

COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT AS A NON-LINEAR PROCESS: A CASE STUDY IN THE PERUVIAN AMAZON VARZEA

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Introduction

The *ribereño* peasants, who live in small communities along the waterways in the northern Peruvian Amazonia, depend on a wide variety of natural resources. Their long-term survival and development require management systems that assure the future availability of these resources. In this context, the management of natural resources by local communities is an important alternative to prevailing private and state models in the sustainable use of resources. However, because there are many factors that can contribute to the success or failure of community-based natural resource management (CBNRM), this can be a long-term and dynamic process that includes performance peaks, valleys and interruptions.

We propose that certain factors, essential for the establishment and continuity of a CBNRM initiative, might not be constant through time. This is the result of the dynamic nature of the social and natural setting in which these riverine communities live. For this reason, a community-based management system must be viewed as a non-linear process that cannot be understood without analyzing its historical development and the dynamic nature of the factors that condition the establishment, interruption and resurgence of resource use control. As such, management systems that are flexible in their response to these factors are better adapted to the existing conditions in the Amazon Basin.

This paper focuses on the factors that condition the emergence, abandonment and resurgence of a community-based fishery management initiative in a *varzea* ecosystem of the Northern Peruvian Amazon basin.

I. Conceptual Framework and Methodology

1. A Conceptual Framework for Community-Based Fisheries Management in Amazonia

Our approach for analyzing the evolution and performance of a community-based natural resources management initiative takes into consideration the resource use choices made by individuals within their domestic group, the social processes that envelop the individual and his domestic group and the relationships between the individual and society. Because this latter relationship is dynamic, like the management system itself, we believe that they must be analyzed as an historical process in which the presence and interaction of different factors combine to encourage and discourage a group's resolve to manage a common resource. In this regard, we give particular attention to the incentives and disincentives that influence decisions regarding resource use made by domestic units and the factors, both external and internal including ecological factors, that may be relevant for the individual's and group's perception of these incentives over time.

This approach is grounded in several schools of thoughts that arose in response to the application of rational choice theory to the management of the commons. Its supporters argue that individuals are always part of a social group and therefore do not make decisions in an isolated way (McCay and Jentoft 1998; Smith 2000). Rather these decisions are circumscribed by those made by the other members of the group and by the group as a whole. Members of the group create and share moral norms that greatly influence and guide their behavior. In this sense, institutions created for managing natural resources are embedded in the community social and cultural system. From this perspective, decisions made by community members regarding natural resource use respond not only to the incentive of maximizing individual advantage, but are influenced by social, cultural and political factors that go beyond the individual. Thus, the ups and downs throughout the history of a resource management process reflect both the choices made by individuals, and at the same time but also to how these choices mesh with and respond to the norms established by the society in which the individual lives.

At the same time, we explore how heterogeneity in the local setting in both social and ecological dimensions may affect the way in which decisions are made and resources are used. This approach assumes that local populations continuously reshape their pattern of resource use in order to cope with social and environmental pressures. Communities respond, then, not only to external conditions and constraints imposed on them, but, over time, may influence and rework them to improve the range of the options at their disposal. These continuous changes in the matrix of environmental opportunities and constraints provide both incentives and disincentives that will likely influence a community's decisions to initiate and continue or not collective action vis-a-vis a common pool resource.

2. Methodology

This paper is part of a major study aiming to determine factors that condition positive outcomes in community-based natural resource management in Amazonía.¹ It is based in five months of fieldwork divided in two phases. The first phase, which lasted one month (July 1999) was dedicated to a rapid assessment of each of the 14 Tamshiyacu River communities and the 21 communities in the Tahuayo River, all located within the area of influence of the Tamshiyacu-Tahuayo Comunal Reserve (see Map 1). This assessment was made to identify and compare community natural resource management initiatives in order to select a case study with a timeline long enough to draw conclusions about conditioning factors for positive outcomes. We selected the lake management initiative in El Chino (Tahuayo river community) begun 16 years ago.

During the second phase, lasting 4 months (October 1999-january 2000), an interdisciplinary team carried out intensive data collection activities. To identify conditions for successful management in El Chino, it was important to reconstruct the historical development of the initiative including its different stages and the factors that affected each stage. We conducted twelve semi-structured interviews with “gate keepers”, that is important stakeholders who stimulated and conducted the management initiative, in order to identify the main events and stages of the management process. These interviews permitted us to have an “official” or public version of this history that at times contrasted sharply with the stories told by its opposers. This was complemented with life history interviews with some key community members that provided an understanding of the larger context and the broader processes within which the lake management initiative has taken place. The perspective of external agents was analyzed through interviews with NGO workers, university researchers and other professionals that worked in the area. Other aspects, such as the relative importance of fishing, compared with other economic activities practiced by the inhabitants of EL Chino, were obtained from a household survey questionnaire applied to each of the 41 different households in the community.

The complexity of the social and ecological factors that are at play in a lake management system required a long term field study to record and understand the historical data needed. Since informants were sometimes reluctant to participate or had difficulties in presenting events in an orderly manner, a long term study and a series of parallel methodological instruments were needed to untie knots, establish confidence among community members and record all existing versions of the same story. Much of the information required for understanding the role of the different factors influencing in the management process, as well as its performance through time, can only be obtained through more informal techniques such as the participatory observation strategy we adopted .

¹ This study is part of the Amazon CBNRM Research Initiative (ACRI) currently being carried out by the Instituto del Bien Comun, the Instituto de Pesquisa Ambiental da Amazonia, The Woods Hole Research Center and Oxfam America, Inc. We would like to express our gratitude to the Ford Foundation for their support of this Research Initiative.

II. The Field Site: The Tahuayo River Basin and the Community of El Chino

1. The Geographical and Regional Setting

The community of El Chino, our case study site, is located along the Tahuayo River within the upper Amazonian floodplain, in northeastern Peru, a region characterized by its geographic isolation and an economy that has traditionally depended on the international demand for forest products. In a region with no roads, rivers are the main source of communication, transportation and commerce, with the city of Iquitos as the main port (Map 1). The complex social and ecological landscape of the Tahuayo River Basin summarizes many of the region's problems and potentials.

The Tahuayo River runs its total length, more than 80 km., parallel to the Amazon River and within its floodplain, constrained to the east by upland forests and draining water from approximately 1400 km². Numerous small tributaries bringing white water from the uplands flow into the Tahuayo River at various points, mixing in with the dark waters from the floodplain. The blackwaters of the Tahuayo River differ considerably from the Amazonian waters as they have mostly an underground origin, are more acidic and nutrient poor than their Amazonian counterpart, and are at the same time relatively sediment free. The banks of the Tahuayo River are characterized by low levees that are intensively cultivated during the low water periods and higher levees where the communities are located.

Although black water rivers are considered poor in regards to their productive potential, the Tahuayo basin has proven otherwise (Coomes, 1992). Production from agricultural and extractive activities has traditionally been sent to Iquitos, the largest urban center in the Peruvian Amazon located only 40 km down river from the mouth of the Tahuayo River. Small riverboats make daily trips to and from Iquitos, linking all the Tahuayo villages among themselves and with Iquitos. Today the river basin supports a population of 3734 inhabitants distributed in fifteen small, nucleated villages and four agriculture colonies².

The history of the Tahuayo Basin shows the same cycles and trends that have affected the rest of the Peruvian Amazon since the beginning of this century. The region has passed through periods of economic booms that correspond to the demand of the international and occasionally of the regional markets (Iquitos) for forest and agricultural products such as rubber, vegetable ivory, rose wood, *leche caspi*, animal skins, etc. These booms are interspersed with periods of recession and low demand for regional products. The result has been a very malleable and dynamic pattern of livelihood for the *ribereño* families living along these waterways, one characterized by the continuous transformation of the landscape in response to shifts in the market and to resource availability (Coomes, 1992).

² This information is taken from a socio-economic survey conducted by the ACRI team in June of 1999. The first census in the basin was carried out in May 1989 and showed 3150 inhabitants in 18 communities.

Most communities along the Amazon and its tributaries were formed after old *patrons* died or when the agrarian reform in the early 70's expropriated the land from the original owner in favor of the local people, who afterwards maintained the old rubber estate boundaries as community boundaries. Nonetheless this extractive economic system survives today through the generations-old relationship of interdependence between *patrons*, who now live in the city of Iquitos, and rural inhabitants.

During the early eighties many communities saw their game and fish being depleted by people entering from outside the basin, usually loggers and fishermen with freezer boats from Iquitos, motivating several of them to take initiatives to take control of the lakes and/or forest. The initiatives varied among communities but in most cases of fisheries, the communities prohibited commercial fishing and the use of nets, traps and poisons in various lakes within their jurisdiction. The initiatives found in the Tahuayo are not an isolated case; similar initiatives have been reported for other areas in northeastern Peru (Pinedo-Vasquez et al., 1992) and in Brazil (McGrath, et al., 1993; Oliveira and Cunha, 2000).

2. A Short History of El Chino

El Chino is a young but typical riverine community located in the upper parts of the Tahuayo River. It is one of a series of small communities set along the rivers edge, characterized by residents with a multi-ethnic heritage who are dependent on a wide variety of natural resources (land, game, fruits, etc.) and economic strategies (agriculture, hunting, fishing, etc) for subsistence and commerce. This settlement was officially founded in 1962, but some elders can trace their ancestors in the area back three or more generations and claim the first inhabitants arrived to the region at the beginning of this century. Like the residents in the rest of the Tahuayo basin, many in El Chino are descendents of indigenous people who were brought from other regions at the beginning of this century to work on one of the 18 rubber estates that existed along the river (Coomes, 1992).³

Although no written memories exist, the Tahuayo basin lies within territories originally inhabited by Yagua and Cocama ethnic people (Villarejo, 1988), who probably migrated from the region when rubber and agricultural estates were established between 1880 – 1920.⁴ Rubber tappers did not live in nucleated villages like today's communities, but were dispersed over the estate along watercourses and boundaries. Although rubber was the main economic activity during this period, tappers also practiced agriculture and hunted the abundant game in the region. The rubber prices eventually collapsed and *patrons* were forced to replace rubber with other extractive products as main sources of revenue (vegetable ivory, balata, rose wood, animal skins, etc).

³ Today, most of the local people in El Chino have surnames that appear to be Cocama in origin although they do not consider themselves members of any ethnic tribe (R.C. Smith, personal comm.). Others with a variety of last names come from other parts of the Peruvian Amazon and from areas located with the Andean foothills (for example, the department of San Martin).

⁴ For example, the estate of Boa Vista, claimed by Brazilian immigrants in 1910, covered 20,980 ha. of lowland and upland forests in the upper parts of the Tahuayo basin including the territory where El Chino is located today (Coomes, 1993).

