Ambiente & Sociedade
ISSN: 1414-753X
revista@nepam.unicamp.br
Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade
Brasil

FUTEMMA, CÉLIA; CASTRO, FÁBIO DE; SILVA-FORSBERG, MARIA CLARA; OSTROM, ELINOR
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Ambiente & Sociedade, vol. V, núm. 10, 2002, pp. 1-21
Associação Nacional de Pós-Graduação e Pesquisa em Ambiente e Sociedade
Campinas, Brasil

THE EMERGENCE AND OUTCOMES OF COLLECTIVE ACTION: AN INSTITUTIONAL AND ECOSYSTEM APPROACH

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Studies of collective action often focus on features of the participants and the managed ecosystem. The social analysis of the participants helps to uncover the factors driving participation in those local enterprises such as individual interest to participate (Ostrom, 1998) and ability of the group to organize (McCAY & JENTOFT, 1998). An ecological analysis of the managed ecosystem helps to unveil how characteristics of a resource influence the type of appropriation system that is designed (SCHLAGER et al., 1994) and how the local institutional arrangement influences the sustainability of common-pool resources (BERKES, 1989; GIBSON et al., 2000).

In this paper, we broaden the social and ecological context of the analysis of common-pool resources by investigating the features of non-participants, in addition to participants, to explore the factors that cause individuals to refrain from contributing in collective action. We also analyze the features of the managed ecosystem and investigate ecological and economic attributes of other closely related ecological ecosystems to explore their interrelationships. This analysis aims at addressing the importance of examining the emergence and outcomes of collective action to common-pool resources by scaling down to household level and scaling up to landscape level to understand individual incentives to participate (or refrain) and the ecological outcomes of these local enterprises.

The emergence of collective action depends, among other factors, on individual incentives to participate in group-based decisions. Group-based activities demand several collective tasks. These include coordination of actions, mechanisms of conflict resolution, and information sharing (OSTROM, 1990). Given these needs, a minimum organizational skill is fundamental to enable initiation and maintenance of collective action. Experiencing collaboration in a group is a learning process of acquiring and exchanging information through a social network that contributes to enhance coordination skills in that individuals learn or develop commitment, responsibility, and the importance of task fulfillment (COLEMAN, 1987). In addition, the development of trust and reciprocity contributes to an enhanced social structure that strengthens relations among individuals, and thus helps to build social capital

(OSTROM, 1999). The process of building social capital takes time and energy, and historical events can facilitate or retard this process (DURSTON, 1998; WHITE & RUNGE, 1994). For example, previous participation in organizations and the experience of beneficial collective outputs are likely to motivate individuals to join collective action (WHITE, 1996).

In addition to well-structured social groups and previous individual experience in political action, particular assets and perceptions directly influence individual choices toward collaborative behavior. Since those features vary in the group, social heterogeneity has been a major focus of debate involving collective action. Despite evidence that socially homogeneous groups can more easily achieve collaboration (BLAIR, 1996; CARDENAS, 2000; CERNEA, 1989), some authors suggest that heterogeneous groups, in regard to political power or economic assets, may help to achieve collective actions but may not ensure equal distribution of benefits (OLSON, 1965; DAVIS & BAILEY, 1996).

Schlager and Blomquist (1998) point out that problems arising from internal social heterogeneity can be solved by defining a solid institutional arrangement, separating different groups of users, or excluding different groups from having rights to a resource. Recent studies have shown that institutional arrangements may help overcome structural problems stemming from social differences among collaborators (VARUGHESE & OSTROM, 2001; GIBSON & KOONTZ, 1997). Likewise, co-management models have revealed the importance of defining different sets of rules for stakeholders sharing different assets and interests (PINKERTON, 1994). Exclusion of groups from having rights to a resource is the most studied situation in regard to common-pool resources in explaining differences between participants and non-participants (McCAY & ACHESON, 1987). Cases in which village residents split into different groups are, however, perhaps the most understudied situations.

Heterogeneity is also an important component in the outcome of collective action as far as it is related to ecological features of the landscape, such as the spatial distribution of a resource and its value. In many cases, participants use multiple ecosystems, and the collective appropriation from one ecosystem may be related to ecological and economic features of other ecosystems. Such problems become more pronounced in areas where local populations are located in highly patchy landscapes such as between mountains and valleys (NETTING, 1976; GUILLET, 1981), and between floodplains and uplands (CASTRO, 2000; FUTEMMA, 2000). In those cases, analysis of the ecological outcomes of collective action should be conducted at the landscape level to account for the relationship between different ecosystems.

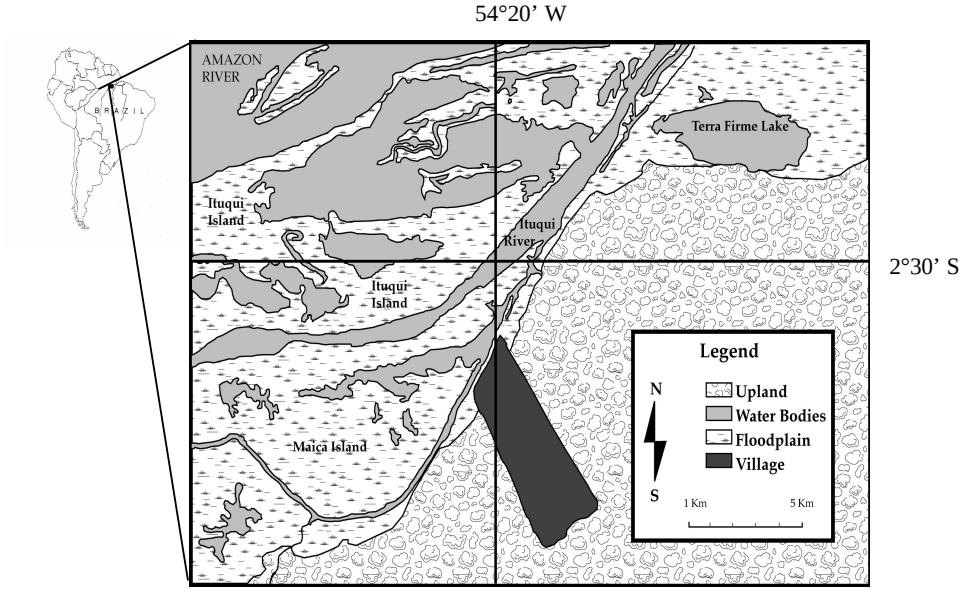
The present study addresses the issue of emergence and outcomes of collective action in light of social and ecological heterogeneities. It is focused on a community located between distinct ecosystems—upland and floodplain—in the Lower Amazon. Two major collective actions took place at different times within a 20-year period. In the 1970s, all the local residents mobilized in a series of demonstration petitions and other activities to gain private property rights to the upland system. Twenty years later, one third of this group self-organized to gain collective property rights to the adjacent floodplain area. We analyze the two events—upland privatization and floodplain collectivization—in an integrative fashion and reveal temporal, social, and spatial relationships between

