Work in Progress

Adaptive Management, Organizations and Common Property Management: Perspectives from the Community Forests of Quintana Roo, Mexico

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For over 15 years an unusual experiment in community-based management of common property resources, particularly forest resources, has been underway in the Mexican state of Quintana Roo.[1] The Plan Piloto Forestal (PPF) has become one of the best-known and lauded experiences in community forest management in the world. It has been called "probably the largest, most important and successful forest management operation in Latin America", "one of the more successful examples of the application of the new approach to forest management", and "the most promising, community-based natural forest management initiative under way in the tropics today".[2] This relative success has been attributed to "tenure stability, the creation of new and flexible institutions, the strength of the producers organizations, rapid capitalization and an aggressive marketing strategy"[3] All of these factors are true but they also beg the question: how were all of these factors, so absent elsewhere, able to combine to produce the outcome of a relatively successful, although now troubled, outcome in community forest management in Mexico?

The problem to be explained in Quintana Roo is how local communities reorganized themselves around a new and sophisticated common pool resource management challenge, while at the same time mounting a second-level organization that become a national actor, and eventually a global model of community forest management. This process appears to have braked a voracious process of land use change that had been underway in Quintana Roo since the 1970s. The literature on the "PPF process"[4] has not been clear on what makes it so different from other experiences in community-based natural resource management, so these unique dimensions need to be stated at the outset. They are:

1. It takes place in the context of Mexico's *ejido* system, an agrarian reform outcome of the Mexican Revolution which gave communities permanent and secure usufruct rights to common pool forest resources under defined common property management regimes in two stages, a) When the *ejido* land grant was originally given as far back as the 1920s in some cases, and b) when communities won the right to exploit the timber on their forest lands in the early 1980s.

2. It has involved the industrial production of timber for commercial markets through formally organized community enterprises, an economic activity that occurs in few other community-based natural resource management regimes in the world outside of Mexico. Almost all other cases of community-based forest management revolve around the fuelwood and non-timber forest products.

3. Although commonly touted as a success in community forest management, what is more crucial and explanatory is the PPF process is that is also a success in the constitution by external actors of first, second, and third-level organizations. These formal organizations are what have driven institutional change, changes in "rules in use", at the community and other levels. They have created almost entirely new common pool resource management regimes at the local and state levels, in interaction with rules changes emanating from frequent shift in relevant national laws in Mexico.

This article will attempt to provide an interpretation of the emergence of these unique features as the driving institutional and organizational forces that have slowed down land use change in Quintana Roo and created a still-evolving mechanism for adaptive ecosystem management of a common pool resource.

In providing this account, I will attempt to construct an initial conceptual framework drawing upon the literature on adaptive management of ecosystems and the consequent linking of social and ecological systems, common property theory, and social capital. By drawing up on a variety of theoretical frameworks, I hope to contribute to a science of the "integration of parts" which will combine knowledge of ecosystem and social complexity towards improving environmental and social outcomes.[5] However, as is also noted, I believe the Quintana Roo case requires modification of some of these conceptual frameworks in useful ways.

The adaptive management approach has evolved to understand how ecological science and management can be brought together into the same conceptual framework in the management of large, regional ecosystems, primarily in the United States. It supposes the availability of on-going scientific research to monitor changes in ecosystems subject to policy interventions, and coordination among multiple stakeholders from government agencies to local residents.[6] An adaptive management approach assumes that the social and ecological systems under some form of management are more complex than can be captured in any conceptual framework or any systems modeling, and that it will be impossible to predict with scientific accuracy how the system will change under management, or how the organizations managing it will evolve. It suggests that organizations can learn as individuals do and stresses the importance of feedback from scientific research and other information from the environment in changing strategies and policies. In this approach, resource management policies, and resource-directed actions should be treated as "experiments" from which land managers and "stakeholders" at all levels of a social system can learn, assuming that some sort of feedback mechanism is in place to realize this learning. It takes the assumption of "trial and error" in the evolution of self-organized CPR systems, and attempts to place it on a more formal foundation of scientific research and adaptive organizational strategies. It is a framework that allows us to look at the Quintana Roo organizations as actively adapting and reacting to a typically complex social and ecological environment, as organizations that "learn".

