

LANDSCAPE DIVERSITY, LOCAL POWER, AND THE APPROPRIATION OF NATURAL RESOURCES IN THE LOWER AMAZONIAN FLOODPLAIN

By Fabio De Castro

PhD student at School of Public and Environmental Affairs (SPEA), Indiana University and affiliated to the Anthropological Center for Training and Research on Global Environmental Change (ACT), Indiana University

Address:

ACT - Student Building 331 - Indiana University, Bloomington, IN 47405, USA
email B fdecastr@indiana.edu

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INTRODUCTION

The debate over the Commons can be divided into three main phases, according to the theoretical assumptions in the framework. The first phase is marked by the acknowledgement of the relationship between resource depletion and its form of appropriation. The seminal publications by Gordon (1954) and Scott (1955) introduced the question of the Commons in an institutional approach by discussing how open access to the oceans was responsible for the increasing depletion of maritime fish resources. Hardin (1967) later applied game theory to explain the logic behind resource overuse. This Tragedy of the Commons model which assumes that users are homogeneous, profit maximizers failed to recognize the ability of individuals to build a social arrangement of resource appropriation (Feeny *et al.* 1990; Feeny *et al.* 1996).

It was not until the Cyriacy-Wantrup and Bishop's publication on the concept of common property (1975) that the Tragedy of the Commons model was first contested. The authors argued that human populations were able to engage in collective property regimes and that, in many cases, the so-called Open Access systems were in fact communal property systems. The recognition of a fourth property system overlooked in Hardin's model was the starting point of the second phase of the Commons debate. This phase was led by social scientists who examined the relationship between resource use and resource appropriation within a local ecological context. Netting (1976), in his Groundbreaking study on the pattern of property systems in the Swiss Alps, demonstrated that property regimes are closely related to ecological and economic features of the resource, a fact which influences the cost/benefit balance of different forms of appropriation.

Netting's study was followed by a massive number of case studies published in the 80s that provided strong ethnographic evidence of collective property systems across different ecological settings and cultural backgrounds. Those systems were mainly built upon traditional ecological knowledge of the system and maintained through local social norms (Ruddle and Akimishi 1984; Ruddle and Johannes 1985; McCay and Acheson 1987a; Berkes 1989; see also Martin 1989; 1992, Hess 1996 for a collection of publication on this subject). This *Cultural ecology* approach to the commons made a turn in the theoretical perspective by annulling two major assumptions from the former model. First, that users were not isolated individuals, but groups that were able to develop local institutions to control access and use of resources (McCay and Acheson 1987b); second, that resource depletion is not an unavoidable outcome path that resource users take; rather, in most cases, it is a consequence of external factors such as market pressure, governmental policies, and loss of local control, which destroy long standing, efficient local institutions (Berkes 1985; McCay and Acheson 1987a; Bailey and Zerner 1992).

The defenders of the *Cultural ecology* approach have not only contributed to the understanding of the relationship between local populations and resource use but also to challenging the dominant private-oriented view used in conservation studies. Key terms such as *Community-based management* and *Co-management* are commonplace in the development projects, which recognize the importance of the devolution of local control over resources in order to achieve both ecological conservation and social justice for those who have traditionally used the resource (Cernea 1991). Although this change should be seen as an accomplishment, it also represents a concern regarding the success of such an enterprise. The efficiency of a local management system should not be taken for granted. It depends on a set of contextual factors that are embedded in the social relationship at the local and regional levels. The ability of local management to respond efficiently to local changes and, therefore, to successfully integrate into a broader institutional arrangement has been treated in more detail in the third phase of the *Commons* debate which has been taking place in the 90s.

The volume edited by Pinkerton (1989) on cooperative management represents a benchmark in this "political ecology" approach to the commons. It recognizes that local institutions represent a strong potential to conserve natural resources; yet it also recognizes that the development of a co-management system involves multiple resource use, and participation of different user groups in a complex political process. Therefore, although it takes into account the role of local management in resource conservation, this new approach also recognizes that collective action requires the provision of certain incentives to the user groups (Ostrom 1990). In other words, while the *Cultural ecology* approach emphasizes the relationship between users and the resource, the *Political ecology* approach emphasizes the relationships among users in regard to the resource use. The focus on the interaction among resource users is appropriate for at least two reasons. First, it allows one to evaluate the resource sustainability in light of the institutional sustainability (Ostrom *et al.* 1993). In this regard, the "management of people" is based on the structure of opportunities and constraints upon which individuals make decisions. Second, the focus on the resource user enables one to broaden the analysis from a sectorial to a systemic perspective of the resource appropriation. In other words, it assumes that a given local management is attached to other local and regional-based social arenas which affect the whole

system. Therefore, study on local management should be pursued at multi-layered social basis in order to identify how decision making is affected in each scale.

Summing up, the "political ecology" approach to the commons calls for a detailed analysis of the resource user in order to identify the factors that may affect the creation, maintenance, and collapse of local management institutions. It calls for an analysis of the local management in light of a broader context including the local and external factors that affect demand and supply of goods and services derived from the resource system (Edward and Stein 1998). In particular, local contextual factors, which can hardly be observed when embedded in the local social structure, may well be the most revealing cause of the success or failure of a given management system (Steins 1994; Edward and Steins 1998; McCay and Jentof 1998). For example, social heterogeneity of the user group may affect the collective action if there are distinct levels of authority, perception, trust, access to information, level of control, and reciprocity (Ostrom 1997; Schleger and Blomquist 1998). Therefore, a detailed analysis of the multiple use of resource as well as multiple user groups in a given system is crucial to evaluate how different actors (not only those involved in the managed system) may affect the local management.