the two events. The main goal of the paper is to understand: (1) why only one-third of the households initiated collective action toward the floodplain ecosystem, and (2) how the collective action in the floodplain related to the upland forest.

STUDY AREA

The Patos community is located along the Amazon River and encompasses 33 households with approximately 200 inhabitants. The community is situated 55 km east of Santarém city, the most important urban center in the Lower Amazon. Transportation to the city can be achieved by bus (six hours on a dirt road) or by boat (three hours upstream). Patos residents are non-Indian Amazonian natives who have been living in the region since the early 1900s. Patos is part of a government-sponsored settlement project (Gleba Ituqui), along with six other communities. This project was established in 1987 and covers 16,589 ha (Figure 1).

Figure 1. Map Depicting the Study Area of Patos Community (at bottom, marked in black) Located in the State of Pará within Brazil and South America (top left)



The region is characterized by an average temperature of 26°C and a high annual precipitation that is concentrated in March and April (approximately 360 mm each month) but varies from 1,000 to 3,000 mm (JUNK, 1984; RADAMBRASIL, 1976). The river level fluctuates within a range of 5 m between the peaks of the dry season (July to December) and the flood season (January to June). The Patos community is located on the riverbank, between the upland and the floodplain ecosystems (see Figure 1).

Upland Ecosystem

The Patos upland ecosystem, characterized by moist tropical forest, encompasses 2,300 ha and can be divided into two ecological zones according to land-use: *bottomland* zone and *plateau* zone. The bottomland zone is a 600-hectare strip of land 1,200 m wide and is located along the river adjacent to the floodplain ecosystem. The houses are located in this zone. Due to its older land-use history, it is mostly covered by secondary vegetation, pasture, and cropland. The plateau zone is separated from the bottomland by a height variation of 200 m, at a 50-degree slope. The plateau covers 1,700 ha and is dominated by mature forest with numerous valuable wood species (RADAMBRASIL, 1976). Highly acidic, nutrient-poor soils (yellow latosol) predominate, interspersed with high-fertility patches of anthropogenic black soil. Timber has been carried out in a few areas, but cropping and grazing are the main land-use activity in this zone.

The private property regime in the upland ecosystem can be traced back through a series of four landowners to the nineteenth century when private land titles were issued by the Portuguese Crown to local elite. Patos residents have lived in the area since the early 1920s. Until 1987, they had informal access to land but no legal rights. In the mid-1960s, a large ranching company bought land that included the Patos community. The company planned to clear the area to sell the timber and cultivate pasture for cattle ranching. To do so, the company tried to expel the local residents from their land. Patos residents, together with residents from neighboring communities and support from grassroots organizations and local NGOs, reacted against them and claimed their legal rights to the land.

After two decades of land disputes, the government office in charge of agrarian reform, the National Institute for Colonization and Agrarian Reform (INCRA), expropriated the land in 1987 and established a large settlement project in the region. The upland ecosystem was divided into 28 parcels of approximately 50 ha. Family units and single males older than 18 years of age were given rights-of-use. According to INCRA policy, a landholder will gain the right to sell the land only when a definite land title is issued. Although landholders are currently only allowed to occupy and use the land, informal land sales have taken place. Today, one third of the community households have no land titles (see Land Tenure and Household).

Floodplain Ecosystem

The floodplain ecosystem covers 200 ha and includes two different zones: *flooded forest* and *natural grassland*. The flooded forest zone is dominated by *açai* palm trees (*Euterpe oleracea*), which yield a high-calorie fruit used for consumption and commercialization. This zone is primarily used for extraction of *açai* fruit, and secondarily for extraction of some medicinal products and timber trees. The natural grassland zone has no woody vegetation and is dominated by grass species used in grazing areas during the dry season.

The floodplain ecosystem has undergone changes in ownership as well. Although the floodplain has been state property since 1934, land transactions still occur

in the region (de Castro, 2000). In Patos, the floodplain area was "owned" privately until 1993 by a series of landholders who allowed local residents free access to its products. During the early 1990s, the last landholder decided to sell the floodplain area, and the prospective buyer was a rancher who had just moved to Patos (the 33rd household, see Land Tenure and Household). Local residents believed that the new rancher would prohibit them from using the floodplain resources.

Their perception of the threat of losing access to the floodplain drove a few residents to organize a group to buy the land. All local residents were invited, but only one-third of the households decided to participate. Each of the 11 households paid US$250 for a share. As a result, access to the floodplain was ensured, but to only one-third of the community.

Land Tenure and Household

With the exception of one household, the changes in land tenure have led to the formation of three household groups since 1993 (see Table 1): (1) 11 households hold a collective share of the floodplain as well as private parcels on the upland, Collective-Private Landholders (CP); (2) 11 households hold only private parcels on the upland, Private-Landholder (PL); and (3) 10 households own no land, Landless (LL).