An adaptive management approach, "is a way of managing in order to ensure that the organizations responsible for ecosystems are responsive to the variations, rhythms, and cycles of change natural in that systems and are able to react quickly with appropriate management techniques.".[7] But "appropriate management techniques" are themselves a normative, negotiated, and scientifically shifting construction which are embedded within dynamic social and political environments, making ecosystem management *and* organizational management a constantly unstable undertaking. The inherent unpredictability in evolving, managed ecosystems and the societies with which they are linked is thus stressed.[8] The central puzzle of adaptive management approaches is why successful management of a target variable for sustainable production apparently leads to "an ultimate pathology of less resilient and more vulnerable ecosystems". Other key

concepts are “resilience” and “turbulence”. "Resilience" is a measure of robustness and buffering capacity in organizations and ecosystems.[9] “Turbulence” may be thought of as the social equivalent of “disturbance” in ecological settings. While “disturbances” reset ecological succession, turbulence refers to the multiple ways in which social management systems are buffeted by larger social systems as they attempt to manage ecosystems. A turbulent social environment is characterized by “uncertainty; inconsistent and ill-defined needs, preferences and values; unclear understandings of the means, consequences or cumulative impacts of collective actions; and fluid participation in which multiple, partisan participants vary in the amount of resources they invest in resolving problems". [10] Finally, it has been suggested that the most crucial focus for understanding the dynamics of social systems in relation to ecological systems are learning and innovation. Thus, the Quintana Roo organizations will be evaluated for what they represent in terms of innovation and their capacity for learning to change or adapt in the face of new ecological and social circumstances.[11]

It should be emphasized that none of the actors in Quintana Roo have conceived of themselves as undertaking adaptive ecosystem management efforts. Nonetheless, it is important to apply the concept because, as analyzed in this paper, the PPF process has nonetheless shown clear evidence of responding and adaptive to new information that is coming from both formal structured observations of the behavior of the ecosystems *and* informal social observations of how some of the social institutional/organizational experiments were failing. A current dialogue between social and natural scientists and principals in the PPF process is attempting to shorten and formalize this experimental cycle.[12]

As noted, the systems under examination are common property regimes, and have been demonstrated to meet all of the "design principles" for successful common property systems, but also vary in important ways from other cases described in the literature.[13] The concept of "institution" as used in the common property literature refers to “rules in use”, the rules or patterns of behavior that shape relations with the environment and more particularly access to a common pool resource.[14] The approach was concerned with demonstrating that self-organized and self-governing common property resource management systems could sustainably manage natural resources as well as private property systems putatively could. A focus on rules of access also allowed for the rigor of applying game theory to common property management problems. However, the focus on rules of access, for all its strengths, is not able to account for the importance of the emergence of formally constituted organizations as vehicles for changing rules in use. For common property theorists, traditional natural resource management regimes evolved over hundreds of years and contemporary inter-government efforts to management ground water present the same problem: how to create rules that allow for the sustainability of a common pool resource in the face of individuals pursuing their interests.