By the mid-1960's, the lowland estates of the upper Tahuayo had shifted towards agricultural production for the Iquitos market. Recent reports described El Chino as a modern industrialized agricultural estate specialized in the production of sugar cane rum. The series of patrons that owned the estate during this period employed a more capital intensive production strategy than the one we find today; local residents claim land was worked much more intensively, including practices long abandoned such as fruit orchards, and cattle and tortoise raising. The 1969-75 agrarian reform expropriated and turned back most of the land to the state leaving the tenants to their own fate and the lakes and forests as open access resources (Bodmer, 1994). The following decade saw the appearance of timber concessions and fishing boats with freezers going into the upper parts of the Tahuayo river, depleting most of their resources in a very short period of time. Communities, including El Chino soon saw the necessity of self-organizing to protect what was left of their resources, a process that will be described in detail in the forthcoming section. Since 1984, the community of El Chino has established a certain degree of control over its resources and territory.

The community of El Chino is currently constituted by 52 nuclear families distributed in 41 households, defined as the family-grouping dependent on a single cook stove (Smith and Wray, 1996). As we see from the above numbers, many domestic units contain more than one nuclear family. We have identified six larger extended family groupings, composed of domestic units linked by kinship ties that act together to some extent as sub-units of the community. These extended families play an important role in community politics and decision-making. They can be identified by their surnames, many of which are of indigenous origin. (Coomes 1992).

The settlement pattern in El Chino is both nucleated and disperse. The nucleated part contains half of the domestic units that are located around the football field that also serves as a central plaza. Also around the football field, one finds the pre- and elementary schools, health post, stores, bars, the NGO house and the warehouse for the lake management project. The dispersed sector includes the other half of the domestic units that are located along both banks of the Tahuayo river up to the mouth of the Blanco River (see map 1).

The Community has an officially recognized system of authorities. There is no competing local or traditional authority system. This official system is composed by two office-holders: the *Teniente Gobernador*, and the *Agente Municipal*. The *teniente gobernador* is the political authority of the community who represents the national government. The community elects on a rotational basis from among its members a person they want to occupy this office. His job is to maintain order and to ensure that community norms and national laws are upheld. The municipal agent acts as a mayor of the village looking after whatever public works exist. However, the functions of the two often get confused and may also include that of calling and directing a community assembly or a community workday (*minga*).

Schoolteachers are also an important part of the Peruvian rural community social organization. As a general rule the schoolteacher, like the one in El Chino, is not born in the community although in most cases comes from a rural environment. Because of their higher educational level, the teacher is an important influence in the community, and his opinion is listened to when decisions are made. In many cases, the teacher assumes a leadership role in the community that may be greater than that of the elected authorities. The elected president of the Parent Teachers Association and local promoters of development projects (e.g. the health promoter) occasionally act as community authorities as well.

3. The Tahuayo *Varzea*: Floodplain of the Amazon

The territory of El Chino is composed primarily of a floodplain or *varzea* ecosystem, characterized by a variety of landscape features, vegetation types, and lakes of diverse origin. In Figure 1, a cross-section of the upper Tahuayo River shows the main features of the *varzea* floodplain as it rises from the Amazon floodplain, in the east, through the Tahuayo basin and until it reaches the uplands in the west. The floodplain or *varzea* ecosystem is defined as the region, on either side of the main channel of the river that is periodically inundated (Junk et al., 1989; Kalliola y Puhakka, 1993). During high water most of the area becomes flooded, temporarily transforming the landscape into one enormous forested lake. When waters recede, they become restricted to the main river channel and to the numerous lakes that dot the region. During its lowest point, a high diversity of vegetation types and landscape features can be readily distinguished; these have a considerable effect on the livelihood and the traditional activities of the local people.

El Chino is located in the upper Tahuayo River where the floodplain reaches its widest point and consequently flooding exerts its most extended influence. Every year between March and May water levels rise 6 to 8 meters, inundating both sides of the river and reaching kilometers inland. This leaves the community of El Chino and most of its territory (up to 90%) underwater for at least 3 months every year. During the high water season many households choose to migrate to the uplands, either near the edge or outside of the community's territory. Although the area floods every year, annual variations also exist and differences between years in the intensity, timing and duration of the floods are very important in determining livelihood strategies for the inhabitants.

For floodplain or *varzea* ecosystems, the flooding pattern is the most important environmental factor influencing the landscape and the livelihood strategies of its inhabitants (Hiraoka, 1985; McGrath et al., 1993). The annual floods follow the seasonal pattern of the Amazon River, rising at the beginning of December and reaching its highest levels by May, then dropping with increasing speed and reaching its minimum level by August. Precipitation patterns tend to follow the same timing as flooding; however, the hydrologic regime of the Tahuayo River is influenced more by the annual rise and fall of the Amazon River than by the input from local rainfall.

The floodplain or *varzea* ecosystem can be separated into three main regions: the meander plain, the flood basin and the alluvial terraces. The meander plain is limited by previous meanders, old channels, and other physical forms created by the dynamic course of the rivers. Special features of the meander plain include beaches or fluvial bars, channel deposits, lakes, ponds, floodplain deposits, among others. The meandering nature of rivers leaves a series of ridges, known locally as *restingas* and lower depressions named *bajiales*. The flood basin is the low point of the floodplain, adjacent to the more active meander plain and its main channel. It is flat with hardly any relief and very poor drainage. The most characteristic and economically important features of the floodplains are the *aguajales*, swamps dominated by two palm species, the *aguaje* (*Mauritia flexuosa*) and the *huasai* (*Euterpe precatoria*). These swamps are located away from the main channel and with very poor drainage that remain flooded for most of the year. Terraces border the floodplain and constitute flat or slightly sloped areas, that are usually 5 to 10 meters higher than the main channel. Low terraces also flood, but for shorter periods of time.

One of the most important aspects of the yearly flood cycles is the constant flushing of the numerous lakes that appear during low water. The lakes become a trap for the different species of fish that were once dispersed in the flooded forest. This causes a substantial increase in fishing productivity and in the importance of fish as a subsistence and commercial resource. Although this productivity diminishes with time, a small rise and fall of the water level in November and the annual rise and subsequent fall of water will constantly renew the system. Lakes are also important feeding and breeding grounds of fish during low water, probably having important implications over the subsequent year's fish stocks.

In the case of El Chino, its inhabitants have traditionally used over a dozen lakes that lie within their territory. These are of diverse origin, and vary among themselves regarding the physical and chemical characteristics of the water as well as the surrounding vegetation. The anthropogenic impact over the lakes has also varied considerably in response to past and current use practices. Distance from the community, size of the lake, access from the main channel, current vegetation, among other parameters, have been important factors in determining human pressure over the lake fishery. In general these lakes are small for floodplain standards, the largest measuring less than a kilometer in its longest side and rarely more than 2 meters deep during low water.

The mosaic of forest types in the landscape is a direct consequence of the complex geomorphologic characteristics of the *varzea* floodplain (Kalliola and Puhakka, 1993) and of the flooding duration, long considered a determining factor in the composition and structure of Amazonian floodplain forests (Junk, 1993). Kvist and Nebel (1998) identify 16 different vegetation classes for floodplain environments based on inundation period, characteristics of the inundating water, soil drainage, geographic location in reference to the main river course, vegetation structure, vegetation succession stage and presence of characteristic plants. In the case of El Chino we have elaborated a regional classification system for this

area that gives preference to the dominant vegetation types that the local inhabitants recognize and that can be readily identified with Landsat images.

Among the forest classes that are important to the residents of El Chino, probably the most limited one is the high *restingas* in the higher parts of the alluvial terraces. This is the only forest type in the more than 18,000 ha of territory that does not flood. High *restingas* are characteristically tall forests growing over old alluvial terraces; they are productive and sought out for planting during the low water periods. Since they are the only areas that do not flood they are important as a reserve of important subsistence crops during low water (e.g. manioc) and for the planting of perennial crops and trees that are not adjusted to flooding regimes (banana, anona, caimito, pineapple). Low *restingas* are characteristically tall forests that flood every year and are constantly cut over for practicing lowland agriculture of perennials such as maize, watermelon, beans, manioc and other annual crops. The palms found in the *aguajales* are important during fruiting season as an extractive resource. *Bajiales*, one of the most extensive forest types in the territory of El Chino, has very limited economic value since it is not good for agriculture, and rarely grows any timber or important fruits. It is characterized by dense undergrowth and very poor drainage conditions. However, it is ecologically important as fish habitat during high water periods.

4. Economic Activities and Natural Resource Use

The inhabitants of El Chino, like most riverine people throughout the Amazon basin, practice a diversity of livelihood strategies as a direct adaptation to the unstable environmental and economic conditions in the area (Hiraoka, 1985; Padoch and Jong, 1988; Coomes, 1992; Coomes and Bradford, 1999). Annual variations in the environment (fruiting season, floods, etc.) force them to distribute their economic activities accordingly, as well as diversifying their production to satisfy subsistence and commercial needs throughout the year. On a larger time scale, such external factors as changes in the market or in the resource availability, the appearance of new opportunities and shifts in state policy can also be expected to influence trends regarding livelihood strategies. Intrinsic changes dealing with access to capital, land, political power inside the community, the evolution of the domestic unit and the presence of external agents have been identified as factors that influence changes in economic strategies at the household level (Coomes and Bradford, 1999). The implications of these variations are enormous since economic strategies can alter the balance between productive (agriculture) and extractive activities.

The existing range of economic practices is extensive and the combination of these is even broader, capturing a wide range of possible outcomes regarding the resource base and the sustainability of the ecosystem (Coomes, 1992). Among the universe of possible economic strategies, the most important in El Chino include lowland agriculture, hunting, fishing, upland agriculture, *aguaje* recollection, charcoal production and small animal raising. Recently *camu camu* (*Myrciaria dubia*) extraction has also become an important activity during the months of December and January. Most families practice to a certain

extent all of these activities. The relative importance of each of these activities depends on the time of the year and on the strategy the family has decided to follow for a particular year or season (see Figure 2).

Fishing is essential for the subsistence economy of the community of El Chino throughout the year, being the main source of protein in their daily meals. For some of the families, it is also the main source of cash income, especially for the months of July – September when the lakes are stocked with fish. According to Coomes (1992), fishing is the second ranking income-generating activity for the community as a whole, after the sale of agricultural products⁵. However, direct measurements, carried out by McDaniel through a three month period in 1994, shows that fishing ranks fourth after agriculture, hunting and aguaje extraction (McDaniel, 1995). Another important aspect of the lake fisheries that has proven useful for the whole community, is its capacity to act as a savings and security mechanism (McDaniel, *ibid*). In a society where there is no bank system or access to credit, large stocks of accessible fish have functioned as a reserve to use in case of emergency, as was the case during the cholera epidemic in 1991 (McDaniel, *ibid*). Cattle herding serves this same purpose for many other Amazonian communities with an abundance of upland soils for conversion to pasture (Nepstad, et al., 1992).