The CP group has access to both upland and floodplain, the PL group has access to upland parcels only, and the LL group has access to upland parcels only with an owner's permission. The LL households are mostly married children of PL and CP members who either did not have families or were under age 18 at the time of parcel distribution. They have their own houses located in areas that average 30 m by 50 m. Landless households cultivate on relatives' land as sharecroppers or by favor, or rotate their gardens among different borrowed lots. They are usually involved in agricultural production, mainly for subsistence, and secondarily for cash income, and are an important source of labor. The 33rd household refers to a rancher who is considered an outsider by the community. Despite holding a private parcel in the Patos upland ecosystem, this household is not categorized as a PL, because the collective action was in many ways a reaction against this household (discussed later). Thus, this household will be treated as a separate actor given its particular position in the present local political-ecological arena.

Table 1. Distribution of Households in the Patos Community According to Land Ownership: CP (Collective-Private), PL (Private-Landholder), and LL (Landless)

Category of Household	**Land Tenure**	**Frequency of Households**
LL	None	10
PL	Upland parcel	11
CP	Upland parcel + Floodplain share	11
Total		32

Data Collection

We carried out the household survey during two visits in 1997 and 1998 to evaluate whether there was a relationship between household attributes and collaborative behavior. We obtained information on demography, land use, socioeconomy, and land tenure through structured interviews with 33 households. We focused our analysis on PL and CP households because they share similar conditions in terms of land tenure to the upland ecosystem, as well as similar economic opportunities.

In addition, a vegetation inventory in the upland ecosystem was conducted to examine the ecological conditions of the upland vegetation vis-à-vis the collective action in the floodplain. Based on INCRA's grid map that displays a total of 28 private parcels across the upland forest, ten parcels (50 ha each) were randomly chosen across PL and CP groups (five parcels each). In each parcel, a 200-meter baseline along 100 meters on each side was measured in the mature forest and 10 plots of 300 m^2 (15 m x 20 m) lying to either side of the baseline were randomly selected. We sampled a total of 3 ha distributed in 100 plots. All trees above 2.5 cm dbh (diameter at breast height) were measured. For this paper, we considered commercially valuable trees to be only those above 45 cm dbh, based on Uhl and Vieira (1989).

Finally, interviews on land use were carried out with the landholders in each of the surveyed upland parcels to map the distribution of land-cover classes (pasture, cropfield, and secondary vegetation), and to learn about the land-use history and the fallow ages.

FACTORS AFFECTING THE SECOND COLLECTIVE ACTION

The Emergence of Collective Action

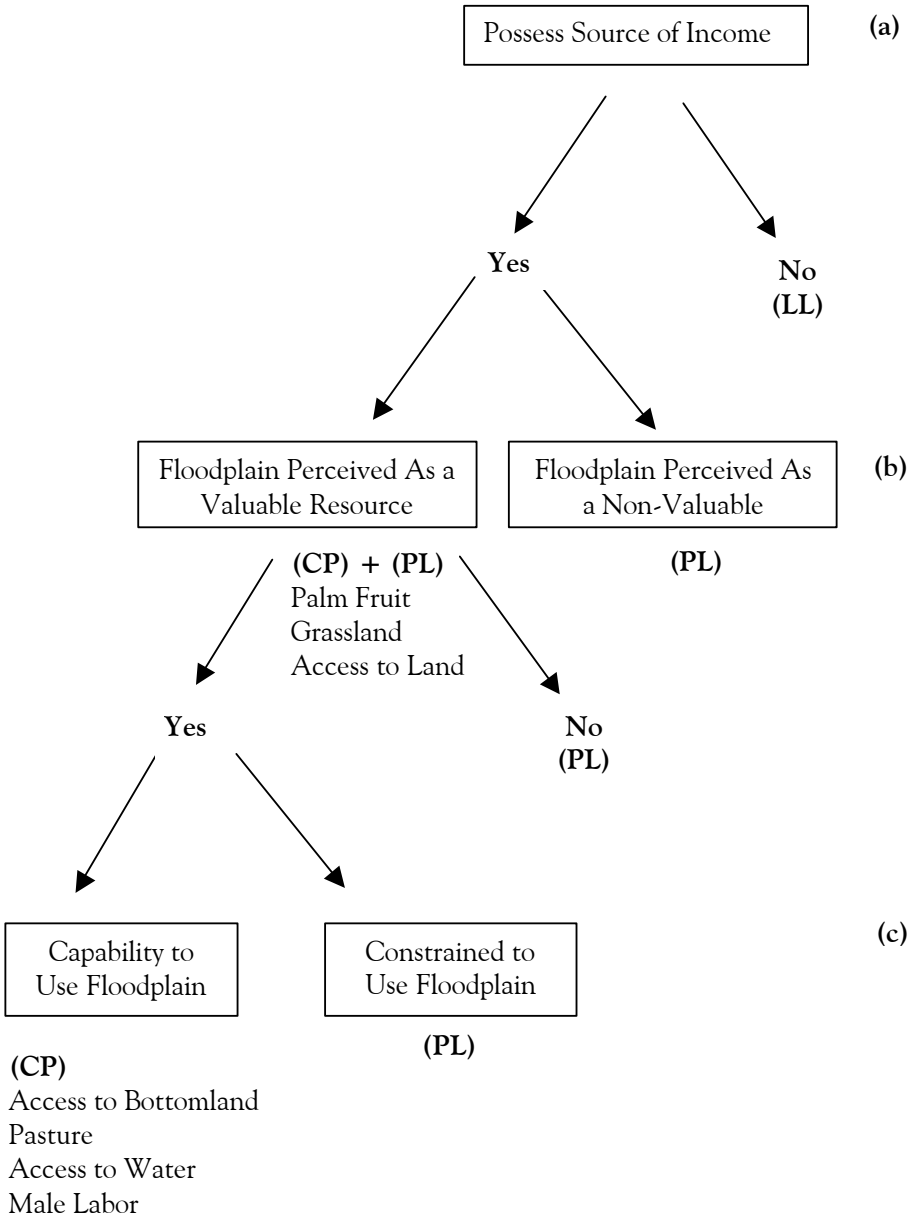
Because the collective action in the floodplain was based on the land purchase, we assume that a household takes into account the expected costs and benefits of obtaining and investing cash to cooperate with the group. In Figure 2, we represent a decision tree that we hypothesize captures the essence of a household's reasoning about whether to join others in the purchase of the floodplain land. In the first-level decision, income may explain why individuals from the LL group did not participate (see "a" in Figure 2). Because the LL group held no parcels in the upland ecosystem, they did not have access to farm credit (bank loans) or to timber for selling.

