In the first case, the household has one or two cows to pull carts, and a small patch of grass (usually in the garden) is enough to feed them. In the second case, a larger amount of cattle are raised (between 10 and 50) and, in turn, a larger area for pasture in both upland and

floodplain areas is necessary. Among Collective households 36% raise cattle for monetary investment, whereas only one Private household (8%) does so (Figure 4e).

Leadership is a proxy for a non-consumptive product – control of land. Forty five per cent of Collective households have a leader as opposed to none among the Private groups (Figure 4f). In particular, most of the Collective households with leaders do not raise cattle; yet, two-thirds of them (3 households) expressed their desire to get involved in cattle ranching activity. They mentioned their plan to convert part of their crop field into cultivated pasture in the near future. Therefore, it is not clear if leaders have joined the Collective group because of their interest in cattle ranching or an interest in gaining control over the floodplain area. In addition, both incentives may be correlated, since the control over the land would ensure access to the grassland in the future. Although it is unclear if leadership affects the individual's decision towards collective action, it seems to have been an important factor in the success of the collective action. The leaders in the Collective group are those who acted politically during land conflict over the upland forest (see Section *Ecosystem Types and Institutional Arrangements*). And they are the ones who initiated, and are currently coordinating the organization of the Collective group.

Condition for Floodplain Resource Use

In regard to ecological factors, we tested the opportunities and constraints regarding cattle ranching, since it represents the most costly (and profitable) activity in the floodplain.

As expected, a larger number of Collective (thirty six per cent) have easier access to pasture than Private (eight per cent) as well as to a source of water (Figures 4g and 4h). The bottomland presents a more favorable environment for cattle raising due to: (1) closeness to the river, and (2) domination of secondary forest, which implies a lower cost of opening pasture in terms of time and labor. About half of Collective households have raised cattle in the bottomland (Figure 2).

And the large-scale ranchers (with between 10 and 50 heads) own parcel in the bottomland.

In particular, male labor represents a key role in deciding to engage in cattle ranching (tau-b = 0.82). It explains why male labor is more available among Collective (forty five per cent of the households) than Private (twenty seven per cent) (Figure 4i). Forty per cent of Collective households had more than three active males available in comparison to 8% among Private households (Figure 5a). Households that raised more than two cows had three or four active males in comparison to households with one or two males that hold only one or two cows. Hence, male labor seems to play a major role for households regarding investing in cattle ranching and thus in joining the collective action.

The Effect of Collective Action on the Upland Ecosystem

Although collective action has taken place in the floodplain ecosystem, it has affected the upland ecosystem in two main ways: (1) demand for pasture in the upland, and (2) extraction of timber to raise money to invest in cattle ranching activity. The former is indicated by the land use analysis, whereas the latter is reflected in the vegetation composition analysis. Collective households have opened 0.08 hectares of pasture per capita, whereas no pasture has been cultivated in the upland by the Private households. On average, Collective households have also cleared more areas (1.19 ha/capita) than Private (0.72 ha/capita) for farming (Figure 6). Collective households also have larger areas (2.64 ha/capita) of fallow than Private (1.92 ha/capita). The more intensive land use among Collective households might also be related to the amount of total labor force in which sixty percent of Collective households had at least three active members compared to 46% of Private households (Figure 5b).[8]

In addition to cleaning for pasture and farming, logging has also affected the vegetation. Two highly valuable wood trees, Tabebuia serratifolia (*pau d'arco*) and Bertholletia excelsa (Brazil nut), are practically wiped out of Patos' upland forest. Although vegetation structure seems to be similar between the two groups, Collective seem to have impacted more the species composition of the upland forest. Private parcels presented higher species abundance (20 spp) than Collective (12 spp), which suggests that the latter has removed more commercially valuable tree species (Table 5). In addition, important valuable wood species such as Simaruba amara (*marupá*), Manilkara huberi (*maçaranduba*) and Clarisia racemosa (*guariúba*) were either not found or were below 45 cm of dbh in forests held by Collective groups. Thus, at the present time, the incentives at stake seem to lead Collective households to use the upland forest more intensively than Private households do.