The stocks of fish, as well as the relative abundance of the different fish species in the area varies seasonally, and are greatly influenced by the annual variations in the water level. Among the most common species found in the waters inside the territory of El Chino we find: gamitana (*Colossoma macropomum*), acarahuasú (*Astronatus ocellatus*) palometa (*Mylosoma spp.*), boquichico (*Prochilodus nigricans*) zungaros (*Pseudoplatysoma spp.*), piranhas (*Serralmus spp.*), among others. Paiche (*Arapaima gigas*) used to be an important ecological component in the lakes until the early eighties when freezer boats operating in the territory of El Chino depleted the stocks. These seasonal fluctuations also influence the fishing gear and techniques employed, as well as the relative importance of the fishing activity

During the low water period, most of the fishing takes place in the lakes and streams that flow into the Tahuayo River, while during the high water period, fishing takes place in the flooded forests or *tahuampas*. The most common fishing technique during low water is to use traps consisting of nylon mesh nets that are left in place through the night and constantly checked for fish. Other techniques include the use of a spear-like instrument, locally called *flecha*, and regular bait fishing. During high water traps are left overnight in the middle of the forest or close to fruiting trees. Another technique is the use of *espineles* or set rot lines, which consists on a series of metal hooks attached to a horizontal line tied to two saplings so the main line crosses the forest. The set net or *arrastradora* has been prohibited in the lakes of many communities but nevertheless is still used extensively. This consists of a large net that has to be manipulated by more than three persons who trap the fish by encircling them within the net. This is the most cost productive technique and can rapidly deplete fish in small lakes if used more intensively.

⁵ Data from our research based on each family's perception of the economic importance of the different activities confirm Coomes conclusion.

III. The Community Lake Management System in El Chino

On the upper Tahuayo River, fish is a resource that is presently, and has historically been, of utmost importance to local people. Fishing provides some cash income for most families, especially during the two-three month period when the floodwaters begin to recede. However, the real importance of fish for the Tahuayo communities lies in the fact that it provides a significant base for the subsistence economy of each household every day of the year. For this reason, the thirteen lakes that surround the village are of vital importance to El Chino. And, we believe, for the same reason, the community of El Chino organized itself to protect those lakes from over-fishing mainly by commercial interests from Iquitos and to regulate the fishing practices of all Tahuayo fishermen. It is our impression that the incentives to implement this management system did not stem from threats to their cash economy, but rather from the importance of fish for subsistence needs.

During the sixteen-year period from 1984 to the present, the residents of El Chino made a series of decisions in their community assembly and took a series of collective actions to exercise greater control over and regulate access to their lake fisheries. We refer to this body of decisions and actions as the community-based management system of their lake fisheries. This management system had four basic components: a group of norms and rules, a system of vigilance and monitoring, a series of sanctions imposed on transgressors, and a tax levied on extractive products.

The implementation of this management system for lake fisheries in El Chino has not been a continuous, linear process since its inception in 1984. Rather the community has approached each of the components of this system with a varying degree of commitment and resolve during the past sixteen years resulting in a series of ups and downs for the over all system. The non-linearity of this process is due in part to the fact that the incentives for both the individuals and the group to invest time and effort in the management activities are not constant, but vary from season to season and from year to year. Thus when factors converge to provide the incentives, norms are enforced rigorously; when these factors disappear or others discourage management, enforcement is relaxed. It is the very fluctuating nature of the ecological, economic and social context of *varzea* settlements that determine the variability in incentives for management. After describing each of the components of the management system, we will look at the history of ups and downs in the lake fisheries management system of El Chino.

1. Community Norms for Lake Fisheries

During the sixteen-year period of lake fisheries management in El Chino, six different types of norms were enacted. These norms were discussed and approved by members of the community gathered in a community assembly and then formally written into the community's Book of Agreements. We will describe separately each type of norm.

1.1 Norms of Exclusion

a) Prohibition of External Commercial Fishing Interests These norms refer to who has access to the thirteen lakes near the community and under what circumstances. One of the first norms enacted by the community was that prohibiting non-resident, large-scale commercial fishermen from entering the community lakes. This prohibition was applied to both high- and low water periods, but was especially important during the two-three month period when flood waters recede and fish are most abundant. The access rights to lakes for the residents of El Chino and the other communities of the Tahuayo River are restricted during the low water season. During the high water period, when fish stocks are dispersed over the entire floodplain except for a few high *restingas*, the fishery in El Chino is essentially open access. Local fishermen are allowed to fish in all the flooded lakes at this time as well. Nonetheless, even during this period, community members maintain their prohibition of commercial boats from Iquitos.

b) Zoning of Lakes The community divided the lakes within its jurisdiction into two categories that we will call lakes for subsistence use and lakes for multiple use (see Map 2). Initially five lakes were designated for subsistence use: *Tapaje*, *Tabano*, *Domingo*, *Narciso* and *Caro*. The use of these lakes was restricted during the low water months when fishing was permitted only with the use of hooks. Therefore, in these lakes fishing was permitted only for subsistence needs. This rule aimed to diminish pressure on the fish stocks and so to allow for their annual replenishment. In 1996, the community further restricted the use of these lakes by declaring them 'reserved' lakes prohibiting the use of all types of fishing gear in them, including hooks. *Bufo* and *Traves* lakes were added to this new category (see Map 2).

According to our interviews, these lakes were chosen for a more restricted use because they were considered to be the habitat of the most valuable species, e.g. *tucunare* (*Cichla ocellaris*). Nevertheless, because of their easy access, the selected lakes were the most devastated by the commercial fishermen from Iquitos and by the local people. We suggest that this was a more likely reason for choosing them.

Up until 1996, the other eight lakes, that include, *Redondo*, *Huiririma*, *Mocinho*, *Yarina*, *Afasi*, *Cumplido*, and *Zoila*, and *Bufeo* and *Traves*, were considered lakes for multiple use. In these lakes fishing is allowed at any time of the year, and fishermen are allowed to use any kind of net. However, the general prohibition on the use of toxic substances or explosives continued to prevail. These lakes are the most distant ones from the community center and therefore they are less used. Norms that regulate the use of both lake categories are stronger during the low water season.

1.2 Regulations on Fishing Gear

One of the central tenets of the management system is the restriction on types of fishing gear that can be used by members of El Chino and other local communities during certain times of the year. This regulation prohibited the use of all types of nets in the subsistence lakes during the low water season. This norm includes set nets (*honderas* and *arrastradoras*), gill nets (*trampas*), and cast nets (*tarrafas*). In the subsistence lakes, only the use of hooks was permitted.

It is important to note that the ban on nets in the lakes could be lifted for special circumstances. For example, the ban could be lifted when the community needed cash for construction or implementation of the school. Special dispensation could also be given to individual cases of special need as in the case that someone needed money for medical attention in Iquitos. A cholera epidemic in the community in 1991 made this an important aspect of the management system. At these times, people can use nets in the subsistence lakes, and the catch is sold to bring in the needed income. (McDaniel 1995: 8).

1.3 Regulations on Fishing Methods and Techniques

Regulations were established concerning the techniques and practices that could be utilized for fishing in the community's lakes. All fishing techniques that destroy fish habitat or limit their reproduction were prohibited. These practices include: (1) blockading with nets the mouths of streams that connect lakes with the main river, because it prevents fish from migrating for either reproduction or feeding; (2) blockading of the mouths of streams with sticks or palm leaves, because it prevents fish migration; (3) destroying aquatic vegetation that gives protection and habitat for fish; and (4) agitating the water to force fish out of hiding because this practice destroys the aquatic vegetation and causes turbidity in the water.

1.4 Norms Against Use of Toxins and Explosive

Community regulations prohibit the use of all fish poisons, dynamite and other explosives in their lake fisheries. Before the community gained control over the lakes in 1984, commercial fishermen from Iquitos used fish poisons such as *barbasco* (*Lonchocarpus spp.*), *huaca* (*Clibadium surinamense*), and *catahua* (*Hura crepitans*), as well as dynamite to deplete the lakes on a yearly basis. This norm is also part of the national fisheries legislation that establishes a sanction against those who used fish poisons and explosives. We have no data to suggest whether or not the community based their norm on this legislation.

1.5 Quotas for the Commercial Extraction of Natural Resources

At the beginning of the eighties, the community established a quota system for all the resources that were harvested for commercial use in order to have a certain degree of control over them. These norms applied to community members as well as to outside parties that were extracting resources for sale. The community set quotas for game meat, timber, palm fruits and fish. In the case of fish, the community set a limit of three tubs of fish per workday⁶. In 1988 after the community closed the lakes to outside fishermen, the quotas automatically applied only to local inhabitants. Subsistence fishing does not have a quota limit since the quantity of fish is a function of the necessities of the household.

In the case of game meat, the community agreed to establish hunting limits of three large animals (e.g. tapir, peccary or deer) or five small animals (e.g. rodents) every sixty days. In reference to timber, after the state suspended concessions in the area in 1988, the extraction of timber was limited for domestic use. Since then, each household is allowed to cut between 5 to 10 logs of wood every time they need construction materials. The people in charge of enforcing the quotas are the *teniente gobernador* and his inspectors.

1.6 Closed Seasons

The community also included regulations from the national fisheries legislation that make reference to closed seasons for fishing certain species. This can refer to a total prohibition on fishing certain species or to limitations on capture of individuals smaller than a minimum size established by the Ministry of Fisheries. The principal specie that is protected by the state in this way is the *paiche* (*Arapaima gigas*).

⁶ One tub is equivalent to 15 -20 kilos of fish.

Fishing of this species is prohibited during the months of October to March, which is its reproduction season. The rest of the year fishing is only permitted for individuals larger than 1.60 mt. It is assumed that individuals of this size have at least reproduced once. In other species, closed seasons are only applied in regards to size. The *teniente gobernador* is the person responsible for enforcing this law; non-compliance is punished with a jail sentence. Although the official law regarding closed seasons was already in effect when El Chino began its lake management effort, it was only incorporated into the local management system in 1998 with the intervention of an NGO and the Ministry of Fishery. We do not have knowledge of any local inhabitant being sanctioned for fishing during a closed season.

2. System of Vigilance and Monitoring

A vigilance system was established in the community to ensure that communal norms were enforced. The community periodically elected a fisheries inspector whose duties included organizing the vigilance system. Most of the men in the community, high school age (15) or older, participated in this system on a rotational basis for an average of two nights a month. A raised thatch hut located at a strategic point on the Tahuayo River served as the central post, controlling access along the river to the lakes. While some guards stayed at the post all night every night, the inspector with his assistants spent occasional nights patrolling the restricted lakes.