In this paper I analyze the ecological and social heterogeneity in the local management of fishing in the Lower Amazon. In particular, I focus on the local context of resource use in the floodplain. The goal of the paper is to evaluate how the pattern of resource appropriation in the floodplain system may affect the local management of fishing in the floodplain lakes.

The "Commons" Problem in the Lower Amazonian Floodplain

The Amazon has undergone rapid economic change since the late 60s (Moran 1981). In particular, the major recent change in the floodplain system has been the decline of jute production -- which was the main economic activity in the floodplain (Gentil 1988) -- and the intensification of commercial fishing and cattle ranching (McGrath *et al.* 1993a). The intensification of commercial fishing drafted fishers from other regions and urban centers to the floodplain lakes, leading to the emergence of constant fishing conflicts (involving gear damage, retaliations, and even deaths) between the local population and outsiders throughout the Basin (Goulding 1983; Hartmann 1989; McGrath *et al.* 1993a; Furtado 1993). The local management of lake fishing, locally called the "fishing accord", has emerged from those conflicts in several floodplain communities. The "fishing accord" is a written document prepared by the local population in which a set of fishing rules is established at community meetings. The rules focus mainly on lake resources, but may define use of other floodplain-related resources such as flooded forest, grassland, and game (De Castro 1998). Despite their illegality, the fishing accords represent a *de facto* ruling system based on the local population's perception of the communal property of the floodplain system (McGrath *et al.* 1993b).

The increasing tension created by conflicts over lake appropriation has caught the attention of both governmental and non-governmental agencies, who are currently trying to develop models of fisheries co-management based systems through the re-establishment of the local management of the floodplain (IBAMA 1995; McGrath 1995). Fishing accords are considered the basic institution upon which the co-management system could be built (Hartmann

1991; McGrath *et al.* 1993a,1994; Isaac *et al.* 1997).

The interest of the government in supporting fishing accords is one of the major steps towards a natural resource policy in the region for at least three reasons. First, there is evidence that fishing accords can increase fishing productivity in lakes (De Castro 1995). Second, it represents the most efficient solution to the current under-monitored condition of the floodplain system, due to the extension and isolation of the region with understaffed, under-budgeted offices (McGrath *et al. in press*). Third, the establishment of local control over the system represents social justice for a population who has traditionally depended (and still does) upon floodplain resources for their livelihood (McGrath *et al.* 1993b). Therefore, there is no question about the importance of such an enterprise. However, while a great deal of attention has been paid to the fishing accords because of the conflicts between the local population and outsiders, other conflicts concerning floodplain resources (Ruffino and Isaac 1994; Furtado 1993) have been for the most part overlooked. In particular, conflicts involving local populations, which have increased in recent years, may represent a threat in the success of community-based management in the region.

In order to present the social interaction among local actors, the paper is divided into five sections. In the first section I present the ecological context of the floodplain system in order to show how environmental changes affect the definition of property boundaries. In the second section I briefly describe the history of interaction between the two main local actors considered in this study, villagers and farm owners. In the third section, I analyze conflicts involving the local actors related to the appropriation of natural resource, in order to uncover their different interests towards resource use. In the fourth section, I discuss the informal property system in the floodplain in light of ecological features and power relationships in the region. The last section presents a general conclusion.

THE FLOODPLAIN LANDSCAPE

Floodplains are systems periodically inundated by the lateral overflow of rivers or lakes and/or by direct precipitation or groundwater (Junk *et al.* 1989). The present study focuses on the Lower Amazonian floodplain, a region that stretches from the Pará-Amazonas State border to the mouth of the Xingu River. It covers an area of 18,000 km² and has an average width of 45 km (Figure 1). The Lower Amazonian floodplain is seasonally provided with high nutrient sediments from recent the geological formation of Andean and pre-Andean zones.

The soft tertiary sediments that have been filling in the basin valley are under frequent erosion, which leads to constant change in the landscape pattern (Junk 1997). Sternberg (1975) describes three main physical changes in the floodplain system: channel aggradation and channel scour, as long-term non-cyclic changes; and annual water fluctuation, as a short-term, cyclic change (p.17-28). Channel aggradation has an accumulative effect, in which the amount of sediment annually deposited at the bottom during the flood season gives rise to new portions of land (locally called *grown land*). Channel scour has a subtractive effect on land banks, which cave in (locally called *fallen land*) due to the strengthening of the current as the river channel is narrowed by the emergence of *grown lands* (Sternberg 1975). Although these phenomena are

more intense in the Upper Solimões, huge transformations can also take place over just a few decades downstream in the Lower Amazon (Junk 1984). For example, an island located in front of Santarém, the main urban center of the region, emerged less than 20 years ago as a result of the land aggradation process. Likewise, all the residents of a floodplain community located close to the same city had to move out in 1995 after most part of the levee where the population lived caved in during a flood season.

Besides sediment-related changes, the fluvial regime represents another source of landscape variation in the floodplain system. The water level is influenced by rainfall and ice melting from the Andes, and has a 5m average fluctuation throughout the year, providing continuous changes in the landscape pattern. During the flood season peak (May-June), almost the whole system is inundated. During the dry season peak (Oct-Nov), four main biotopes emerge: streams, natural levees, grassland, and lakes (Figure 2).

Streams are the waterways, with higher currents that feed lakes with fluvial water. Streams have two main landscapes that deserve more attention for the purpose of this study: 1) the *main channels* which are the ever-flooded part of the stream, and 2) the *beaches*, which are lowlands located at the streams-edge that are exposed during the dry season only. Both the main channels and the beaches are used for seasonal commercial fishing of some migratory fish species.