Discussion

Patos has experienced two collective actions in less than 20 years that were similar in some aspects but have had different outcomes. Both cases involved the very same group who felt threatened by the potential loss of access to resources. Concerning the upland conflict, the collective action was involved the entire community and their access was insured without any

[8] Total labor force: considering male and female members of a household between 15 and 55 years old.

monetary cost, whereas in the floodplain the collective action was based upon a group of households and their access was secured by land purchase. Therefore, participation in the collective action of the upland ecosystem basically demanded political participation, whereas in the floodplain it demanded direct economic investment. [9]

The decision to join a collective action in the floodplain property can be explained by the analysis of limits and opportunities that each household faces. In the past, the local population had access to both upland and floodplain but both systems were owned privately. In upland areas, subsistence crops were cultivated in small plots close to their houses and free access to extractive activity did not demand the development of a more elaborate system of appropriation. Only when their rights to use the upland and, more importantly, to live in the area were threatened, did most of the community engage in the collective action. The new picture that emerged from this process changed the structure of opportunities in many ways. The right to the land provided new sources of money (timber and credit line), and control over land use. This new structure created incentives for local residents to engage in long-term investments, such as cattle ranching.

Cattle ranching is a traditional activity that has increased in the Amazon due to tax incentives created by the Brazilian government between the 1970s and late 80s (Hecht 1993, Hecht *et al*. 1988; Moran 1981; Uhl *et al*. 1988). The local population considers cattle a measure of wealth, and upland smallholders in the Amazon are increasingly turning to ranching activity due to the low labor demand and the low cost of pasture in comparison to other activities such as perennial crops (Hecht 1993). In the floodplain, smallholders who engage in cattle ranching may face a tradeoff between ecological opportunities and household constraints[10]. In Patos, for example, the easy access to both floodplain and upland provides an ecological and institutional opportunity to develop cattle ranching. This trait explains why almost all cattle raisers from Patos decided to join the collective action when access to the floodplain was threatened (see Floodplain Ecosystem). [11]

However, it does not explain why the Private group, with similar access to resources and threat did not engage in cattle activity and, in turn, did not have enough incentives to join the collective action. The answer to this question lies in the household structure. Cattle activity is carried out by male members in the household. The association between the number of males and cattle activity is strong and positive (tau-b = 0.82). Household structure has long been considered an important factor for production systems among farm families (Chayanov 1986). Decisions about division of labor for production activities, in several cases, take place within households

[9] Political participation is an economical investment in the sense that time spent in political action affects the time allocated among other economic activities (Olson 1965; Udehn 1993). In addition, risks taken in such activities also raise the long-term economic cost. However, the short-term investment represented by joining the floodplain property demanded payment in cash.

[10] Because Patos is located between both floodplain and upland systems, it creates incentives for local villagers to invest in cattle due to its lower cost of production; in comparison riparian people who live on island instead of the riverbank transport cattle by boats from the floodplain to the upland during the flood season. Ranchers have to pay the cost of transport and rental of pasture in the upland which increases the cost of cattle ranching (Futemma and McGrath 1998). People from the Patos community already live in a riverbank where floodplain and upland systems are promptly accessible at low cost, thus creating more incentives to raise cattle.

[11] As discussed before, the only cattle rancher who did not join the communal property was the rancher who was willing to buy the floodplain system on his own (see section Ecosystem Types and Institutional Arrangements).

(Cheal 1989; Netting *et al*. 1984; Wilk 1989, 1991), especially among peasants (Netting 1993). Thus, household analysis can provide information that better explains decisions for or against group collaboration.

Considering the fact that cattle ranching was a major driving factor behind collective action in the floodplain system, the participation of non-cattle ranchers in the Collective group can be explained by their interest in raising cattle in the future. Those individuals were mostly the leaders, who played a key role in the origin of such a collective action. The fact that the same persons who were leaders in the upland conflict were the ones who organized the collective action in the floodplain 20 years ago is not by chance. It reveals a social capital that was created with the support of the Catholic Church in the past through the Federation of Agencies for Social Work and Education (FASE) and the Movement for Brazilian National Education (MEB) (Leroy 1991). Some scholars consider leadership an important element in collective action, in particular regarding its origin and coordination (Olson 1965). Singh and Ballabh (1994) show that leadership plays a strong role in several functions, such as the generation of ideas, the motivation of a group, the mobilization of resources and the development of management systems.