Assuming the same level of income for CP and PL groups, we expect that the way each household measures the economic importance of the floodplain would determine the second-level decision regarding their interest in joining the collective action (see "b" in Figure 2). In this regard, those PL households that did not value the floodplain resources (e.g., natural grassland for grazing) have little incentive to collaborate.

The importance of a resource is related to ecological and social features of the household. These features may influence the third-level decision by constraining households from exploiting the potential resources from the floodplain ecosystem. In other words, households that face more favorable ecological and social conditions for

using the floodplain resources are the ones predisposed to collective action (see "c" in Figure 2). Each decision-making level is discussed in more detail below.

Figure 2. Hypothetical Decision-Making Tree for Participating in the Collective Property of the Floodplain, Involving Three Groups of Households: Collective-Private (CP), Private-Landholder (PL), Landless (LL)



Sources of Income

CP and PL groups have three main sources of income available to them: farm credit, retirement income, and timber sales. Since 1989, the State Bank of Amazônia has provided farm credit for agropastoral activities. We expect that a larger number of CP households than PL have borrowed money to invest in cattle and/or to buy a floodplain share. A moderately strong relationship exists between access to credit and participation in collective action (tau = 0.64), as 82 percent of CP households used farm credit compared to only 18 percent among PL households (Table 2).

Table 2. Social and Ecological Variables of Collective-Private (CP) and Private-Landholder (PL) Households in the Patos Community Related to Decisions to Participate in the Collective Action (CP households = 11; PL households = 11)

Variables	**CP (%)**	**PL (%)**	**Strength of Association (Tau-b)***
Sources of Income			
Uses Farm Credit Line	82	18	0.64
At Least One Member of Household Has Retirement Income	64	27	0.37
Trades Wood	100	91	0.19
Value of Floodplain Resources			
Grazes Cattle (a herd of at least 6)	45	8	0.54
Harvests *Açai* (for commercial purpose)	64	0	0.64
Conditions for Use of Floodplain Resources			
Access to Water	55	0	0.61
Access to Bottomland Pasture	36	0	0.47
Male Labor	45	9	0.41
Leadership			
Access (has one or more leaders)	45	0	0.54

*Because this is a census of the relevant households, tests of significance are not appropriate.
Note: One household from the Patos community is not included in the present analysis because the head is an outsider rancher. He is the cattle rancher who wanted to buy the floodplain area in the early 1990s. He has a herd of more than 50 cattle, opened more than 16 ha for pasture area in the bottomland zone, and uses both family and paid labor.

With regard to retirement income, women older than 60 and men older than 65 receive a monthly stipend of about US$120. This contributes a great deal to the household economy in comparison to a salary of US$60/month for an elementary school teacher, which is a highly valued profession in the region. Results show that a larger percentage of CP (64 percent) than PL households (27 percent) have at least one member who is retired and thus receives a regular income, which indicates that

availability of retirement salary is moderately associated with participation in buying the floodplain land collectively (tau = 0.37; Table 2).

Finally, both PL and CP households have access to woody trees in the upland forest, and the interviews revealed that almost everyone had sold wood in the past (Table 2). The price paid per tree is about the same among all households (mean of US$10 per tree), giving them a similar profit from trading. Taking into account only data on trading wood, income from timber sales is weakly associated with the decision to cooperate in a group (tau = 0.19; Table 2).

In general, in regard to sources of income, farm credit and retirement income are positively associated with participation in the floodplain purchase. Given their inability to gain access to farm credit or retirement income, it is now clear why the LL households could not afford to join a collective action and chose not to participate. But these variables do not fully explain why PL households did not cooperate while the CP group did. PL households could have obtained credit based on their land, and some of these households had retirement income. The fact that some PL households did not participate may be related to the way they value floodplain resources. In order to address this question, two main floodplain products are analyzed in the next section: natural grassland and a*çai* fruit.

Value of Floodplain Resources

We suggest that local residents take into consideration the economic value of products such as natural grassland and *açai* fruit in the household economy (subsistence or cash income) when deciding whether or not to participate in a collective effort.

The first product, natural grassland, is directly related to cattle raising. Cattle are used as draft animals or monetary investments and are raised in the upland during the flood season and in the floodplain during the dry season. A household that has one or two cows to pull carts will cultivate a small area of grass (usually in the garden) to feed them. For monetary goals, a larger number of cattle are raised (between 10 and 15), and a larger area for pasture is necessary. Thus, we expect that CP households would (1) be more involved in cattle than PL households because they would value grassland as a grazing area, and (2) have more impact on plateau forest due to the opening of the pasture. Results show that raising cattle is moderately related to decisions on collaborating with collective action (tau = 0.54), since 45 percent of CP households raise cattle for monetary investment, with a combined total of 61, whereas only one PL household (8 percent) raised a herd of six (Table 2). The impact on the plateau forest is addressed in detail in the next section.

Açai is an important subsistence and cash product from the floodplain in Santarém county and other parts of the Amazon region (Anderson, 1990; Brondízio and Siqueira, 1997). The fruit can be promptly sold in the local market and harvesting *açai* is a low-cost extractive activity, thus increasing the interest among all households in collecting it. The establishment of the collective property in the floodplain generated

considerable conflict over the *açai* harvest. In the first year of the collective ownership only CP members were allowed to harvest *açai* for commercial use, which created strong resentment among PL and LL residents. By the second year, after harsh conflict, CP members allowed everyone to harvest *açai* for both subsistence and commercial purposes. We cannot reconstruct the differences in harvesting of *açai* fruit prior to the collective action, but the present data show that there is a moderate strength of association between *açai* harvesting and participation (tau = 0.64). At the time of the survey, 64 percent of CP households harvested *açai* for commercial purposes, while no household among the PL group did (Table 2).