This vigilance system was established to assure that people from other communities and commercial fishermen were not entering the lakes at night, and that members of their own community were not using nets in the lakes. After an initial period of confrontation with commercial fishermen during which the community successfully established its jurisdiction over the lake fisheries, the incidence of infractions fell. A former fishery inspector told us that usually only one or two people were caught during the low water period with nets in the lakes (McDaniel 1995: 71-2). The system of vigilance was deactivated in 1996.

There was considerable discontent in the community regarding the vigilance system. Some people interviewed admitted they had been reluctant to participate in the vigilance system. Some claimed that other community members used their turn on the vigilance patrol to make illegal catches. Many of those interviewed accused one particular community member who, while acting as fisheries inspector and without permission of the community, used to catch *paiche* (*Arapaima gigas*), a highly valued commercial species while on patrol. When questioned about these actions, his response was that the number of nights he spent working as inspector for the community entitled him to an occasional *paiche* (McDaniel 1995: 72-3).

3. Taxes Imposed on the Extraction of Commercial Resources

The community created a tax on all products extracted for commercial purposes from the forests and fisheries as a mechanism to restrict exploitation of the natural resources in El Chino. The tax was first implemented at the beginning of the 1980's when a large number of outsiders were entering the area to extract resources for sale in Iquitos. As in the case of the quotas, the decision to impose taxes was agreed to in a communal assembly. The purpose was to discourage extractive activities by outsiders and thereby to diminish the pressure on the resource base. The resources taxed were game meat, timber, palm fruits, and fish. The total tax paid varied depending on the amount extracted. For example, in the case of fish, the unit was the tub; for game meat, the tax varied according to the size of the animal. Before timber concessions ended in the uplands in 1988, loggers were taxed 5 to 10 Peruvian soles for each log of wood depending on its size.

The taxes collected were put into a communal fund used for buying tools or materials for communal work (e.g. weeding the soccer field or the cemetery) or for supporting community members when they are in need (e.g. diseases such as malaria). The local governor and his inspectors are in charge of collecting the taxes at the moment the products are placed on the *colectivo*, the local boat that goes daily to Iquitos. Larger boats that used to go upriver were also inspected when they were leaving.

4. Sanctions for Transgressors

Failure to comply with some of the norms described was sanctioned by the community. They punished the use of nets during the low water season by confiscating the transgressor's nets. In order to retrieve their nets, those who disobeyed the norm had to pay a fine. When the transgressor did not pay, the net remained with the community and was used in communal fishing expeditions. The amount of the fine was usually quite high, discouraging fisherman from disobeying this rule. McDaniel reports that in the early 1990s, only one or two persons were caught fishing with nets in lakes for subsistence use during the low water season. In some cases the community may also take the fish which would be sold for a low price to community members and the money was given to the transgressor.

The Fishing Inspector was responsible for enforcing the regulations regarding fishing gear and methods. Cases of the use of poison and explosives fell under the jurisdiction of the *Teniente Gobernador* because they were punishable by law. In this case transgressors were taken to the Buenavista police station and left under police custody. The Teniente Gobernador also had responsibility for enforcing the closed season norms. We have no information if other infractions, such as refusal to be part of the vigilance team, were sanctioned.

IV. The Vicissitudes of the Community-Based Lake Management in El Chino

1. The Forerunners: Primatology Studies in the Upper Tahuayo (1974-1984)

Before the residents of El Chino took their first steps in 1984 to manage some of the natural resources that they extract from both upland *terra firme* and seasonally flooded *varzea* forests, they had been collaborating with Peruvian and foreign scientists doing research in the area. This relationship which began in 1974, had an important formative influence on the resource management initiatives that would take place years later.

At that time, the upper Tahuayo Basin became an attractive area for scientists because of the extraordinary diversity of primates living there⁷, and its accessibility from Iquitos. Peruvian biologists from IVITA (Veterinary Institute for Tropical and Highland Research) began in 1974 to carry out research on the biology of two primate species. These were the *pichico* (*Saguinus* spp.), an abundant primate that was utilized in the elaboration of a vaccine against hepatitis, and the *huapo rojo* (*Cacajao calvus*), an endemic species of the area. The members of IVITA contracted local people to capture the *pichico* individuals for use in their laboratories.

During this same period, the open access system that developed after the abolition of the estates with the enactment of the agrarian reform law in 1969 encouraged the uncontrolled extraction of natural resources. Timber was cut by local people and numerous outside loggers who entered to Upper Tahuayo forests; at the same time, game animals, palm fruit, and fish were exploited intensively by both local residents and larger-scale commercial extractors operating from the city of Iquitos. When the scientists realized that the habitat of the primate species was in danger, they began visiting the local communities to introduce ideas about the conservation of natural resources, especially wildlife and its forest habitat. Both these ideas and the scientists would play an important part in the establishment of community management of fisheries in El Chino years later.

2. The Autonomous Beginning (1984-1986)

The first steps towards management of the community lakes in El Chino took place in an autonomous way in 1984. This year, in response to the large number of hunters, fishermen and lumbermen entering the community's jurisdiction, residents decided to impose a quota and tax system on the commercial extraction of natural resources, including fish, exempting only products for subsistence needs. In this first phase, then, fishery management was limited to the payment of a tax on all fish caught within the territory of the community of El Chino for commercial purposes by any fisherman (even community members).

⁷ According to Bodmer (1994: 119) there are fourteen species of primates found there.

Local authorities were in charge of collecting these taxes. Nevertheless this initiative was not successful as a management technique or as a strategy to gain control over the resource because the large fishing vessels continued entering the lakes. Available data suggests that local authorities were reluctant to dedicate the time required for tax collection.

Although there were some research biologists who continued to work in the area at this time, their participation in the tax initiative in El Chino was minimal. Because there was no active participation of outside agents in establishing the tax as a resource management strategy, we conclude that this initiative had an autonomous beginning.

3. The Consolidation Of The Fisheries Management System: The Outside Threat And The Influence Of External Agents (1986-1994)

During this period, community lake management in El Chino was strengthened and reached its peak. Community members elaborated specific written rules for regulating access to and use of the lake fisheries; by 1991 fish stocks had experienced a significant recovery (Penn and Alvarez 1990: 10). While regulations regarding use of the fishery were designed within the community and the implementation of rules was carried out by community members, several external agents such as Peruvian and foreign scientists, NGO members and government officials exercised an important influence on the system. Thus, we conclude that the community management system developed less autonomously during this phase.

Since the 1970's, the more accessible lakes were being over-fished by commercial fishermen from Iquitos and from other villages of the Tahuayo and Amazon rivers that utilized freezer boats, illegal nets, traps, poisons, and explosives such as dynamite. The lakes were over fished on a yearly basis, being quickly depleted in the beginning of the low water season, depriving community members of their primary source of subsistence until the water began to rise again and fish from the river re-entered the lakes. Over harvesting of fisheries affected the subsistence and commercial activities of local inhabitants. The scarcity of fish, therefore, was the major incentive that stimulated the community to take steps to protect the resource base. In 1986, all of the community members of El Chino, gathered in a communal assembly, decided to exercise greater control over the access and use of the lakes within their jurisdiction.

Direct cash incentives were not the primary motivation for initiating the fisheries management in 1986. As we pointed out earlier, fish never ranked high as an income generating activity; agricultural produce, and especially in high water months, game-meat and palm-fruit far exceeded the cash value generated by fish (McDaniel 1995: 9). On the other hand, fish clearly provide a significant part of the community diet, for fish is consumed daily. We conclude then that the primary reason for taking action to protect and manage their lake fisheries was to protect a principal source for fulfilling daily subsistence needs.

The management norms established by the community in 1986 were the following:

- (1) Lake zoning: Five of the thirteen lakes, the more accessible ones, were designated for subsistence use: Tapaje, Tabano, Domingo, Narciso and Caro (see map). The use of these lakes was prohibited during the low water season. The remaining lakes (Bufeó, Redondo, Huiririma, Mocino, Traves, Yarina, Afasi, Cumplido, and Zoila) were declared for both commercial and subsistence use and could be fished at any time of the year.
- (2) Nets were prohibited in the subsistence lakes and both for non-resident fishermen and local people. Fishing was permitted in these lakes only with hooks. In the subsistence and multiple-use lakes as well as in the Tahuayo River nets were permitted.
- (3) The use of fish poisons and explosives was prohibited in all community fisheries.
- (4) Non-residents with large fishing boats, especially those equipped with freezing equipment, were prohibited to enter all the lakes.

For about two years following the approval of these norms in the community assembly, some community members resisted complying with them despite their initial support. However, in 1988, after a great decline in the fish stocks of the lakes, there was once again general support in El Chino for the lake protection efforts (Penn and Alvarez 1990: 10).

This management system was successful in excluding large fishing vessels, especially those that were freezer-equipped, from the lakes. Their presence diminished in a significant way after 1988, and disappeared all together after 1991. Since then, the only fishermen from outside of El Chino who fish in their lakes are those with small boats from other Tahuayo Basin communities. Access to the lakes was controlled from the vigilance post located on the banks of the Tahuayo River. Here, a group of community members registered every boat that went up river to fish within the confines of the community. This vigilance squad also patrolled the lakes zoned for subsistence use searching for possible transgressors of the management norms.

This period of maximum intensity in the lake management system in El Chino coincided with the increased presence in the area of external actors and with the creation of the Tamshiyacu-Tahuayo Communal Reserve. From the mid-1980's to the mid-1990's, several natural and social scientists came to El Chino to carry out biological, economic and social studies with direct participation by the local people. Before 1988, River, lumbermen were exerting enormous pressure on game animals in the uplands around the Blanco River Basin, an affluent of upper Tahuayo. The scientists together with some local government officials worked for the creation of a reserve in the upland area east of the Tahuayo River. In 1988 the regional government declared the area a "reserve under study", a classification that brought to an end the timber concessions and the over-exploitation of game. In 1990, a Peruvian-American NGO came to El Chino and together with researchers, state officials and the local communities, they took the necessary legal and bureaucratic action to legalize the reserve. In 1991 the Regional Government of Loreto enacted the creation of the Tamshiyacu-Tahuayo Communal Reserve (TTCR) (Bodmer 1994: 121).

While the majority of the local people wanted to extend their control over their lake fisheries situated in the varzea zone, the biologists working with the NGO were more interested in protecting the natural resources, especially the fauna, of the upland zone in and around the Communal Reserve. For this reason, several studies about the biology and economics of sustainable hunting were carried out for the establishment of community-based management plans for the buffer zone of the Communal Reserve. With the help of extension workers, local people set up a vigilance system that prevented city-based hunters from entering the reserve that apparently helped mammal populations to recover.