Therefore, leadership is an important social capital that must be considered in the local organization, as well as household structure in order to understand how the structure of opportunities and constraints acts differently across households and affects the interrelationships among them, leading them towards a common interest.

Conclusion

Cooperation in the collective action of the floodplain depended upon the constraints and opportunities that individuals met, which can essentially be defined as push and pull factors. Behind those factors, cattle was the main driving force that led local villagers to get organized. A contextualization of decision process in three levels--capability to buy the share, potential value of the resource, and capability to exploit the resource--enabled us to reveal the major factors to participate in a common property of a floodplain area in the Lower Amazon. We can summarize the decision process into opportunity factors (access to grassland) that pushed individuals to join a collective (one-third of Patos community) as opposed to constraint factors (lack of money source for Landless and lack of labor force for Private) which pulled back two-thirds of Patos households. Household analysis allowed us to uncover constraints found at the household level that would not have been revealed through community analysis. Furthermore, leadership was a push factor that helped in the formation of the user group, reducing costs of organization due to previous experience in three ways. First, how to get organized; second, how to utilize external assistance to get information; and finally, how to gain bargaining power with local government agencies. Therefore, the collective action in the Patos community is likely to be a result of defending floodplain lands against external threat to the local access and use of, primarily, grassland for cattle and, secondarily, *açai* fruit.

Another aspect of the common property of the floodplain is its “side-effect” towards the upland forest. One of the main contributions of community-based management literature is the recognition of the ability of local people to engage in collective action to conserve natural resources (Berkes 1989; Bromley *et al*. 1992; McCay and Acheson 1990). This approach

evaluates conditions of the system where collective action takes place. However, in places where the user group explores more than one system in an integrated production system, the actions taken in one may affect other related ecosystems. The present study shows that because cattle use the floodplain during the dry season and the upland during the flood season, this activity affects both ecological systems. Although the target of the collective action is the floodplain, the upland is indirectly affected by opening pasture and removing wood species to subsidize cattle activity. Despite the relatively low rate of deforestation for pasture (0.08 ha/capita; see Figure 7), if incentives for cattle raising are to be continued, this figure may rapidly increase. Furthermore, timbering will continue to be carried out for two reasons: (1) it can lower the cost of opening areas for farming and pasture, and (2) it provides cash and/or other services that can subsidize cattle (Hecht 1993; Uhl *et al.* 1988). Several families reported that they sold lumber to logging companies two to three years ago in exchange for opening roads within the Patos community. Therefore, the collective action in the floodplain system could be better understood only when contextualized in terms of the production systems (including both floodplain and upland systems) and the household attributes (labor force and leadership). Studies at household and landscape levels can contribute to CPR analysis, in order to more fully understand decision making with regard to collective action in different arenas.