Thus, we find that the value assigned to floodplain resources by Patos residents is positively associated with participation. The economic importance of floodplain products helps to explain why Patos residents were attracted toward participation in a collective action, but it does not fully explain why PL households refrained from collaborating, since they were potential cattle raisers and *açai* collectors. In the next section, we analyze another set of variables affecting the decision to participate or not.

Conditions for Use of Floodplain Resources

The exploitation of consumptive products in the floodplain may depend upon the opportunities and constraints that are related to conditions for using them. While harvesting palm fruit is a low-cost extractive activity, engaging in commercial cattle ranching may depend upon a set of ecological and social conditions.

The bottomland zone presents a favorable environment for cattle raising, because it is close to the river (good water access) and is dominated by secondary forest (lower time and labor cost for pasture opening compared to mature forest). In contrast, the plateau zone is dominated by mature forest and is located further from the river. Therefore, households whose parcels are solely in the plateau zone face limitations in raising herds of cattle and would thus have less interest in obtaining access to the floodplain. We expect that CP households holding parcels in the bottomland area would be more likely to have participated than those in the plateau zone. Results confirm that 36 percent of CP households hold parcels in the bottomland zone in contrast to none among PL households.

In addition to ecological conditions, commercial cattle raising depends on the household's ability to carry out ranch-related activities. Cattle raising is typically a male activity in the Amazon region (Hecht, 1993), and the availability of an active male labor force plays a key role in a household's decision to engage in cattle ranching. Because of the CP group's investment in cattle, we expect that CP households would have more male labor than PL households. Although availability of labor is moderately related to collaboration with such a collective effort (tau = 0.41), results show that a larger portion of the CP group (45 percent) has more than one male in comparison to the PL group (9 percent) (Table 2).

In sum, conditions for harvesting *açai* in terms of labor force, access to water, and access to bottomland are positively and moderately associated with

cooperative behavior (Table 2). Therefore, less favorable conditions for exploiting the natural grassland faced by the PL households help to explain why they did not participate in the collective effort.

Prior Leadership Experience

Finally, due to the history of threats to land access, the interest in maintaining access to the land prompted local leaders to initiate collective action. Leader is defined as an individual or group of individuals who assume leading roles within the community in the decision-making process of the group's political agenda. Currently, the leaders in Patos are four residents who have a history of political participation and leadership roles in the upland movement. They are in their 60s, Catholic, and belong to traditional families with strong kinship ties. They have contributed to and are still fulfilling functions within the Patos political structure, such as coordinator, promoter, and representative of the community association and of regional unions.

Thus, the CP group is expected to have more leaders than the PL group. The results show that 45 percent of CP households have a leader, as opposed to none among the PL group (Table 2), indicating a moderate relationship between the presence of a leader and participative behavior (tau = 0.54). The four households who were leaders in both collective actions are the only CP members who have no cattle. Their participation is partially explained by their interest in investing in cattle in the near future. Having participated actively in the prior collective action made them particularly sensitive to the risk of losing access to the floodplain resource to an outsider.

Summary of Empirical Results

Table 3 presents all the attributes discussed above in one table. This array enables one to examine the distribution of households that engaged in collectively purchasing the floodplain land as contrasted with the households that did not. Each variable is given a score of zero if it is not present. For all variables, except male labor and cattle, a "1" means that the variable is present. For male labor, a "1" connotes that up to two male laborers live in the household and a "2" connotes that three or more are present. For cattle, one or two are coded "1," and more than two are coded "2." The coded values were then summed to provide a rough indication of the overall presence in a household of attributes that are potentially conducive to economic use of the floodplain land. As one can see, the households who jointly purchased the floodplain land have higher scores than those who did not, with few exceptions. The sum of attributes ranged from 9 to 4 for the households who jointly purchased land and from 3 to 1 for those who did not, with the exception of households 12 and 23. Household 12 joined the CP group initially but dropped its membership months later due to disagreements with other members of the CP group. This household has a total of 10 active individuals who produce manioc flour on a commercial basis, and owns two cows, adding up to a higher score than the remaining PL households.

Table 3. Matrix Displaying the Attributes Measured for Each Household of the Collective-Private (CP), Private-Landholder (PL), and Landless (LL) Groups

ID	Sources of Income			Value of Floodplain Resources		Conditions for Use of Floodplain Resources			Leadership	Total
	Credit Line	*Retirement Income*	*Trades Wood*	*Grazes Cattle*	*Trades Açai*	*Access to Water*	*Bottomland Pasture*	*Male Labor*		
CP Group										
hh1	1	1	0	2	1	1	1	2	0	9
hh2	1	1	0	2	0	1	1	2	0	8
hh3	1	0	1	2	1	0	0	2	1	8
hh4	1	0	0	2	1	1	1	2	0	8
hh5	1	0	1	2	1	1	0	2	0	8
hh6	1	1	1	0	1	1	0	1	1	7
hh7	1	1	1	1	0	0	0	1	1	6
hh8	0	1	0	0	0	1	1	1	1	5
hh9	1	1	1	0	0	0	0	1	1	5
hh10	1	0	1	0	1	0	0	1	0	4
hh11	0	1	1	0	1	0	0	1	0	4
PL Group										
hh12	1	0	1	1	0	0	0	2	0	5[a]
hh13	0	1	1	0	0	0	0	1	0	3
hh14	0	0	1	0	0	0	0	1	0	2
hh15	1	0	0	0	0	0	0	1	0	2
hh16	0	0	1	0	0	0	0	1	0	2
hh17	0	1	1	0	0	0	0	0	0	2
hh18	0	0	1	0	0	0	0	1	0	2
hh19	0	1	1	0	0	0	0	0	0	2
hh20	0	0	1	0	0	0	0	1	0	2
hh21	0	0	1	0	0	0	0	1	0	2
hh22	0	0	1	0	0	0	0	1	0	2
LL Group										
hh23	0	1	0	0	1	0	0	2	0	4[b]
hh24	0	0	0	0	1	0	0	1	0	2
hh25	0	0	0	0	1	0	0	1	0	2
hh26	0	0	0	0	1	0	0	1	0	2
hh27	0	0	0	0	1	0	0	1	0	2
hh28	0	0	0	0	0	0	0	1	0	1
hh29	0	0	0	0	0	0	0	1	0	1
hh30	0	0	0	0	0	0	0	1	0	1
hh31	0	0	0	0	0	0	0	0	0	0
hh32	0	0	0	0	0	0	0	0	0	0

Note: Except for male labor and cattle, 1 = yes and 0 = no. For male labor, 0 = no male labor, 1 = 1 to 2 male labor, and 2 = 3 or more male labor. For cattle, 0 = no cattle, 1 = 1 to 2 cattle, and 2 = 3 or more cattle.

a HH12 joined the floodplain collective endeavor but dropped out months later.

b HH23 has a bad local reputation because it helped a large-scale rancher rather than supporting the upland social movement. The head now receives a retirement salary, which provides a household economy with stable monthly income.