The NGO also worked with some of the Tahuayo communities a diverse array of pilot projects that included the management of aguaje and fish, the promotion of the communities' legal rights, and community organization. As part of the activities to protect the buffer zone of the reserve, this NGO lent support directly to the fisheries management in El Chino by donating equipment such as lamps, batteries, raincoats, etc., and taking some steps for the legal recognition of the management initiative.

4. The Relaxation Period (1993-1998)

After 1993, the community efforts to manage the fisheries in El Chino diminished but did not disappear altogether. While none of the management norms established in 1986 were actually rescinded by the community assembly, several of them fell into disuse. Thus, at this time some components of the management system, such as the vigilance and monitoring system and control over fishing gear and lake zoning, were abandoned little by little while other aspects, such as the rules prohibiting the use of toxins and explosives, quotas and taxation, remained throughout this period.

Large-scale fishing vessels stopped fishing in the upper Tahuayo in 1991. Without an external threat present, residents felt that the vigilance task was a big investment of time for little return. Since then, incentives for vigilance and monitoring efforts have been minimal and an active vigilance program has no longer been a permanent activity, operating only when there was the evidence of an infraction. As a result, control over fishing gear and lake zoning was relaxed.

One set of circumstances that triggered the relaxation of the management system in 1993 was the election, as community authorities in El Chino, of two residents who had always opposed the management system. One of these people was a local *patron* who used the credit system called *habilitacion* to accumulate and sell in Iquitos game meat and timber extracted by others. The other was a small-scale commercial fisherman who had always opposed the management rules that limited his freedom to fish where and how he chose. Both the TTCR and community-based management programs were seen as obstacles for their economic interests. Once in power, they put political pressure on other community members to support the elimination of the reserve. Furthermore, during that year, they used their status and power to suspend the vigilance system. However, towards the end of that year, the *patron* was put in jail due to a legal problem he had and consequently this attempt to eliminate the management system

failed. Subsequently, the management system did not fully recover either the same level of community support or that of implementation.

The vigilance system was abandoned completely in 1996. As a consequence the community was no longer capable of enforcing most of the norms for fishing in the lakes. Without a system for vigilance and monitoring, the lakes for subsistence use were used once again during the low water season and no control was exerted over the type of nets used in the lakes. Only the prohibition on the use of toxins and explosives remained in force, for these practices had been totally eradicated. Following the loss of control over the nets used in the subsistence lakes there was an enormous increase in the number of nets acquired by local people. During this same period, the price of netting on the Iquitos market came down, thus making them much more accessible for the inhabitants of the Tahuayo Basin. This, in turn, widely increased the use of nets for fishing. A few members of the community were able at this time to purchase set nets, which were prohibited once again in 1998. With the increase in the number of nets available, fishing became more important as a source of income for many in El Chino. For a few who began lending their new nets mostly to young people and charging half of the catch for their use, fishing became an important means of capitalizing small businesses. Consequently, very few in the community were concerned with the lake management system at this time, because the use of nets in the lakes became an important source of income for many.

At the end of this period, data from interviews with community members suggest that there was a noticeable fall in fish stocks. Because commercial fishing interests had not returned to the Tahuayo Basin since 1991, the cause of this decline was most likely an increase in local pressure on the fisheries. While we do not rule out natural causes, we have no data available to us that suggests this. Assuming then that local pressure caused this decline, the threat to the Tahuayo fisheries, the basis of the local subsistence economy, shifted from an external one to an internal one. Our interviews with local fisherman show that although they perceived themselves as the cause of the new problem, they were not highly motivated to take collective action to protect the fisheries. In our judgement, it was more difficult for local people to confront an internal threat- that is to limit their own fishing and that of their neighbors, than to take collective action against an external threat.

5. Renewed Efforts and Community Disempowerment (1998-present)

This period is marked by a renewed effort to implement the fisheries management system in El Chino. The participation of an NGO together with personnel from the Ministry of Fisheries in these renewed efforts, in our opinion, introduced strong disincentives for community management. We base this conclusion on two indicators that resulted from our analysis. On the one hand the local people suffered the formal loss of control over their lake fisheries and on the other, the level of participation by the local inhabitants in the management process fell drastically. As a result, following a rise in interest among

community members, the overall effort to manage the lake fisheries declined considerably, reaching levels as low as before 1984.

The NGO entered the Tahuayo Basin in 1996 with a proposal to implement a community development program that was focused primarily on agroforestry projects and marketing. Their program was focused on the implementation of several projects, including agroforestry and fish farming, oriented towards improving the livelihood of the local residents viewed by the NGO as peasants. A secondary component of their program aimed to diminish local pressure over the natural resources in the area, including the TTCR.

In 1998, as a result of pressure from some local inhabitants of El Chino to reestablish the fisheries management system, the NGO launched a new project focused on the sustainable use of the community fisheries. From the perspective of the NGO, the project responded to their interest in finding alternatives failed fish farming projects in the *varzea* environment. This new project had three objectives: (1) the elaboration of a lake management plan based on ecological studies from which harvesting rates could be ascertained; (2) the legalization of the lake management system through the adaptation of the community fishing regulations to the national fisheries law; and (3) the industrialization and improved commercialization of the fish as a means to generate interest and incentives for its management.

One of the first actions taken by the NGO was to bring in personnel from the Ministry of Fisheries as a strategy for officially sanctioning the management effort. These government officials worked with the community to elaborate new rules for lake use in accordance with national laws. As part of this process, the government officials informed the community members that all water and aquatic resources in Peru are public resources administered by the state and their use is regulated by national legislation. This, according to the officials, had two serious implications for lake fisheries management in El Chino. One, the community has no inherent rights or authority to exclude anyone from the lakes found within their jurisdiction; only the Ministry of Fisheries acting on behalf of the national government has that power. And two, community norms for fisheries management must be in accord with national legislation; local communities cannot make up norms of their own.

For the residents of El Chino, this dealt a hard blow to their lake management initiative. The keystone to their efforts had always been the exclusion of large commercial fishermen from the community lakes. This was both possible and successful because community members perceived the lakes to be a key part of their subsistence economy and because they were convinced that the lakes belonged to the community. Those perceptions empowered the community members to take collective action to protect the lakes and its valuable resource when they perceived an initial threat. The message delivered by the Ministry of Fisheries was clearly a disempowering one. Many residents concluded that it does not make sense for them to invest time and work in the lake management if they have no power to exclude others, especially the more powerful commercial interests from Iquitos, from the benefits.

As a result, the conflict between the national law and the local norms became evident. Some fishermen from El Chino used this conflict as an excuse to ignore the local norms arguing that the national law is superior to local norms. For example, a few families ignore the local regulations prohibiting the commercial catch of the alevines of *arahuana* (*Osteoglossum bicirrhosum*) claiming that this activity is not prohibited by the state.

Another important initiative undertaken by the NGO was an attempt to reactivate the vigilance system with the construction of a new vigilance post at the mouth of the Blanco River. However, these efforts were short-lived, lasting less than a year before the post and system were abandoned completely and dismantled. Our analysis suggests that the combination of no external threat and the lack of authority to exclude anyone from the lakes acted as powerful disincentives for maintaining an active vigilance system. After an initial peaking of renewed interest, local participation in the management system diminished in a significant way. A majority of the domestic units in the community continue to oppose the management efforts or to express their indifference.

Another factor that explains this current situation is, we suggest, the rivalry that exists between extended family groupings for the control and management of the lake fisheries. In this new NGO-sponsored project, a new extended family replaced the extended families that had controlled the management process since 1988. Members of the displaced extended family constituted an active opposition to the new project and consequently to the renewal of the management system. The loss of political control over the management process is only part of the explanation however. Among the opposing families we find a majority of those who recently bought large set nets known for their destructive capacity in small lakes, prohibited under the current norms.

The majority of community members now identify lake fisheries management in El Chino with the NGO's project. Thus, many, who for whatever reason, feel alienated from the project automatically transfer those feelings to a disagreement to the management system as a whole. Under these new circumstances, even those who voted in favor of the new lake management norms in early 1998 are now against the project and by extension against the agreements. Of the 41 households who live in El Chino, only 18 participate in the NGO fisheries management project at this point in time. During this period, the community authorities have had great difficulty enforcing the norms.

Currently, the community finds itself in a dilemma. On one side, fish continues to be the mainstay of the subsistence economy in El Chino. The community is conscious that non-compliance with the management norms along with the lack of a monitoring system will eventually produce a reduction in fish available for subsistence. On the other hand, a combination of factors acts as a strong disincentive for an active management effort. These include the fact that many individual households now have a strong cash-economy interest in the use of once prohibited fishing technology in all the lakes at all times of the year, and the disempowering impact of the Ministry's message disallowing exclusion as the basis for

community lake fisheries protection. At the same time, the Ministry of Fishery is now reformulating their policies regarding local management of the fisheries in order to encourage management systems at the broader basin level rather than at the individual community level. While from a technical perspective, this may seem more efficient; in fact it further disempowers, and thus discourages local communities from exercising direct control over the resources that they depend on.

V. CBNRM As A Non-Linear Process: Causes Of Emergence, Interruption And Resurgence Of A Community Fisheries Management Initiative

A series of factors converged to encourage residents of El Chino to establish a lake management system while many others have influenced its subsequent evolution. Some have helped strengthen the process while others have weakened it. Over time these factors have shaped the lake management system's dynamic nature, resulting in a sinuous, non-linear process that is constantly adapting to the context in which the community finds itself. A rich source of insights about these variables lies in an analysis of the history of the process. In this paper, we have presented such an analysis of the lake management system in El Chino in an effort to develop insights regarding how different factors condition the evolution of a management system.

As we have seen, the El Chino lake fisheries management system is composed of a complex set of norms and mechanisms strongly interrelated among themselves. It is at the same time extremely dynamic through time and strongly embedded in the socio-cultural setting in which the management takes place. The resolve with which the community members implement the different components of the system depends on how well adjusted the system is to the environmental and social conditions at any given point in time. This explains, in part, why each of the component parts follows a different performance curve through time. While some components are reinforced, others become obsolete; new ones may emerge and old ones may disappear and even reemerge later on. This dynamic behavior, dependent on many variables that affect the community's and the individual's perception and resolve to implement a particular norm, is continuously reshaping the management system. .

Figure 3 summarizes the performance curve for the overall management system between 1984 and 2000. Each point in time on the curve represents the sum of the performance values for each of its component parts. A scale from zero (no enforcement) to three (complete enforcement) was used to evaluate each component part of the management system in terms of the level of resolve with which community members implemented it and the degree of willingness of the local population to accept and

obey the norm.⁸ The management system is presented as the overall sum of the intensity with which each of its different components was implemented at a particular point in time.