Lakes differ from the traditional limnological concept of a closed, lentic system by presenting a flexible system of several water bodies interconnected by small creeks. Lakes are surrounded by grassland, and the boundaries change according to the river level fluctuation throughout the year. During the flood season, they expand and merge with streams, forming one large water body, and the size can vary from a few to a thousand square kilometers (Sioli 1984). During the dry season, only deeper lakes remain, while a large part of the system dries out, giving rise to the grassland. Lakes are used all year long for both subsistence and commercial fishing. However, fish productivity in lakes is higher during the dry season when sedentary fish species become concentrated in small water bodies. During the flood season, lake productivity is patchy, being higher in spots closer to the aquatic vegetation (e.g., macrophytes and flooded forest).

Grassland is the emergent lowland surrounding the lakes during the dry season only. It overlaps completely with lakes in physical terms, i.e., the grassland becomes lake during the flood season. When inundated, chunks of mycrophyte vegetation are detached from land and float downstream (Afloating meadows@). The Afloating meadows@ provide appropriate ecological conditions for fish spawn or small fish species to live as they supply shelter, oxygen concentration, and food during the flood season (Junk 1986). The two main grass species that dominate the floating meadows, *Echinochloa polystachya*(canarana) and *Paspalum repens* (premembeca), are important for ranching during the dry season, when the vegetation is accessible to cattle (Goulding *et al.* 1996). Besides cattle ranching, the grassland is used for agricultural purposes since the annual flood provides the land with high quality sediment every year. Grassland may be old lowlands that have traditionally been used by the local population (traditionally-used grassland) or lowlands that have recently emerged through the aggradation process (newly-emergent grassland). Misunderstanding regarding institutional arrangement of the latter is more

common, emerging grassland represents unclaimed land.

Finally, natural levees are ridges formed from ancient sedimentation process. Levees may not get flooded every year depending on the elevation, and therefore are habitat for perennial tree species (flooded forest). The villagers use the levees mainly to build their houses and grow their gardens, which are based upon annual and semi-perennial crops such as a fast growing variety of manioc, corn, bananas, beans, watermelon, and squash (Futemma 1995).

FLOODPLAIN OCCUPATION AND LOCAL SOCIAL RELATIONSHIP

The floodplain was the most densely populated system in the Amazon Basin before the Conquest, due to its highly productive soil and protein availability (fish) (Meggers 1971; Roosevelt 1980; Denevan 1992). During the colonization process, the floodplain was emptied when the native populations escaped to the upland, or were killed in wars against the colonizers or by disease. The reoccupation of the floodplain started only in the late 18th century when the Portuguese Crown gave land titles ("*sesmarias*") to Portuguese immigrants to establish cocoa farms along the levees. At this time, a few smallholders (*caboclo*)¹ were dispersed on the levees. They were absorbed as labor force in the farms until the end of the cocoa cycle, in the mid-19th century. The floodplain did not reach economic expression again until the 1930s, when the Ajute boom took place. At this point, the smallholders practiced a mixed subsistence production system of agriculture, fishing, and small livestock (chicken and ducks), and made a little cash from fish (dry and salt), and wood collection for steam boats.

The smallholders engaged in jute production through a patron/client relationship with local farmers in order to get access to land. They paid back the land rental with part of the production. This system lasted until the end of the jute cycle, in the early 70s, when the jute price declined in the world market (Gentil 1988). Meanwhile, the region was experiencing other socioeconomic changes. The population density was growing due to immigration waves attracted by development programs launched by the government in the surrounding upland, combined with technological improvements in fishing production which created incentives to intensify the commercial fishing in the region. Also, farm owners engaged in more intensified cattle ranching activity and became primarily large ranchers. Smallholders also engaged in small-scale cattle ranching through two means. First, by accumulating capital from jute activity. And second, by the so-called "cattle partnership" which consists of an informal agreement in which a villager takes care of a rancher's herd and receives, in return, half of the breed. Currently, about 70% of the smallholders involved with cattle ranching have up to 10 heads (small-scale ranching) and the remaining own between 10 and 50 heads (middle-scale ranching) (unpublished data).

In the 60s, smallholders experienced a sociopolitical change through the organization of their scattered households into a community-based structure. The status of villagers was provided by the Catholic Church through education and religious activity. The Lower Amazonian

¹ Caboclo are non-indigenous native population resulted from the miscigenation of Indigenous, Europeans and African during the process of the Amazon occupation after 1757 (Parker 1985).

floodplain is currently dominated by several of those communities ranging from a few to a couple hundred houses on one side and large cattle farms on the other. Câmara (1995) estimate that ranchers occupy 76% of a floodplain island close to Santarém. A careful guess is that about 70% of the floodplain is occupied by ranchers while the remainder is occupied by villagers.

The initial stage of fishing accords, in the early 70s, was a collective initiative taken by villagers and ranchers to guarantee their right to the communal control of the lake system. Yet both actors had distinct interests. While villagers envisaged the local control of lakes, the ranchers were trying to control cattle piracy by barring outsider access to their farms. Therefore, despite the distinct use of the floodplain subsystem, both actors had a common interest in closing the access to the lake system to outsiders. The support from ranchers in the past was crucial to overcome conflicts that often took villagers to defend from accusations. Ranchers used their social network in the urban centers to help villagers in their defense against frequent accusations from outsiders regarding retaliations. Recently, economic and political factors have changed this picture. Villagers have strengthened their political empowerment, and fishing accords have mainly been established by villagers. Ranchers are called upon to participate, but usually do not attend the meetings or sign the fishing accords.

Although villagers and ranchers are no longer economically connected to each other as much as in the past, they still share a few social strings. First, as discussed earlier, the engagement of villagers in cattle activity has been facilitated by a system of informal partnership between ranchers and villagers. Second, the lack of institutional support in the local communities enhances the importance of ranchers to villagers as a source of financial aid, information, and contact with formal organizations. Finally, the social relationship between villagers and ranchers has transcended the economic bond to a socio-cultural arena through a system of co-parenthood, which represents a social commitment of reliance, respect and trust between the families involved (Wagley 1953; Lima 1992). Therefore, villagers and ranchers represent actors who have both occupied the floodplain system during the same historical period, but present distinct cultural, economic and political backgrounds, which have in turn led to the definition of distinct endowments. When collective action is analyzed, it is essential to understand how the heterogeneity of the occupants of the system can influence local decisions regarding the use of natural resources.