The LL group has been discussed in this paper in terms of how the lack of private rights to the upland affected their participation in the collective property rights to the floodplain (Figure 2). Lack of private rights affects them in terms of financial sources, which reflects in the lowest scores, from 0 to 2, with the exception of household 23. In that household, the head individual "betrayed" the upland land movement by working for the large-scale rancher. As a result of his non-cooperative behavior, the household received no private parcel when they were allocated. This household now has a work force of seven, and the head receives a monthly retirement stipend that provides the household with a stable source of income. All these positive attributes give the household 23 case a higher score than the rest of the LL group, while its bad reputation has kept it isolated. In general, households that participated in the collective action have more of the assumed important variables than PL and LL households, which means higher material assets among the CP group. In sum, the higher the score, the higher the chances are for cooperating.

The Outcome of Collective Action

The main value of the floodplain for the participants is related to *açai* fruit and natural grassland. The low degree of use of those products suggests that currently no negative impact of human action has taken place in this ecosystem. The total number of cattle is still small (approximately 60) for the available grazing area of approximately 200 hectares. By the same token, extraction of *açai* fruit does not involve tree removal, so the flooded forest has remained relatively unchanged. Thus, the floodplain collective action seems to have been able to maintain that ecosystem's integrity.

While collective action has taken place specifically in the floodplain ecosystem, it has also affected the upland ecosystem in many ways related to cattle ranching. Extraction of timber to raise money to buy cattle and increased demand for pastureland during the early 1990s represent the two major driving factors regarding change in the forest cover on the upland ecosystem. The logging activity affects the composition, structure, and regeneration of forest, while the opening of pasture affects the landscape change. When all species (including trees, saplings, and seedlings) are considered, the forest parcels of both PL and CP groups have similar diversity indexes of 4.8 and 4.9, respectively. Yet, when only trees above 10 cm dbh are considered, the forest areas held by PL households present a lower richness value in species than CP parcels (Table 4). It is important to note that higher diversity in land cover is not necessarily related to ecosystem health. Some studies show that increased numbers of species and individuals may be related to logging activity, especially among light-demanding and pioneer species (Carvalho, 1992).

The high number of secondary vegetation species in the CP parcels suggests that trees were probably removed in those parcels, creating more forest gaps than in PL parcels. Considering only trees above 45 cm dbh, the parcels of CP households have, on average, a smaller number of commercially valuable species compared to

those of PL households. Logging activity has also affected the vegetation structure related to the reduction of basal area after logging (see Futemma, 2000) as observed in other Amazonian regions (Lopes et al., 1984; Uhl and Vieira, 1989). While the PL forest parcels display a basal area similar to unlogged areas, CP forest parcels present traits more similar to logged ones (Table 4). Additionally, PL parcels present a smaller number of young trees between 10 and 26 cm dbh than CP parcels (Table 4). This pattern changes above 26 cm dbh, in that PL parcels have more trees than CP parcels. These results suggest that there is a larger number of young trees among CP parcels due to regeneration processes than in PL parcels, as also observed by Lopes et al. (1984).

Table 4. Effects of Floodplain Collective Action on Tree Species in the Upland Forest - Comparison of Forests Held by Collective-Private (CP) and Private-Landholder (PL) Households in the Patos Community

Parameter (per plot)	**CP[a] Mean (*SD*)**	**PL[a] Mean (*SD*)**	**T-Test**
Number of Trees 10–26 cm dbh	14.42 *(4.64)*	13.88 *(3.52)*	1.68
Number of Trees > 45 cm dbh	1.09	1.48	---
Number of Species > 10 cm dbh	12.43 *(3.97)*	11.68 *(2.38)*	1.68[b]
Number of Species > 45 cm dbh	1.04	1.41	---
Total Basal Area (m^2/ha)	26.61 *(18.88)*	33.91 *(21.81)*	1.68[c]

[a] N = 49
[b] $p < 0.1$
[c] $p < 0.05$

Besides forest structure, landscape changes related to cattle ranching are expected to be more pronounced in parcels among the CP group, because they have opened a larger area for pasture in the bottomland. The results of an analysis of remotely sensed images (reported in Futemma 2000) show that the CP group has not only opened larger areas of pasture (1 percent of the lot area on average) but also larger farming areas (4.6 percent of the lot area on average) than the PL group (0.4 percent for pasture and 2.9 percent for farming). Consequently, CP households have smaller areas of mature forest and secondary vegetation due to their logging and cattle ranching activities.

DISCUSSION

The Emergence of Collective Action

Patos has experienced two collective actions in less than 20 years. Both were similar in some aspects but had different outcomes. Each case involved a group of people who perceived a threat to their access to and use of resources. The conflict over the upland ecosystem ended with the privatization of this area, while the floodplain conflict led local residents to purchase the area and convert it into a collective property. The entire community cooperated as a group in the upland conflict (with one exception of an excluded household). The group had support from external agents, and their access was maintained due to considerable time and effort of local leaders. In the floodplain ecosystem, only part of the community participated and the political process was mostly internal. Group access was maintained by a purchase of the relevant land. Therefore, the cooperation that occurred in the upland ecosystem demanded mainly political participation, whereas, in the floodplain, it demanded direct economic investment and political involvement.