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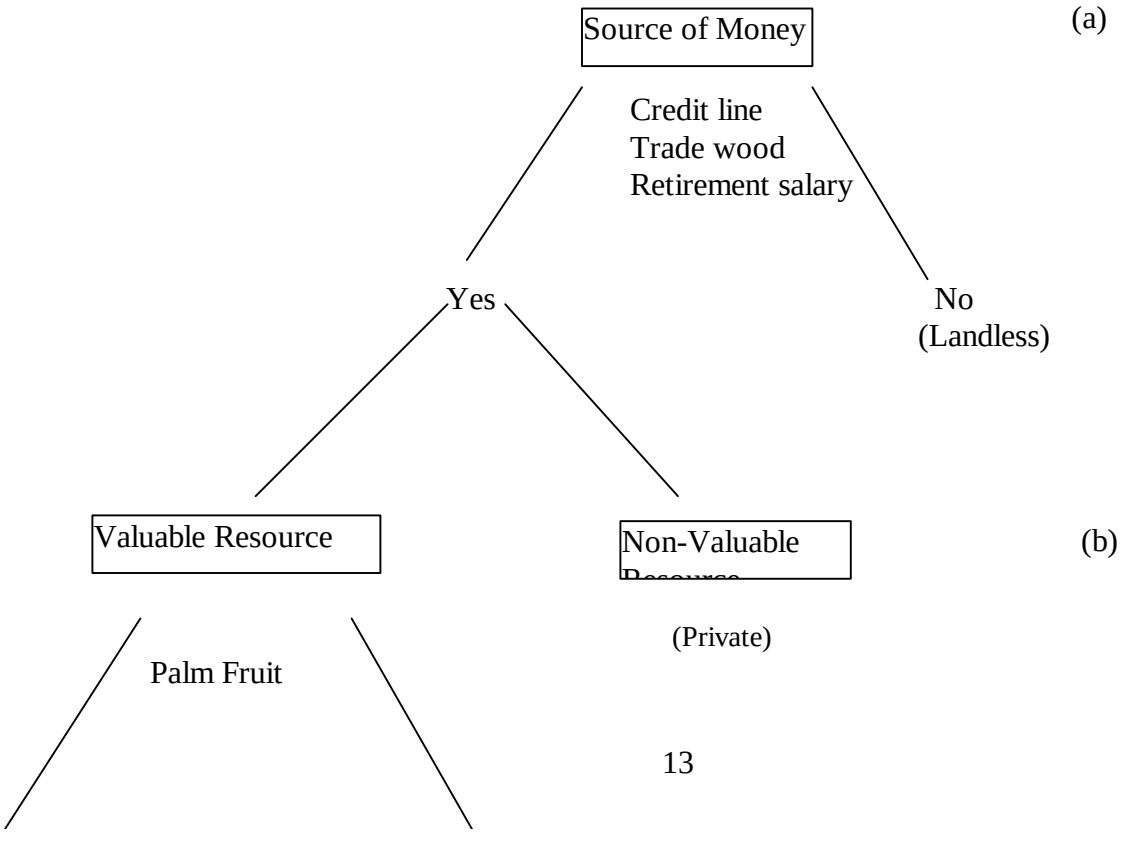
DECISION-MAKING TREE



Grass
Control

Capability to Use

(Collective)

Constrained to Use

(Private)

(c)

Access to upland pasture
Access to water
Male labor

Figure 3. Hypothetical decision making tree towards participation on the common property of the floodplain

] Figure 1. Map depicting the area of the Patos do Ituqui community (at the bottom), located in the State of Para within Brazil and South America (at the top left). Santarém, state of Para, Brazil (1997).

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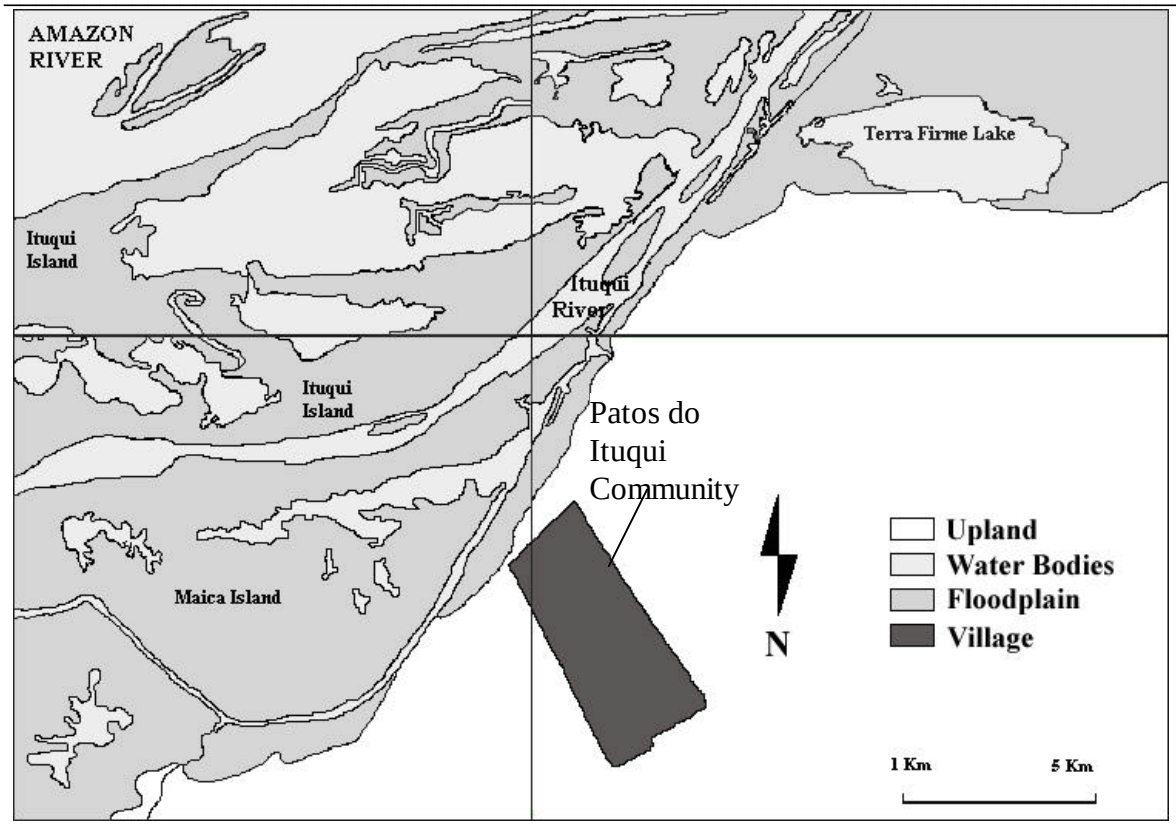