An analysis of the variables that determine the dynamic behavior of the management system and its components requires a multidisciplinary approach. One needs to look at how both the community and the resource (fish stocks) respond to the cyclical changes in the local environment (e.g., water level). At the same time, the social composition of the users group or such external forces as the political interests in the region or fluctuations in prices on the market have a continuous effect on the management system. In the case of El Chino, these variables have influenced the management system through time in two ways: they influenced the community members' interest in maintaining the management system as a whole; and they obliged the community members to reevaluate continuously, in terms of cost, benefit and effectiveness, the different management components to the system.

Thus, by looking at the causes and consequences of the different events that shape the management intensity curve through time in El Chino, we are able to suggest which variables are likely more important and how they have evolved through time (Figure 4). We have identified several variables that have acted as both incentives and disincentives for maintaining the management system as a whole and its component parts. In the following, we will describe each of them.

Fish stocks: The state of the fish stocks is probably one of the most important variables in El Chino working as both an incentive for management when fish stocks are low, and as a disincentive when fish stocks are high. Although this was not an important factor for the decision to close access to the lakes in a first phase (1984 – 1986), it was decisive for gaining ample support in the community at a later phase (1988 – 1990). As the most important source of protein for subsistence in the region, it is a widely shared goal for the community members to keep a constant supply of fish on their table. Although many species of fish are migratory and lakes are continuously flushed and restocked every year, the quantity and quality of fish can be directly affected by the availability of quality habitat during low water (lakes). After closing access to strategic lakes in the region, fish populations recovered (1990 – 1994) and interest in maintaining the management system declined. Only recently, when fish stocks once again declined (1997 – 1999) did they act an incentive for renewed management efforts.

Emergency Insurance Mechanism: After fish stocks recovered and the external threat of large-scale fishing vessels was controlled, the incentive for maintaining a management system shifted to that of using the lakes as an insurance mechanism for emergencies (1991 – 1994). During this phase, the vigilance organization that previously kept commercial boats out of the area took on a new role in assuring a supply of fish throughout the low water season from the lakes designated for subsistence use. This was especially important in the case of household emergencies; with the approval of the community, the members of a

⁸ Our valorization of these criteria is based on our interpretation of individual responses to questionnaires and recorded interviews with gate keepers of the management system and with external agents.

household could use nets in these lakes, assuring an easy and extremely large catch of fish. This was also the case when the community needed to raise funds for collective project or expense.

Power relations: The management system as a security mechanism ended abruptly when a local *patron* who viewed the management system as a threat for his commercial interests was elected as *teniente gobernador*. Because of his social status within the community, he was able to convince community members to dismantle the vigilance system. This indicates that the perceived need for a norm, or for the management system itself, is not a sufficient condition for its existence. Despite the perceived need in this case, those with more power in the community can oppose the norm or the management system and influence the decision making of the group in order to override it. The community's fear or incapacity to confront the abuse of power by its own power groups can act as a disincentive to local management.

External support: The financial and technical support from external agencies has been an important factor influencing management initiatives in El Chino. We find a direct correlation between the periods of intense outside agency activity in the area and the periods of stronger community commitment to lake fisheries management. Although the original proposal for a conservation area in the uplands for the protection of wildlife was not of much interest for the local population, it marked the beginning of a period of close collaboration between the community of El Chino and conservationists. The two shared many innovative ideas about conservation and participatory management during the formative years (1984 – 1986) and the period of consolidation (1988-1993). While conservation biologists, government officials and NGO extension workers pushed the idea of a communal reserve at the same time that the community wanted a lake management system, both parties needed each other for the establishment of their projects. While the community helped establish the Communal Reserve, biologists played a key role in helping the community negotiate and enforce the lake management system.

The presence of an external agency and its development and later management projects were an important factor again during the period of resurgence of the management system (1996—2000). At first, the management system gained new impetus, in part as a result of a large investment of capital and a well intentioned participatory approach promoted by the agency and in part as a result of the community's expectations of benefits to come. However, this lasted only a short while, as other disincentives, in large part a result of the NGO project itself, began influencing the effort.

Internal conflicts: The rise of conflicts within the community and its failure to resolve them in the last phase (1998-present) acted as a powerful new disincentive for community resource management. In this period, rivalry among several of the extended families into which the community is divided became a serious obstacle for reorganizing the management system. These families struggled among themselves for control over the management project in order to obtain the benefits that the NGO offered. The extended families that were excluded from power in the new project became a strong force opposed to management in general. These same families along with a few others also opposed the renewed management efforts

because of their increased economic interests in commercial fishing. In this context of increasing competition among extended families, the authority of local officials lost legitimacy. That in turn affected their capacity to enforce the management norms and sanction any transgressors.

These internal conflicts imply a weakening of the social bonds based on norms of reciprocity that underlie social relations in the community. The strength of reciprocal exchange and indebtedness bears a direct relation with the level of political organization of the community and its capacity to resolve internal conflicts. To some extent, the increased importance of fishing as a commercial activity of the individual household suggests that the relations among them regarding fishing are moving from a sphere based on trust and reciprocity to one based on competition.

At the same time, the existence of external threats can be a stimulus for the cohesion even among warring extended families, as occurred in the initial phase (1986-1988). However, when the external threat disappears leaving only an internal one, cooperation among the extended families is more difficult and may require an external referee. This may explain why our informants perceive that during those “good old days” at the height of the management system, the leaders were better able to exercise their authority and the community members were less reluctant to comply with the norms.

Outside Intervention as Disempowerment: One of the principle disincentives that arose during the latest phase, (1998 – 1999) resulted from the intervention of officials from the Ministry of Fishing brought to the community by the NGO. The community of El Chino had exercised de facto rights of property, control and traditional use over the lakes inside their boundaries for more than three generations. These perceived property rights had been a strong incentive for organizing and controlling access to the lakes during the first phases of the management system (1974 – 1988). The Ministry of Fishing, through the NGO, informed the community that, by law, the lakes were public property, and as such, the community had no right or authority to exclude anyone from them. It is our strong impression that this confused and disempowered the local population and in the final analysis, acted as a strong disincentive for continuing to invest in the management system.

Figure 4 demonstrates graphically the positive or negative impact through time of different variables on the fisheries management in El Chino. By comparing the impact of these variables with that of the intensity/ performance of the system (Figure 3), we see a strong correlation through time, between the performance of the overall system and the presence or absence of particular incentives. We learn from the El Chino case that resource management is a process throughout which numerous variables are at play and that no one variable is exclusively responsible for its overall success or failure. Instead each variable is constantly evolving, gaining or losing importance through time and combining with others to determine the community’s perception about how important the management system is for a particular point in time. This in turn results in a re-adjustment of the system, through its numerous components, to respond to the changes in the social and ecological environment.

We have attempted to show the significant implications that the fluctuating social and natural environment in which the Amazonian *riberieños* live has had over their livelihood. Living in between the forest and the water, they have learned to change their livelihood strategies from subsistence agriculture to extraction of forest products, from small commercial ventures to hunting, from crafts production to fishing according to the opportunities and limitations that change with the seasons and with longer-term cycles (Padoch & Jong, 1990; Coomes, 1992). The lake management system came into existence and evolved within this context as a new component of an important age-old subsistence strategy, fishing; as such it combines the traditional knowledge and experience of *riberieño* culture with the necessity of protecting their fishery resource from modern threats (McGrath *et al.*, 1993).

The dynamic nature of their livelihood strategies through time is a consequence of a deeper adaptation by *riberieño* peoples to living in the Amazon environment, itself a dynamic and heterogeneous system. This *riberieño* lifestyle, part indigenous and part not, deeply embedded in their socio-cultural context, influences and becomes a part of any management system they may initiate, be it for lake fisheries or for forest resources. The lake management system that we described for El Chino follows this logic of dynamic adaptation: the fact that the management system is not enforced or practiced with the same intensity or in the same way every year is both natural and reasonable for them. The same reasoning applies for the management components and their dynamic behavior. The sinuous performance curve simply reflects the sinuous curves of all the other natural and social cycles in the Amazonian system. The success of a management initiative, inside a *riberieño* community, can be greatly enhanced by viewing it as a dynamic system and allowing enough space for incorporating the flexibility that *riberieño* lifestyle demands into the management system and its components.

VI. Some Conclusions

The twenty-five year history of the fisheries management system in the community of El Chino shows us a very dynamic process, whose sinuous performance curve has given us important insights about the nature of community-based natural resource management in the Amazonian *varzea*. The management experience in El Chino has responded throughout that quarter century to many variables that were driven by both natural and sociocultural factors. These variables have generated both incentives and disincentives for collective action towards resource management. It is clear from our historical analysis of the El Chino case that the power of the incentives to encourage or discourage management fluctuates through time in accordance with the cyclical flow of changes in the natural or social context. We believe then that the performance of and outcomes from the fisheries management is a result of the type of incentives and disincentives that are at play. These influence the choices made by community members regarding which

norms they are willing to obey, which monitoring mechanisms they are willing to implement and with what degree of intensity.