PATTERNS OF RESOURCE APPROPRIATION AND LOCAL CONFLICTS

The floodplain system has been state property since the Constitution of 1934, according to Article 11 (2º, Dec. 24.643/34) (Vieira 1992). However, the negligence of the state towards floodplain tenure has provided room for local actors to develop a *de facto* property system, based upon ecological features of the system such as patchiness and boundary permeability. This customary property system presents a gradient from open access to private property according to the different patches of the floodplain subsystems. Streams are open access, grassland and lake are communal property, and levees are private property (Figure 3).

This property system is a common understanding among villagers and ranchers

throughout the region and is clearly observed in the discourse of the local population. Indeed, the establishment of fishing accords is based upon the perception that a lake system is a communal property of the landholders living in the surrounding levee. However, this customary property system may change to another layer of institutional arrangement that can be observed when confrontation over appropriation of natural resources takes place.

Perhaps the little attention paid to the social relationship between villagers and ranchers is due the hidden@obvious conflict of interest between these actors. The closer social relationship between them makes engagement in an open conflict very costly since it would affect the long-term cultural, economic, and political commitment between those groups. As a result, while conflicts with outsiders often stand out due to verbal and physical confrontations, negotiations between villagers and ranchers are rather subtle and usually cannot be depicted in the local discourse.

In this section I present thirteen conflicts over appropriation of the floodplain system in which villagers or ranchers violate the common understanding@related to the so-called community-based management of the floodplain. The conflicts were observed in different communities in the Lower Amazon during the 1992-1996 period. For each conflict case, I combined information obtained from direct observation and from non-structured interviews with individuals involved in the conflict. The conflicts are grouped by biotope for analytical purpose.

Streams

Streams started to be exploited only after the 60s, when the introduction of new fishing-related technologies (gillnet and diesel engine) enabled fishers to overcome environmental constraints, such as strong currents and relatively low fish density. Stream fishing is seasonal and takes place during the annual upstream fish migration with drifting nets and longlines in the river channel, or gillnets and small trawlers at the beaches.

Usually, fishers have free access to the main channels, and no conflict was observed in this type of fishing. The appropriation of main channels is difficult because they must be accessible for transportation, which makes exclusibility troublesome. Despite the open access condition of the main channels, conflict over the beach system was observed.

CASE 1

An outside fisher was fishing at the beach nearby a community when villagers came and asked him to leave. As the fisher refused to abandon the fishing spot, villagers took his gillnets, and later destroyed them.

Commercial fisheries in streams have become increasingly important. While main channels remain difficult to defend, communal beach property is a new trend that may increase in the following years due to its proximity to the settlements and more easily defined boundaries.

Natural Levees

Natural levees are very important to villagers since they comprise the subsystem where the

villages build their houses and grow their crops. Levee property, which can be informally sold, rented, and inherited, is defined in terms of the extension of the facade along the riverbank, whereas the length inward is rather confused due to the boundary permeability throughout the year. Sale transactions are carried out by using informal receipts where the owner's name, property size, and sale price are written down. The private system of natural levees is facilitated by its clear definition of boundaries based upon elevation, i.e., the area with the least probability of flooding. Hence, the property is measured by the width of the water front while the length varies according to the water level (Figure 3).

At present, the levees are totally occupied in the Lower Amazon, either by villagers or ranchers. Levees for cultivation have been limited to smallholders for two main reasons. First, the landholds have successively been subdivided among the offsprings, and have created a decrease in land for agriculture. Second, the different height of levees increases the risk of floodplain agriculture due to the water fluctuation regime (Chibnik 1994; Fudemma 1995). When the property is on a lower levee, it is considered a misfortune for the owner. Likewise, fallen land is considered a private loss. In both cases, the owners do not claim their loss, and no conflict was observed in regard to those issues. Despite the clear private-based arrangement, the natural levees have a collective component in decisions to sale, illustrated in the Case 2.

CASE 2

In a community, an outsider who was disliked by the members expressed his interest in buying a piece of land for sale. The community warned the owner not to sell to him. Later on, a fellow community member decided to buy the land, a turn of events which allowed the owner to avoid selling the land to the outsider.

Due to the community-based structure of the settlement, villagers are expected to consult other community members before putting their landhold up for sale. According to local norms, priority is given in the following order: 1) to the neighbors; 2) to any other community member; and 3) to an outsider. This norm is clearly understood in several communities, and may even be written down in documents.

The right to use the communal systems -- lake and grassland -- is based upon residency criteria. Therefore, the concern about who will be living in the community is related to the concern about with whom you will be sharing the communal property. The communal control over decisions regarding who can move in and become a community member is a strategy to lower the risk of threat to the collective structure of resource appropriation.²

Grassland

Like beaches, grassland is lowland between the natural levee and the aquatic system (lake in this case) which emerges only during the dry season when the water recedes. This seasonal

² Lima (1992) argues that community membership may not only be related to residence status, but other facts such as kinship and land use. Notwithstanding, fishing accord as an institution has been clearly defined in terms of residency.

landscape is exposed across the villagers= and ranchers= properties in the floodplain system. Grassland may be a traditionally-used lowland or newly-emergent lowland that results from successive sedimentation (Agrown land@). Property rights over grassland swing between communal and private. Because grassland is the main biotope exploited by ranchers, the power relationship between ranchers and villagers is clearly uncovered when a conflict arises. For analytical reasons, I present separately the conflicts over the traditionally-used grassland and newly-emergent grassland (Agrown land@).