Parameter (per plot)	Private (n = 27) Mean (SD)	Collective (n = 22) Mean (SD)	T-test
Number of Trees	1.48 (0.41)	1.09 (0.08)	2.87**
Number of Species	1.41 (0.33)	1.04 (0,04)	3.07**
Diameter (cm)	71.33 (355.40)	64.61 (475.97)	1.14
Height (m)	29.23 (7.67)	28.48 (1.05)	1.37
Total Basal Area (m^2/ha)	44.82 (888.64)	36.72 (740.24)	0.99

** $p < 0.01$

Table 4. Values of non-parametric association between the driving forces with the decision to join the common property.

Driving Force	Tau-b	Strength of Association
Source of Money	0.21	Weak to moderate and positive
Value of Floodplain Resource	0.48	Moderate and positive
Condition for Floodplain Resource Use	0.62	Moderate to strong and positive

Table 5. Distribution of woody species trees (forty-five cm of dbh or higher) among Collective (n = 50) and Private (n = 50) parcels in the Patos community.

Scientific Name	Portuguese Common Name	Distribution	
		Collective	Private
Caryocar villosum	piquiá	x	x
Pithecelobium pedicellare	mupucixi vermelha	x	x
Vochysia maxima	quaruba verdadeiro	x	x
Cordia bicolor	freijó branco	x	x
Sclerolobium paniculatum	tachi pitomba	x	x

Jaracaranda copaia	paraparará	x	x
Ocotea costulatum	louro amarelo	x	x
Virola michelli	ucuúba preta	x	x
Sclerolobium paraense	tachi branco	x	
Pithecelobium marmoxylum	angelim rajado	x	
Vochysia guianensis	quarubatinga	x	
Clarisia racemosa	guariúba		x
Tetragastris panamensis	breu areiu areiu		x
Couratari oblongifolia	tauari		x
Endopleura uxi	uxi		x
Couratari guianensis	tauari de folha grande		x
Simaruba amara	marupá		x
Qualea paraensis	mandioqueira		x
Parkia velutina	faveira de folha peluda		x
Vantanea parviflora	achuá		x
Manilkara huberi	maçaranduba		x
Hymenea parvifolia	jutai mirim		x
Copaifera reticulata	copaiba		x
Total number of species		**12**	**20**

Table 1. Description of variables included in the analysis

Sources of Money

1. Credit Line: Since 1989, the State Bank (BASA) has provided credit lines for agropastoral activities; all local villagers who hold parcels in the Gleba Ituqui are eligible to apply (INCRA 1994; BASA 1996) for credit. We expect that a larger number of Collective households than Private have borrowed money to invest in cattle and/or to buy a floodplain share.