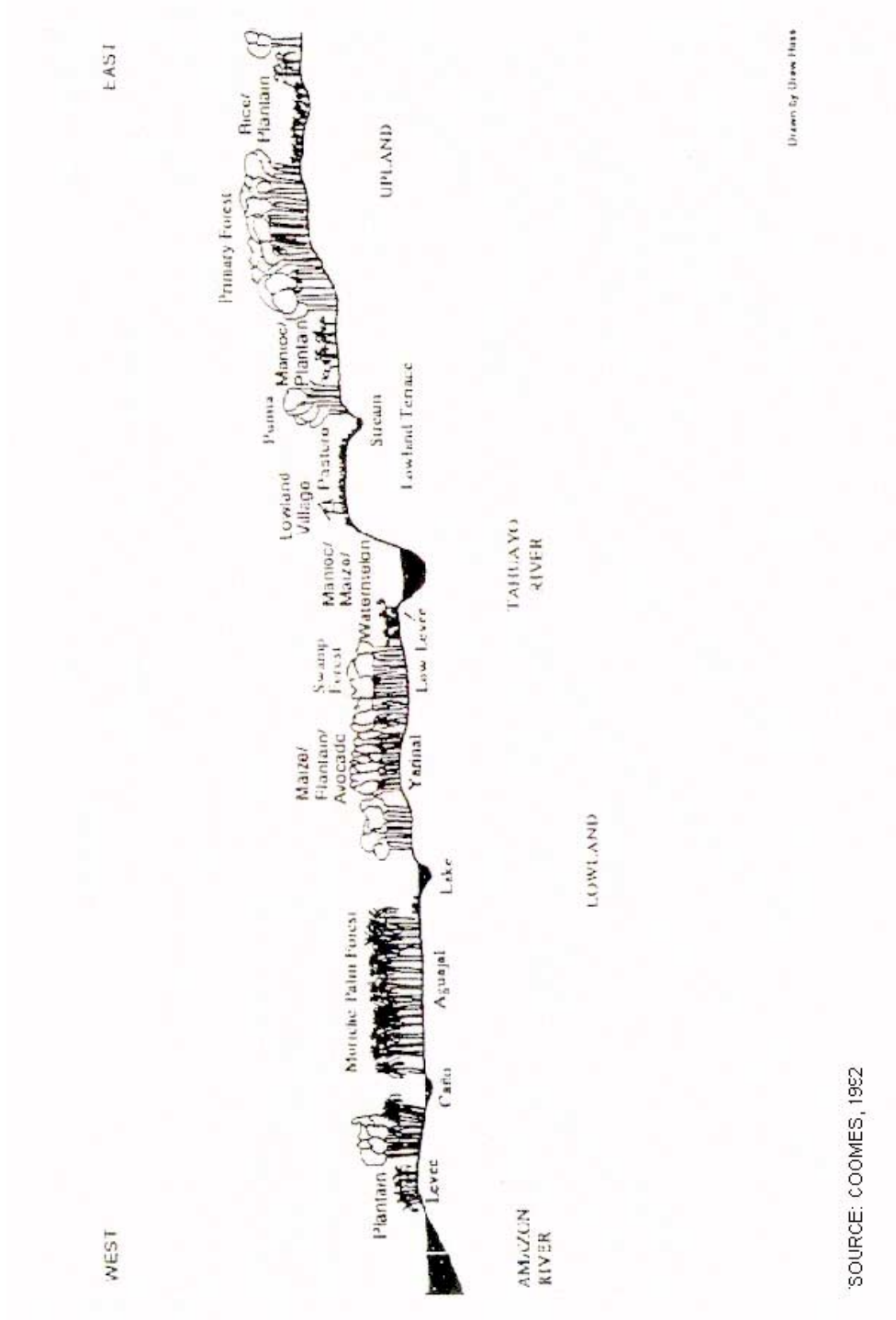
It is this complexity of factors derived from the sociocultural and ecological context of a management system that goad a community to take action to protect and manage their resource base and at the same time that shape their capacity for carrying out such actions successfully. External agents from the government or an NGO may attempt to promote resource management among local communities. But the real possibility that a community initiate such a process depends on such contextual factors as the existence of an external threat to the resource base or on whether the price of fishnets in the local markets makes them accessible to community fishermen. Implementing resource management for the longer term with an upward slanting performance curve depends on other variables like the state of power relations within the community, the capacity of the community institutions to deal with conflict or the health of the fish stocks in the community fisheries at any given moment. The fluctuations of a management process, then, can be related to both the collective perception of need for managing a resource and the capacity of a social group to carry it out. On the other hand, as we have seen in El Chino, when there is an urgent need to protect resources, a community is quite capable of getting beyond any obstacles that may keep them from taking collective action.

Currently, the lake management system in El Chino is suffering from a new collapse that is a result of a combination of disincentives. While the need to manage the fisheries is probably patently obvious to community members and certain factors are working as incentives, the failure to take action reflects the diminished capacity of the community to deal with internal conflict and to organize itself for new challenges. The presence of an NGO that supports local fisheries management has given a big push to renew management efforts. Yet even the participatory methodology that they have used in this case has not been enough to assure the success of the project. A deeper understanding of the contextual factors that are currently acting as incentives and disincentives and of how fisheries use and management are embedded in the local social structure and culture are more decisive factors in this case. We suggest that an important first step to remedy the current impasse is to re-empower the community emphasizing a more horizontal approach and a more autonomous management system while at the same time consolidating property and usufruct rights to the lake fisheries and the territory of the community.

In the present context, policies that support private enterprise and state predominance over natural resources, and the recent resurgence of a preservationist point of view in conservation efforts (Terborgh 1999) obscure the development and conservation potential of community-based management initiatives throughout the Amazon (McGrath *et al.*, 1993). The results of case studies like that of El Chino can have important implications for a movement towards more participatory local management of natural resources in the Amazon Basin (Schwartzman *et al.*, 2000), and on how these are implemented (Smith and Wray, 1996). For example, some of the recent difficulties found in El Chino suggest that in Peru the legal

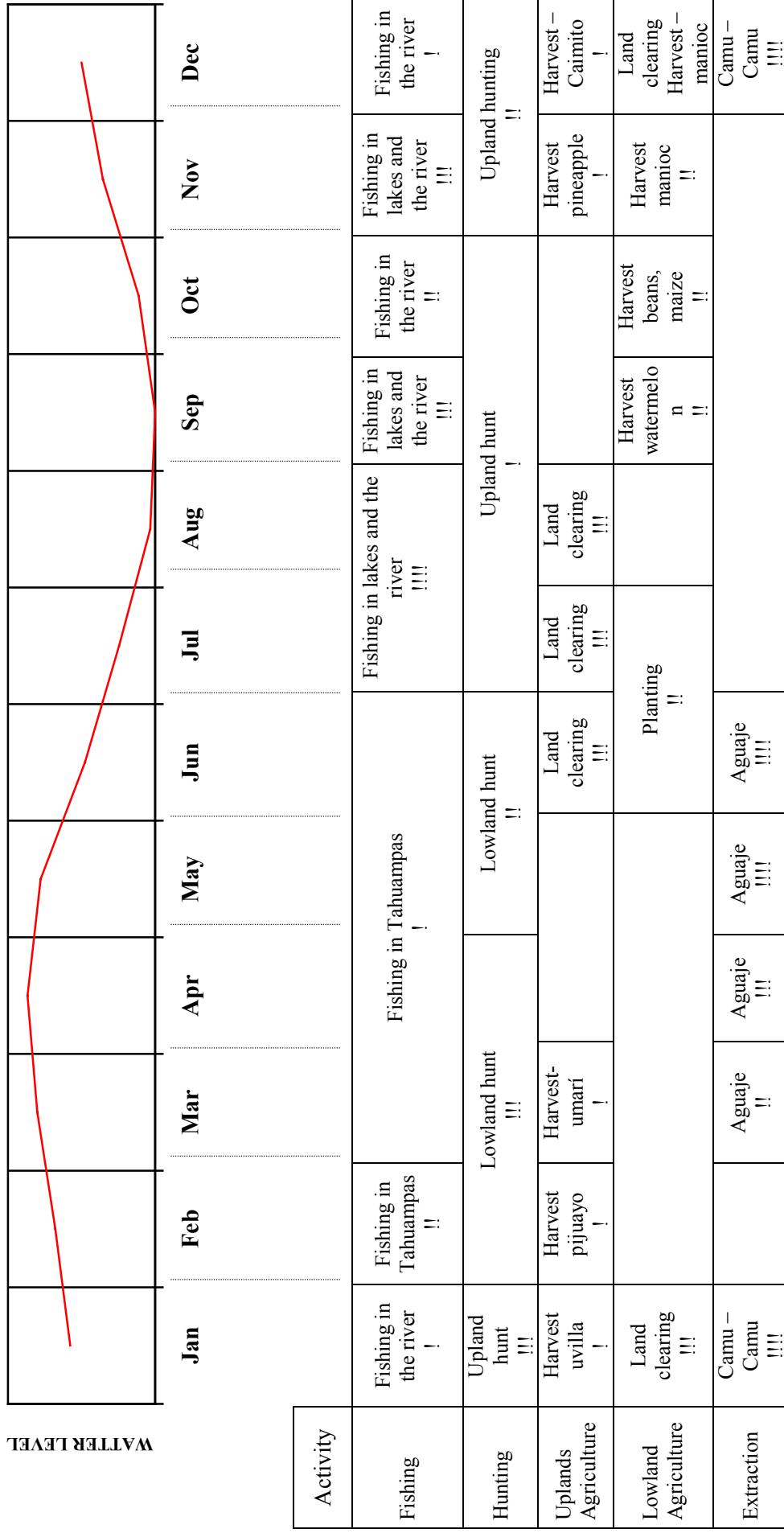
framework and the models of resource use currently practiced do not take community-based models of resource management into account, much less provide them with incentives. Initiatives that were autonomous in their beginning taken by communities who felt themselves empowered by doing so can find themselves truncated by laws and policies that do not consider local efforts to manage resources as valid land-use practices. The model of state property over all natural resources which ignores traditional claims for territory and that considers the commons as irrational, also acts as a powerful disincentive for community-based management initiatives. Public policies and incentives for community control and management of natural resources can encourage an important movement towards more sustainable land- and resource-use practices in the Peruvian Amazon.

Figure 1. SCHEMATIC CROSS-SECTION OF THE LOWER TAHUAYO RIVER AND AMAZON LOWLAND



SOURCE: COOMES, 1952

Figure 2. CALENDAR OF PRODUCTIVE ACTIVITIES IN EL CHINO



Legend: low: ! medium: !! high: !!! extremely high: !!!!