Traditionally-Used Grassland

CASE 3

Grassland is scarce in the upland during the dry season. Upland ranchers pay floodplain occupants a monthly rent per head to take care of their cattle and feed them on the floodplain grassland. This activity has gradually become an income source, and villagers who raise cattle as well as ranchers are involved in this grassland rental business. Although cattle are fenced in on the caretaker=s land, the animals are set free in the Acommunal grassland@ to graze. At one point, ranchers started to feel signs of overgrazing, they proposed to villagers that they set a rule which said that the number of cattle that each floodplain occupant can bring must be proportional to the owned grazing area. The rule was accepted. Therefore, grassland was considered privately owned, and ranchers were the only group able to rent grassland.

CASE 4

Usually, the local norm says that cattle should be set free while cultivators must fence in their garden in order to avoid any damage by cattle. However, cattle and buffaloes can easily break the fences, reach out the private gardens and damage the crops. Most of the communities experience this problem and try to solve it by setting a rule that says that the cattle owner should pay for such occasional damages by the animal. However, it is hard to prove whose cattle invades the crop and the damage remains unpaid. Ranchers usually do not cultivate and have the largest herds, while villagers are doubly affected by having to fence their garden, and by being more susceptible to crop damage.

CASE 5

Water buffaloes are adapted to wetlands. They have been introduced in the Amazon estuary for more than 200 years, and only recently in the Lower Amazon. Although they fit well into the system, they have caused major environmental damages. Among a large list of problems cited by villagers, they destroy grassland area, floating meadows where fish grow, and gardens (more than cows because they are better at destroying fences). Several communities have experienced conflict regarding buffalo-related damages. However, efforts made to prohibit buffalo raising have been effective only among villagers, whereas ranchers have kept raising buffaloes.

It is clear in the three cases how ranchers have power over decisions in the floodplain in regard to cattle raising issues. Case 3 shows that although grassland is communally used, ranchers

control the decisions over its use. Cases 4 and 5 show that the incompatibility between ranchers' and villagers' production systems is not taken into account by the former group. Therefore, grassland is used communally but is claimed as private property by ranchers whenever their production system is affected. Oppositely, ranchers often do not respect the private property of levees when their cattle invades the villagers' gardens.

Newly-Emergent Grassland

AGrown land@ is a frequent source of conflict over grassland between ranchers and villagers. As discussed earlier, land aggradation gives rise to emergent land over time. The "grown land" has potential economic value, due to the highly fertilized soil. For ranchers, it represents potential grass to feed cattle; for villagers, who have been experiencing land scarcity, it represents good soil to cultivate fast growing crops, such as beans, and watermelon. Below I discuss four conflicts involving Agrown lands@.

CASE 6

An island emerged close to a community and was promptly occupied by a rancher to keep his cattle. Agriculture is not practiced in this community due to its location on a very low levee, and fishing is the only economic activity practiced by most of the villagers. A friendly relationship between the rancher and the villagers was maintained in regard to the island use; the former exploited the grassland, while the latter exploited the lake within the island. When the rancher died, his son took over the island and suddenly prohibited the villagers from using the lake. Supported by the Fishers Union, the villagers claimed the right to cultivate, arguing that they did not have any other place to grow their crops. The villagers won the communal legal use-right of the island and the rancher had to leave.

CASE 7

An island emerged in front of a community and was occupied by a rancher to keep his cattle. The occupant claimed a legal use-right and had the area recorded in the document. As time went by, the island area increased due to the aggradation process, and the villagers occupied the land contiguous to the former property. Several years later, his son decided to sell the land and claimed the whole island, including the area occupied by the villagers. Supported by the Fishers Union, the villagers claimed and won the communal legal use-right of their part of the island, and the rancher was allowed to sell only the area defined in the document.

CASE 8

Villagers occupied a piece of land that emerged contiguous to a community. One of them was a medium-scale rancher and took for himself a piece of land whereas the others were bean cultivators and took another piece communally. Some years later, the rancher claimed the whole area for his use-right. He was a patron in the community and most of the villagers withdrew during the conflict process. Two villagers stayed on, fought for their use-right, and won it two

years later. The land was divided into three equal pieces and each claimer was given individual use-right.

CASE 9

The land described in case 8 was separated from a buffalo farm by a small stream, whose bottom recently sedimented, thus merging both lands. As a result, the buffaloes started to cross the farm's boundary and invade the meadow and bean crops on the land next-door. The villagers who grow beans have not been able to solve this problem, but the middle-scale rancher of the invaded land has engaged in a conflict with the buffalo rancher. The case is currently being tried in court and local threats between the two parties have occurred.

The cases above reveal three main important aspects. First, in general, ranchers are the first to occupy "grown lands" as they emerge. Second, community members do not claim their formal use-right until their informal access is threatened. Third, when a grassroots organization is supportive, villagers are able to strengthen their power, and their claim for collective use-rights is more likely to succeed. Like in the upland (Hecht & Cockburn 1989; Alegretti 1990; Leroy 1991), land conflict has triggered the development of local organizations. When external support is lacking, collective action is more difficult to engage and traditional local power prevails. For example, in case 8, the collective occupation that formerly took place in the grassland shifted to a private-based occupation because the rancher influenced other villagers to withdraw from the conflict. On the other hand, the only two villagers who continued with the conflict were local leaders. Likewise, the case 9, which involved two ranchers (the same rancher of case 8 and his neighbor), has been hard to settle because they have similar political and economic power.