Although the processes that took place in the upland and floodplain were different events, they are closely related due to ecological and social connections between the two ecosystems. The location of Patos between the floodplain and upland ecosystems provides an ecological opportunity to develop cattle ranching. The provision of year-round access to pasture—cultivated pasture on the upland during the flood season and natural pasture on the floodplain during the dry season—lowers the cost of pasture maintenance. However, the proximity to floodplains and uplands is not enough for the local population to use the resources unless institutional arrangements ensure their access to both ecosystems. In Patos, residents were able to achieve institutional access to the upland ecosystem and, in turn, to improve access to sources of money. Since the floodplain's collective action was based on a financial investment derived from use of the upland, the floodplain collectivization is ecologically and socially related to the upland privatization.

In the past, the local population enjoyed access to both the upland and the floodplain, but held no legal rights to either location. The development of legal private rights was not necessary until access to use and residence in the area was threatened by the actions of an external rancher. The 15-year period of engagement in the social movement provided the residents with two major assets. First, their legal property rights to the upland provided new sources of capital (timber and farm credit) and land tenure security. These created incentives for local residents to engage in long-term investments on their lands. Second, the experience of participating in this political process generated an unintended outcome: formation of social capital based on local leadership and integration with external supporting actors such as religious, civil, and grassroots organizations.

The first group of assets—the private rights to the upland parcels—is related to the floodplain ecosystem through cattle activity. Cattle ranching is an

attractive economic activity among smallholders because it demands less labor and involves lower production costs (HECHT, 1993). A source of money from natural (timber) and institutional-based (credit lines) capital explains why almost all cattle raisers decided to cooperate in a group when access to the floodplain was threatened. Cattle ranching is carried out primarily by male members of the household and relies upon a water source. The differential household structure among CP, PL, and LL groups reveals that household assets, such as available labor, are key variables influencing participation in collective action whenever the capability to exploit the resource strongly affects their decisions.

In addition to the individual interest in and the financial capability of purchasing the floodplain area, the CP group enjoyed organizational abilities to develop an institutional arrangement and encourage other residents to convert the land into a collective property. The leaders, who played a key role in the origin of the floodplain collective action, are the same leaders who participated extensively in claiming the land rights to the upland, revealing the political relationship between the process of land tenure change in the upland and floodplain ecosystems.

The formation of a leadership is an important asset in most collective action groups, particularly in areas with poor institutional support (SINGH & BALLABH, 1994; DURSTON, 1998). In Patos, as in other Amazonian floodplain areas, peasants regularly exchange labor, food, and other products and even share land among kin households (LIMA-AYRES, 1992; FUTEMMA, 1995). Social capital is an asset that may be built from a history of past cooperation (DURSTON, 1998; WHITE & RUNGE, 1994). Previous experience in group cooperation and their success in a previous collective action contributed to the Patos residents' willingness to initiate the collective action that occurred in the floodplain ecosystem.

In sum, the ecological, social, institutional, and economic connections between floodplain and upland ecosystems are key to understanding the emergence of the collective action. By the same token, the analysis of the ecological outcomes of the collective action indicates a similar interaction between floodplain and upland forest.

The Outcome of Collective Action

Cattle raising has been one of the main activities from small- to large-scale rural producers, and changes in land-use patterns can be observed throughout the Amazon region (Fearnside, 1989). The integrated use of floodplain and upland ecosystems for cattle ranching has steadily increased during the past two decades in the Lower Amazon and has altered both ecosystems, in some places at higher degrees of disturbance than others (ARIMA & UHL, 1997).

In Patos, the connection between upland and floodplain ecosystems is not only related to the influence of upland private rights, but to the emergence of collective property rights on the floodplain. The upland and the floodplain are also related in terms of ecological outcome in forest cover. The floodplain ecosystem has not shown

signs of change in vegetation cover since the collective property regime was established, but that does not mean collectivization has led to resource conservation. The change in property rights may be too recent to be reflected in the land cover. While the group still holds a small herd, there is a trend toward increasing the number of cattle. Therefore, an impact similar to what would take place faster by the rancher and his large herd is still possible in the long run by the joint owners. A second reason the collectivization of the floodplain should not be related directly to forest conservation is its connection with changes in upland forest cover. The decision of the participants to purchase the floodplain area was based on sources of money provided from the upland system (such as timber and credit lines), and value of the land related to the cattle investment was backed up by conversion of upland forest to pasture.

Thus, although collective action in the floodplain has not directly affected the ecosystem where it took place, it has indirectly affected the land-cover change on the adjacent ecosystem due to the integrated production system of the households involved in the process. The role of cattle ranching in changing land-use patterns of both the upland and the floodplain ecosystems simultaneously reveals the importance of an ecosystemic approach in studying the impact of human action on natural systems. The ecosystemic approach enables one to understand how human actions that take place in a given ecosystem can affect (and be affected by) another ecosystem (ELLEN, 1982; MORAN, 1979). This approach stresses dynamic processes. At the present time, the incentives at stake seem to lead CP households to use the upland forest more intensively than PL households. We cannot yet firmly conclude that in the long run CP households will continue to impact the forest more than PL households. The "side-effect" of the floodplain collectivization on the upland forest does not represent a prompt threat to that ecosystem. The impact is still small and represents a tradeoff between the social responsibility of local users to maintain their access to an area they have long relied upon for their livelihood and the chance to ensure maintenance of ecological integrity in both ecosystems.

In this case, the questions related to the outcomes of collective action must be closely attached to both ecosystems. The ability of the joint owners to develop a robust institutional arrangement that accounts for the interconnection of floodplain and upland ecosystems, the external economic and political changes that affect the production systems and the local dynamics that influence the balance between collaboration and conflict are fundamental to achieving a positive performance of this local enterprise in the long run. Future studies will reveal how this dynamic system evolves over time.

CONCLUSION

The Patos case shows that the analysis of emergence and outcomes of collective action should consider other scales of analysis besides a single community. At the household level, differences in household assets may influence the motivation to participate in collective action. Although all community members were invited to

be part of a floodplain collective property, a low investment capability explained why the Landless group did not participate. The potential value of the floodplain resource explains why the Collective-Private group participated, and restrictions on credit and income and lack of other economic incentives explain why Private-Landholder households refrained from participating. Landscape-level analysis reveals that connection between the managed ecosystem and adjacent ecosystems influences the decisions to participate as well as the ecological outcomes of the collective actions. Finally, floodplain collectivization was not only influenced by the upland privatization but influenced the ecological outcomes on the upland ecosystem.