Figure 3. FLUCTUATIONS IN MANAGEMENT INTENSITY

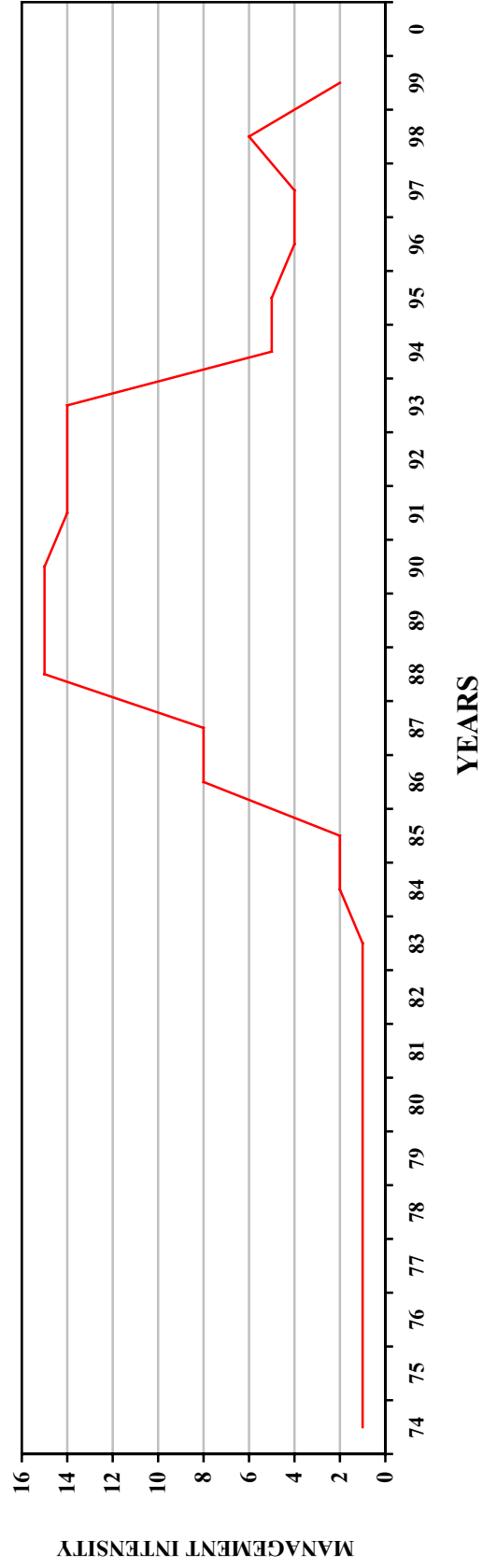
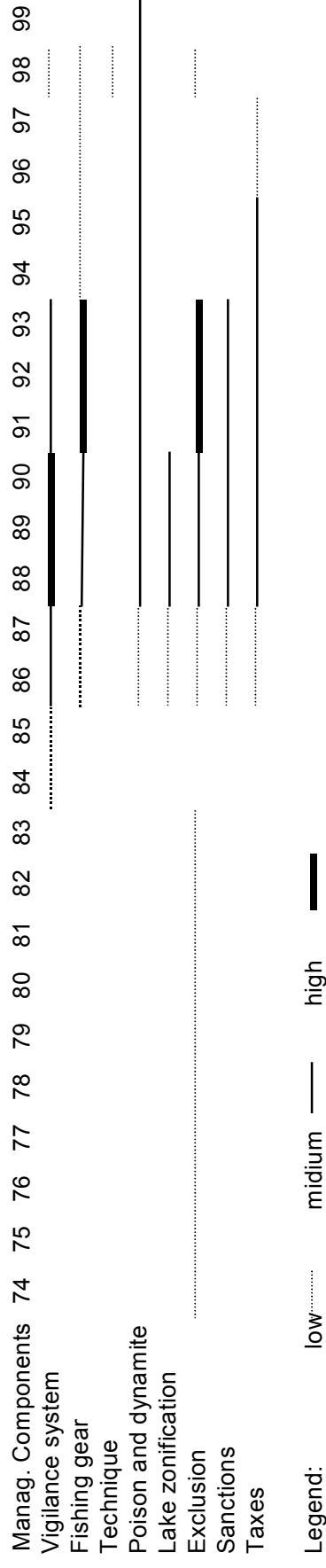
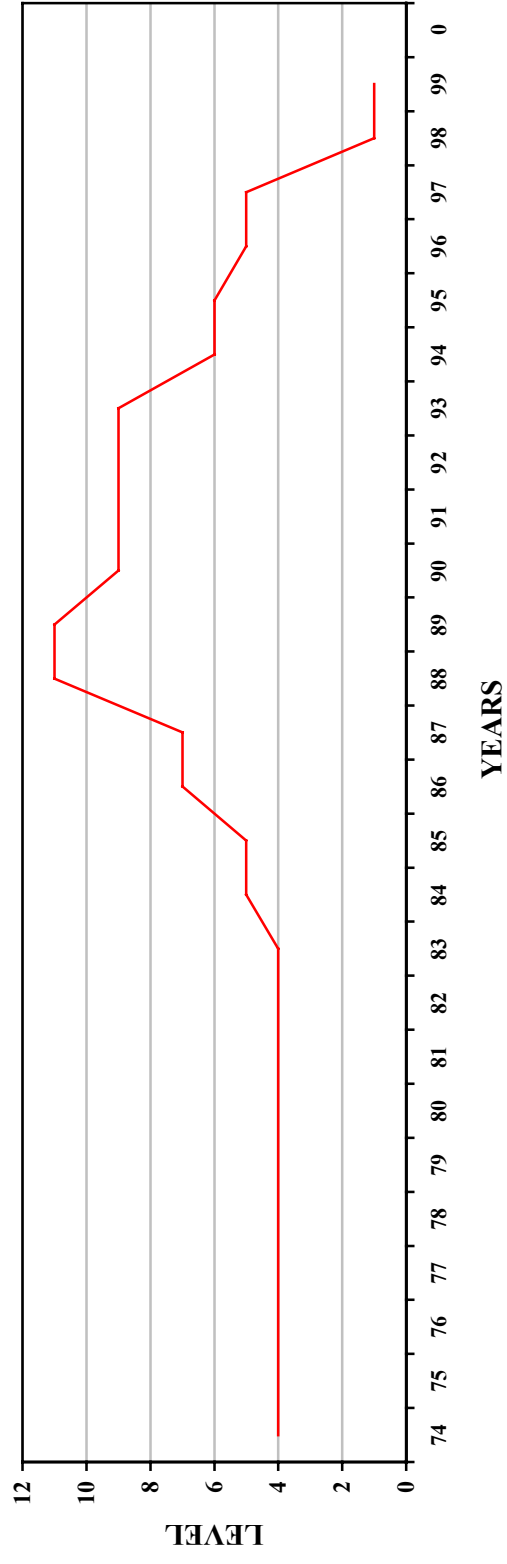
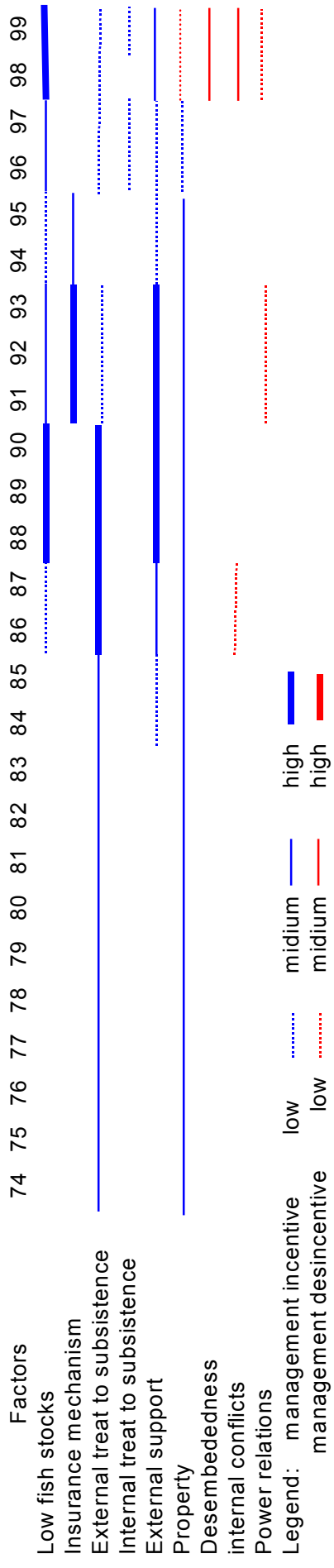
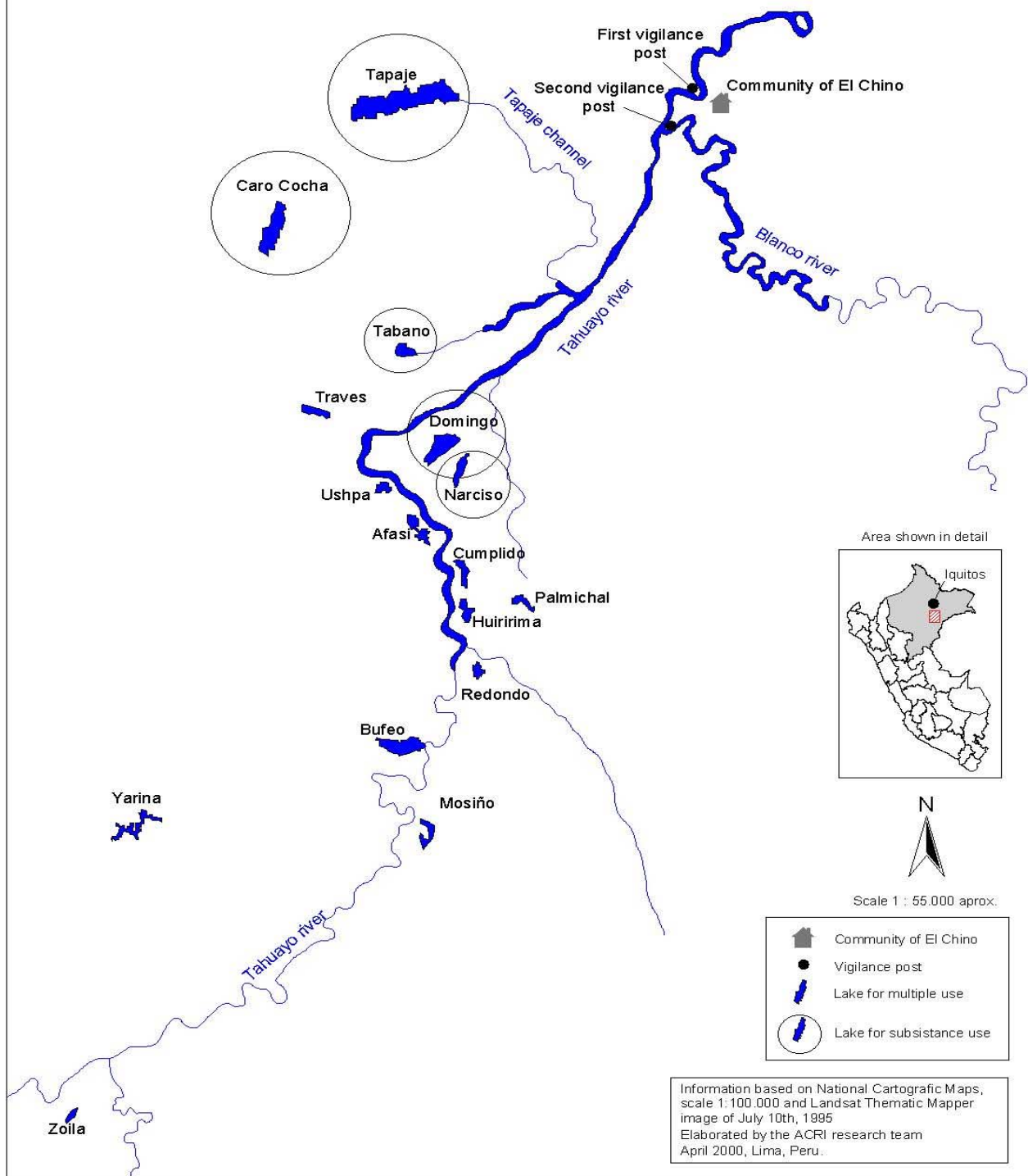


Figure 4. FACTORS INFLUENCING MANAGEMENT INTENSITY



Map 2. LAKE ZONING IN EL CHINO



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