The comparison of conflicts over traditionally-used grassland and newly-emergent grassland reveals that the former is a matter of defining control of decision whereas the later is a matter of defining access to the land. Traditionally-used grassland holds the communal component that was defined in the past, and has been rearranged into a private regime by ranchers. The newly-emergent grasslands, on the other hand, are new landholds that have emerged in a different local social context than when property rights over traditionally-used grassland were defined. Today, the floodplain system presents a distinct power structure as well as land use activities between ranchers and villagers. As a result, boundaries must be clearly defined from the beginning.

Lake

As in the streams, the high efficiency provided by technological improvements has created incentives for commercial fisheries in lakes. The frequent conflicts between local fishers and outsiders regarding property rights are related to the claim for communal property of lakes through fishing accords, in which local occupants (villagers and ranchers) are the only eligible users. While conflict resolution at the regional level is straightforward, conflict resolution at the local level is rather unclear. Unlike grassland, a lake is a perennial system with flexible boundaries. During the flooding season, the lake becomes an open system that trespasses the boundaries of ranchers' and villagers' properties. Yet, during the dry season, the lake shrinks and becomes a semi-closed system, access to which is provided only by small creeks (*igarapés*). When lakes

remain within ranchers' property during the dry season, conflict between these two actors may emerge.

CASE 10

Ranchers usually bring friends to fish in the lakes. Even though they fish recreationally in the lakes surrounded by the ranchers' land, they must follow the community fishing rules. A rancher broke this rule once and triggered a conflict that ended up in court. After this incident, the rancher never broke the rule again.

CASE 11

A gillnet ban was established in a community, but a rancher claimed the right to use gillnets in his water, since he would not be able to fish otherwise. The community consented, but for subsistence purposes only. The rancher agreed.

CASE 12

A community set successful fishing rules that increased the lake productivity, and provided higher income by the commercialization of a high-priced fish species. Recently, a rancher who owns the land contiguous to a highly productive fishing spot claimed the right to buy all the fish caught in that spot. The villagers accepted it since it was his condition to support the collective fishing rules.

CASE 13

A communal decision on a gillnet ban was established in a community but three villagers did not support it. The community committee decided that the family members could use gillnets only in their water, which meant the area where water covered their land. This constraint to lake access led the families to accept the local rules later on.

The cases above reveal a gradient of negotiation between ranchers and villagers regarding lake use according to the importance of the resource. In case 10, where fishing is for recreational purposes, the rancher completely ceded to the communal decision. In case 11, where fishing is for subsistence, there was a negotiation in which the rancher accepted some communal control, but claimed the privilege to use prohibited gear. In case 12, where fish have a high economic value, the rancher imposed control over the resource and the community had to accept it.

The perception of communal access to a lake is connected to the perception of a water for both villagers and ranchers. Although they are confused about the inward limits of their landholds, they seem to share the same perception that lake and grassland is part of the property. This is clearly shown among ranchers in the cases 11 and 12, and among villagers in case 13. When villagers were asked to draw the farms boundaries on a picture taken during the flooded season, they drew a line in the middle of the lake. The informants explained that the imaginary boundaries were clearly observed during the dry season, when the surrounding lowland is exposed. Therefore, definition of property boundaries seems to be mainly based upon the dry

season landscape. Hence, while ecological factors define access, political factors define control. And the conflicts based on boundary permeability should not be seen as a problem of perception between the two actors. Rather, it is a result of recent changes in the local socioeconomy and politics in the floodplain. The more economically important the resource becomes, the more the power relationship between ranchers and villagers is exposed, and the more likely it is that private rather than communal control will take place.

DISCUSSION

While the *de jure* state property of floodplain has not been efficiently monitored, *de facto* property systems regulating resource use have been developed by local actors. The customary appropriation system of the floodplain is two-layered: the *explicitly-ruled property system* and the *implicitly-ruled property system*. Both layers consider the floodplain a patchy system, but each one takes place in different level of social interaction and is defined upon a different set of factors. The *explicitly-ruled property* layer takes place between the local population and outsiders, and defines property rights in the floodplain mainly in terms of ecological attributes of the system. Landscape diversity directly affects the pattern of appropriation, leading to a range of responses according to the feature of each subsystem -- open access to streams, private property on levees, and communal property on lakes and grassland.

Thomas (1996) explains the diversity pattern of property systems found in the floodplain in Nigeria in terms of the physical characteristics of fisheries resource and the cost of defense and exclusion. The author provides an ecological analysis based upon the economic defensibility model which assumes that ecological territoriality takes place when the benefits overcome the cost of the territory protection (Brown 1964). In this model, the ecological attributes of the resource such as predictability, abundance (Dyson-Hudson & Smith 1978), spatial distribution (Netting 1976), mobility and storage capability (Schlager *et al.* 1994) directly affect the pattern of resource appropriation. According to Thomas (1996), the constant change of the floodplain system is reflected in the tenure system as the transformations occurring in the physical features of the system affect the cost and benefits of resource defense and exclusion (p.305). While Thomas discusses the tenure diversity in the aquatic system, Vondal (1987) compares tenure system changes in a swampland in Borneo throughout the year in terms of the interface between the aquatic and terrestrial systems. The author observes that the same physical environment that is communally shared during the flooding season is privately owned during the dry season. Such a change influences boundary definition, which in turn affects the ability to exclude outsiders. Likewise, the continuous changing landscape in the Lower Amazon affects the property boundaries of two overlapping subsystems -- the lake and grassland -- due to the continuous "pulsing system" of expansion and retraction of river water throughout the year (Junk *et al.* 1989). The boundary permeability of both biotopes, combined with the land use (fishing and cattle ranching), make the definition of private property costly. On the other hand, the communal property regime is advantageous for the local population who has been claiming their tenure rights over the lakes in order to exclude outsiders.