2. Retirement Income: Women older than 60 and men older than 65 receive a monthly retirement salary of about US$120.00. This contributes a great deal to the household economy in comparison to a salary of US$60.00/month for an elementary school teacher in the region (Oliveira et al. 1994**).** We expect that Collective households will have a larger number of retired members than Private.

3. Trade wood: Private and Collective households have access to wood trees in the upland forest. Local population in the region has been involved in timber activity (Oliveira et al. 1995). The price paid per tree is about the same among all households (mean of US$10/tree), giving them a similar profit return from trading wood also. Some authors have observed in other regions of the Amazon that local people sell timber to invest in ranching (Hecht 1993; Uhl et al. 1988). Thus, we expect that the parcels held by Collective groups have fewer numbers of individual trees and a lower basal area among woody species than in parcels held by Private groups.

Value of Floodplain Resources

4. Açai: Açai is an important subsistence and economic product (Oliveira et al.

1994) from the floodplain. We expect that Collective households will be more involved in açai harvesting than Private households, especially for cash income.

5. Cattle: Cattle are raised in the upland during the flood season and in the floodplain during the dry season. Thus, we expect that Collective households will: (1) be more involved in cattle than Private households because they need grassland as a grazing area, and (2) have more impact on upland forest due to pasture. Thus, cattle are a proxy variable for grassland.

6. Leadership: Due to the history of threat to land access, the interest in keeping the access to the land may represent a force to participate in a collective action, regardless of the economic value of the products. In this regard, leaders are expected to be more prone to participate in the Collective group than non-leaders. Therefore, leadership is a proxy for security of control over land.

Condition for Floodplain Resource Use

The exploitation of consumptive valuable products in the floodplain may depend upon the opportunities and constraints that are related to use. While palm fruit is a low-cost extractive activity, cattle ranching may depend upon a set of ecological and social variables, described below: **Attributes**

7. Access to Upland Pasture: Topography such as a hilly area has been pointed out as an ecological constraint for cattle (Pichon 1997). In Patos, the plateau offers two main constraints for cattle ranching in comparison to bottomland. First, it is dominated by mature forest that requires a high cost of labor and time allocation to establish a pasture. Second, it is located in an elevated area that may create difficulties for carrying out the seasonal transportation of cattle between upland and floodplain ecosystems. Thus, as far as cattle raising is concerned, individuals whose parcels are in the upland area will be less willing to participate in a collective action as opposed to those who hold a parcel in the bottomland. Therefore, we expect that a larger number of Collective households hold parcels in the bottomland area than Private households.

8. Access to Water: In the present case, the limited availability of water in the upland forest in contrast to the bottomland makes it an important factor for raising cattle. It is crucial to have water close to pasture areas or accessible to the animals. Individuals with a source of water in the bottomland or upland will be more willing to invest in cattle in contrast to those whose parcels are not close to a source of water. We expect that a larger number of Collective households have water close to their parcels than Private.

9. Male Labor: Cattle raising is a typical male activity although it requires relatively little labor force (Hecht 1993). In addition, Patos households rely on a traditional family labor force. We arbitrarily defined Aactive@ male as a healthy male between 15 and 55 years old. We expect that Collective households will have more active males available than Private.

MALE Classes	Private	Collective
0	38	30

1-2	54	30
3-4	8	30
4 or More	0	10

Classes	Collective
0	30
1-2	30
3-4	30
4 or More	10

Male/Female

Classes	Private	Collective
0	15	10
1-2	39	30
3-4	15	20
4 or More	31	40

Classes	Collective
0	10
1-2	30
3-4	20
4 or More	40

(a) (b)

(c)

(d)

(a)

(b)

	Collective	Private
Cattle	36	8

	Collective	Private
Credit Line	45	15
Trade Wood	Collective 100	Private 93
Retirement	Collective 64	Private 25

	Collective	Private
Harvest Acai (Sub+Market)	45	0
Leadership	Collective 45	Private 0
Labor Male	Collective 45	Private 27
Male Head	Collective 100	Private 30.8
Water	Collective 55	Private 8
Access to Pasture	Collective 36	Private 8

(a) **(b)** **(c)**

(d) **(e)** **(f)**

(g) **(h)** **(I)**