The two ecosystems are not only spatially connected. They also have a temporal connection regarding the creation of social capital. The first collective action that took place in the upland ecosystem helped to build the social capital that was used in carrying out the collective action that took place in the floodplain ecosystem twenty years later. The social capital from external actors in the upland collective action enabled local residents to initiate the floodplain collective action drawing almost entirely on internal resources. Local leaders were able to organize the group, seek external assistance in obtaining information, and gain bargaining power with local government agencies.

In sum, the analysis of collective actions in systems with pronounced social and ecological heterogeneities requires analysis at different scales—combining household, community, and region—to tease out factors influencing the emergence and outcomes of those local efforts.

ACKNOWLEDGEMENTS

We appreciate the support provided by the National Science Foundation grant SBR9521918 to the Center for the Study of Institutions, Population, and Environmental Change and the support provided by the World Wildlife Fund grant CSR-107-98 to the first author for doctoral field research. We are grateful to Projeto Várzea (IPAM–Instituto de Pesquisa da Amazônia) for their logistic support. We owe our gratitude to Manoel Cordeiro for plant identification and Antonio Jerônimo and Joanna Tucker for field assistance. We would also like to thank Emilio Moran for his helpful comments on an earlier draft of this paper. We thank Joanna Broderick and Patty Zielinski for careful editing of this paper. Finally, we are deeply grateful to all Patos residents for making the collection of data possible. The authors assume full responsibility for the content presented in this paper. This article was originally published in *Society and Natural Resources,* 15: 503-522, 2002.

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many variables, which makes them an important tool in interdisciplinary studies on environment.
Keywords: multivariate analyses, ecology, environmental sciences.

SÉRGIO LUÍS BOEIRA

Political Ecology: GuerreiroRamos and Fritjof Capra

The aim of this essay is to contribute with the articulation of a trans-disciplinary research field, *political ecology*, by means of the comparative synthesis of two works: "The New Science of Organizations" by Alberto Guerreiro Ramos (1981), and "The Mutation Point", by Fritjof Capra (1982). The central hypothesis of this article is that both authors, although with very different academic background, get to very similar conclusions in these two works, under the same emergent paradigm. Given the still diffuse context of environmentalist thought these books may be considered *classics of political ecology*.
Keywords: paradigm, ecology, instrumental reason, mechanistic, systemic.

Ecologia Política: Guerreiro Ramos e Fritjof Capra

Este ensaio tem por objetivo contribuir com a articulação de um campo de pesquisa trans-disciplinar, a ecologia política, por meio da síntese comparativa de duas obras: A Nova Ciência das Organizações, de Alberto Guerreiro Ramos (1981), e O Ponto de Mutação, de Fritjof Capra (1982). A hipótese central deste trabalho é que os autores, apesar de suas formações acadêmicas muito diferentes, chegaram a resultados muito semelhantes nestas obras, a partir de um mesmo paradigma emergente. Dado o contexto ainda difuso do pensamento ambientalista, estes livros podem ser considerados clássicos da ecologia política.
Palavras-chave: paradigma, ecologia, razão instrumental, mecanicismo, sistêmico.

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A Emergência e os Resultados da Ação Coletiva: Uma abordagem institucional e ecossistêmica

A participação numa ação coletiva é estudada com freqüência por meio de uma análise baseada nas comunidades e enfocada nas características sociais dos participantes e nas características ecológicas do sistema manejado. Este estudo refere-se à importância de se limitar a análise ao nível das famílias para compreender os diferentes incentivos

individuais que colaboram (ou não), assim como de se ampliar a análise ao nível da esfera territorial a fim de se avaliar o resultado ecológico das formas locais de ação coletiva. Um estudo feito numa comunidade costeira de 33 famílias na Baixa Amazonia situada entre dois ecosistemas diferentes —uma mata/floresta de propriedade privada situada em terras altas e uma planície pluvial pertencente a uma comunidade— revela que a análise baseada nas famílias mostra que a heterogeneidade dentro da comunidade conduz a diferentes incentivos para participar das atividades na planície pluvial. A análise sistêmica, no entanto, mostra que a interconexão entre o ecosistema manejado e o ecosistema adjacente influi nas decisões para participar assim como nos resultados das ações coletivas.
Palavras chave: ação coletiva, recursos naturais compartilhados , ecosistema, planície pluvial, uso florestal, heterogeneidade, Baixa Amazônia, direitos de propriedade, capital social, terras altas

The emergence and outcomes of collective action: an institutional and ecosystem approach

Participation in collective action is frequently studied through a community-based analysis, with focus on the social features of the participants and on the ecological features of the managed system. This study addresses the importance of scaling down to household level to understand different individual incentives to collaborate (or not) as well as scaling up to the landscape level to evaluate the ecological outcome of the local forms of collective action. A study of a riparian community of 33 households in the Lower Amazon located between two distinct ecosystems —a privately owned upland forest and a communally owned floodplain— reveals that household-based analysis uncovers how heterogeneity within the community leads to different incentives for participation in the communal floodplain, while systemic analysis reveals that interconnection between the managed ecosystem and adjacent ecosystem influences the decisions to participate as well as the ecological outcomes of the collective actions.
Key words: *collective action, common-pool resource, ecosystem, floodplain, forest use, heterogeneity, Lower Amazon, property rights, social capital, upland*

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MARIA CELINA PEREIRA DE CARVALHO

A Atualização do Conceito de Quilombo: Identidade e Território nas Definições Teóricas

O presente artigo trata das novas definições sobre comunidades de quilombo, elaboradas a partir da necessidade de reconhecimento oficial destas para que lhes seja assegurado o direito constitucional de propriedade sobre suas terras. Discute-se aqui o abandono de uma visão cristalizada pela historiografia clássica baseada no isolamento