Therefore, the explicitly-ruled property system represents a consistent cultural ecological

explanation for the pattern of floodplain appropriation in the Lower Amazon. It is explained as a result of a long-term shaping process influenced by the patchy distribution and abundance of resources. In other words, it is an adaptation to a patchy ecosystem, which provides a range of biotopes with distinct ecological attributes. This "cultural ecology" approach to the "commons" is not only supported by etic analysis, but also by emic evidence expressed by the local population in their daily discourse as well as through their current local management system (fishing accord).

Nevertheless, the history of floodplain occupation shows that floodplain was privately held by ranchers until 1934. The shift to state property has not affected the local appropriation system as much as the social relationships among the local actors as well as the economic importance of the resources, historically. Ranchers have exercised their private rights over subsystems according to their economic importance. Until the late 60s, when natural levees were the main economically important subsystem in the floodplain for jute cultivation, ranchers exercised their private rights over the levees to engage in a patron/client relationship with villagers. Grassland and lakes were freely accessed by both villagers and ranchers until the early stage of the intensification of fishing and cattle ranching. During this period, those actors experienced resource partitioning of the system. Ranchers exploited grassland during the dry season whereas villagers exploited the lakes for commercial fishing. As grassland became more important to villagers (for both agricultural and cattle ranching purposes) and the lake became a potential economic source for ranchers, the claim to private rights over grassland and lakes by ranchers started to take place. The analysis of conflicts between local actors reveals the *implicitly-ruled property system* as a tenure layer embedded in the explicitly-ruled property with redefined property regimes in each subsystem. This underlying tenure system is asymmetrically exercised by the local population according to their degree of empowerment. Villagers have been able to participate in the redefinition of property system on streams and levees, while ranchers have been influencing the redefinition of property rights on grassland and lakes.

The major driving force of this tenure layer is the economic importance of the resource. The recent claim for communal property of beaches by villagers has emerged due the increasing economic importance of fish. Likewise, the local population has acted collectively in controlling the sale of levee estates despite the private status of this subsystem. According to some informants, the goal of this collective control is to avoid eventual threats to collective action by newcomers. Likewise, the claim of private rights on grassland and lakes by ranchers is a result of the increasing economic importance of the resources of the system (pasture and fish).

Although villagers have succeeded in excluding outsiders from the former open access system (beaches) as well as controlling fellow villagers= decisions regarding the former private system (natural levee), they have been unable to affect ranchers= decisions. Ranchers sell their landholds under no local control from villagers. Likewise, villagers have been unable to control the decisions over the two most economically important subsystems, and locally considered communal property systems@-- grasslands and lakes.

Local Politics and Discursive Strategies

The two-layered property system of the floodplain reveals a pattern that acts on different

levels. The explicit-ruled system is used by villagers to claim local control of the system. Villagers have strengthened their claims to governing local natural resources due recent internal and external social transformations. Internally, the Catholic Church has played a key role in organizing the scattered smallholders into community-based institutions. In addition, the Church has provided villagers with information network (Radio Station, Bulletins, and regional meetings), and a political organization which has created a collective identity through the formation of a common interests and a group strength (leadership) in relation to resource appropriation (Leroy 1991; Lima *in press*). Externally, international agencies have supported development projects and have pressured the government to consider the local population in the development/conservation projects (Lima 1994; IBAMA 1995). As a result, villagers have not only been affected by new trends in conservation issues but also have affected them, by embracing a conservationist discourse to gain more political power and keep their control over the local resources (Allegrati & Schwartzman 1987; Schmink & Wood 1992).

While the explicitly-ruled system is present in the local discourse and have been assumed to be the only *de facto* appropriation system, the local actors may recognize the private status of grassland and lakes. As discussed earlier, both villagers and ranchers recognize "their water" and the boundaries of farms in the middle of the lakes. The invisibility of the implicitly-ruled system to policy makers and researchers is due to the lack of contextualization of the local management in the social relationship between the local actors. While access to communal resources (lake and grassland) is maintained by both local actors, ranchers have the control over decisions regarding its use. This subtle shift in the structure of control of the floodplain system can be observed only when property right is analyzed in terms of its five components -- access, withdrawal, management, exclusion, and alienation -- which define different levels of control (Schlager & Ostrom 1992). Table 1 shows how the implicitly-ruled system leads to a loss of the villagers' management rights of the communal system.

Although villagers are able to manage the local resources in relation to outsiders and themselves, they are not able to manage them in relation to ranchers. As a result, collective action becomes even more dependent upon ranchers' support. The dependence of villagers on ranchers helps the latter to maintain control over the floodplain at a low cost, since there are no frequent confrontations. Yet, as villagers have gained external political support through the fishing accords, they have been able to confront and sometimes win over ranchers. Cases 6 and 7 are examples that collective action combined with the support of grassroots organizations can lead to a victory over more economically powerful actors. On the other hand, the floodplain is dominated by ranchers' land and, therefore, their support remains essential to facilitate the monitoring of access to lakes. Moreover, in many cases, ranchers and villagers still maintain close social bonds either economically (as a source of financial aid) or culturally (through kinship or co-parenthood). Therefore, conflict between villagers and ranchers is a delicate social arena in which the negotiation process is embedded in a complex social relationship. It swings between cooperation when fighting against outsiders (in the form of fishing accords) and conflict at the local level. This dual social relationship takes place simultaneously, at different levels. And the exercise of the implicitly-ruled property system by ranchers can threaten the social justice goal of the local management which is the recognition of the right of the local population to control the use of the

floodplain system in a communally, and equally distributed power basis.

If the aim of fishing accord is to integrate a co-management system, it first must account for heterogeneities in the floodplain systems. Ecological patchiness of a system leads to a heterogeneous pattern of distribution and abundance of resources. And the economic importance of each resource influences the decisions regarding the defense of the resource at the communal or individual level. The institutional heterogeneity of the floodplain, under three distinct layers of property systems -- state property, explicitly-ruled property system, and implicitly-ruled property system **B** works on different levels, and affects different social scales. Finally, the social heterogeneity, represented by villagers and ranchers, reveals local actors with distinct incentives and power in relation to resource appropriation. Furthermore, social heterogeneity can take place on a smaller scale, such as within family groups in the communities (Araújo 1993) and at the household level (Futemma *et al.* 1998), or larger scale such as with outside fishers. Therefore, it should not be assumed that fishing accords will work promptly once recognition of local control and economic incentives are provided. Rather, a local contextualization of the social structure is crucial to reveal potential barriers to the development of a participatory and democratic system of fishing accords.

CONCLUSION

The ecological attributes of the system are important in defining forms of appropriation but may not be sufficient to explain the patterns of tenure. Rather, they may hide internal aspects of social relationships that are essential to understanding how appropriation takes place. The present case shows that while the explicitly-ruled system is mainly based on ecological attributes of the floodplain system, the implicitly-ruled system is subtle and may emerge according to the economic importance of the resource and the power relationship at the local level. The analysis of resource appropriation reveals local heterogeneities and the level and mechanisms under which resources are defended. In particular, the analysis of conflict between ranchers and villagers reveals a complex social relationship based upon cultural, ecological, and socioeconomic factors that leads to asymmetric control over decisions concerning resource use in the floodplain. The historically close social links between the two actors in regard to natural resource use has recently been disclosed due to internal and external economic and political changes. The new social structure may help to improve the success of local management as far as pressure on the resources by outsiders is concerned; yet it may enhance local conflicts that can undermine the collective action at the local level. Therefore, any attempt to incorporate fishing accords into a co-management system should consider a detailed analysis of the relationships among villagers and ranchers, and support a negotiation process among these groups in order to achieve a common understanding in regard to the local management of the floodplain.

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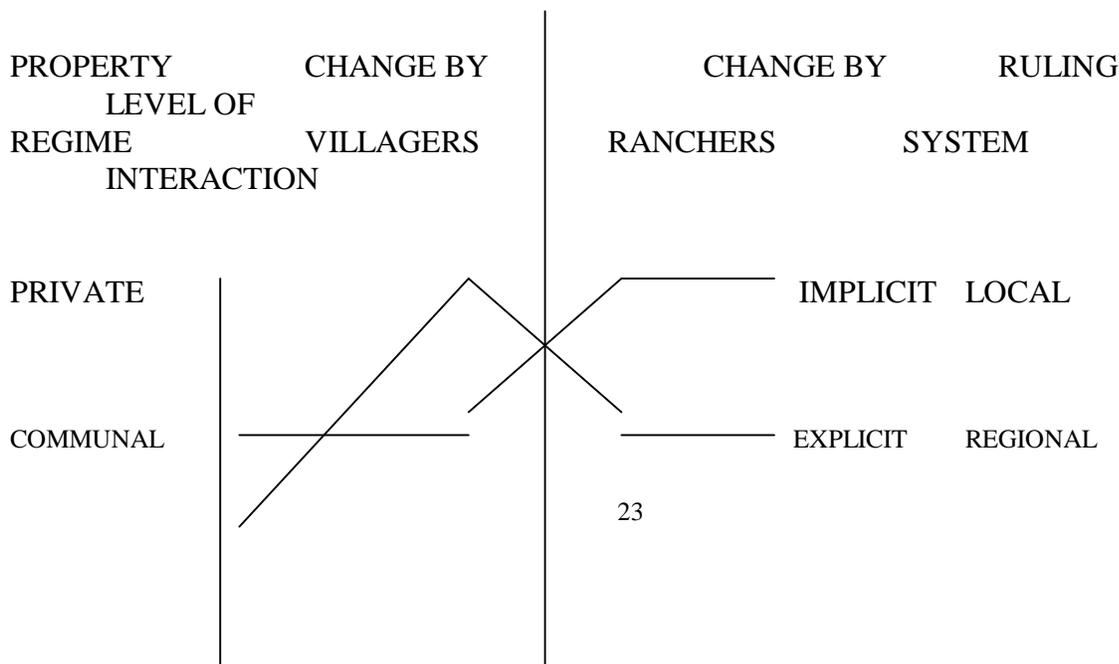
FIGURES AND TABLES

Figure 1. Map of the Lower Amazon

Figure 2. Picture showing the four floodplain biotopes.

Figure 3. Scheme of the property regimes for subsystem, according to the level of social interaction. The horizontal dashed line divides legal and customary property systems, and the vertical dashed line divides the actors (villager and rancher) controlling the implicitly-ruled property system.

Figure 3.



OPEN ACCESS

STATE _____ LEGAL FEDERAL

SUBSYSTEM STREAM LEVEE GRASSLAND LAKE

RIVER LEVEL

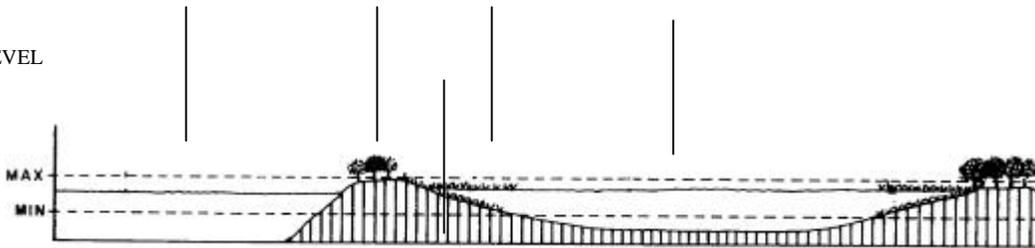


Table 1. Components of property rights in the explicitly-ruled system (E) and implicitly-ruled system (I) for each subsystem.