The powerful but narrow focus on the generation of rules does not account for the importance of formally constituted emergent grassroots organizations, in interaction with government agencies constituted at various levels, in generating new rules for natural resource management. Organizations, as distinct from but including institutions, are

corporate actors that can be demonstrated to be the most important variable in inducing changes in rules and in creating the socially sustainable structures that permit resource managers to have the training necessary to appropriately implement the new rules.[15] In Quintana Roo, we have common property management systems and common pool resources largely established by the State in interaction with local communities. The formal management organizations and the rules in use emerged out of these state-established systems through contemporary political dynamics, not out of the depths of time, and were significantly "donor-initiated common pool resource institution". Although in some cases it clearly was able to draw on indigenous cultural forms and practices, it does not depend primarily upon local ecological knowledge.[16] Thus, it is not "self-organized" although in the best of the cases it now has a significant degree of self-governance. The systems involve management for commercial markets and nested formal organizations at multiple levels. Recent literature has deconstructed the concept of "community" in community-based conservation for a view of communities as sets of institutions.[17] But the analysis of the social context of natural resource management must go beyond this to also analyze the emergence of actual formal organizations. Agrawal and Gibson recognize this when they note, in reference to common property management organizations that "it would be imperative (to) organize themselves into larger collectives or federations that can span the gap between the local and the national".[18] As they also note, community-based conservation emerges with a disenchantment with both the state and the market, but the experience in Quintana Roo suggests that these successful experience draw essential elements from bot the state and the market. I would however also suggest that the "greater autonomy" that they call for will necessarily be relative in a globalizing world, that there will almost always be other “stakeholders" and that the operative should indeed be one of "checks and balances" but within the context of "strategic alliances" among stakeholders.[19]

Such successes in collective action in the modern world necessarily involve the emergence of formal grassroots organizations. These organizations are the necessary social catalyst for the emergence of new and sustainable rules in use for natural resource management. The difficulty grassroots organizations in rural Third World counties have in becoming effective thus becomes the another crucial subject in understanding how we can construct a more sustainable future. One of the key explanatory factors to the emergence of these organizations is "social capital". Ostrom uses social capital to refer to the richness of social organization and institutional capital, the "supply" of organizational ability and social structures that a society has at its disposal.[20] As Fox has pointed out, the political construction of social capital, when it occurs, requires particular explanation in conditions where participatory democracy is not a tradition.[21] The combination of agrarian revolution and its consequent policies, intertwined with, in some cases, indigenous cultural forms, have given Mexico a particularly rich matrix of social capital. Formal local-level governance structures formed through the agrarian reform process and a legacy of government activism in establishing new organizational forms, albeit for control purposes has, as we shall see below, created a vitally unique context for the emergence of formal natural resource management organizations.

With this theoretical background, I will attempt a synthesis and interpretation of over fifteen years of the PPF experience. I will be attempting a synthetic analysis of the history of these organizations, the social and ecological conditions which forged their emergence, and how they have transformed over time within a turbulent policy and political environment and in interaction with the constraints and possibilities of the ecosystem. As a part of this synthesis I will also be discussing the organizational evolution of the two principal organizations that have emerged from the PPF process, the Sociedad and the Organization. The comparison of the two reveals important differences in their evolution. I will be arguing that the differences arise from different learning processes that arise from the different social and environmental realities in two different areas in which they operate. [22]

The PPF: Its Ecological and Social Context.

The Ecological Context: The tropical forests of southeastern Mexico, now occurring principally in the states of Chiapas, Campeche and Quintana Roo, are the remaining areas of a vast tropical forest which once stretched from San Luis Potosi in the north, along the Gulf Coast and spreading out into the southeastern states, and on into Guatemala, Belize and Central America. These forests are postglacial in origin, and thus are less than 11,000 years old.[23] The Quintana Roo segment of this forest mass is composed of seasonally dry tropical forests, standing on extremely rocky soils, with elevations which vary only from 0-60 m. [24] Annual rainfall in southern and central Quintana Roo is 1200-1500 mm per year and during the height of the of the dry season, in March and April, many species drop their leaves for a short time. There are many even-aged stands due to the catastrophic natural disturbances of hurricanes and fires. Canopy heights are from 25-30 m., with a discontinuous overstory. They are thus medium-height, semidecidious forests with some 100 species of trees, with the most abundant being *chicozapote* (*Manilkara zapota*), the source of chicle. There are also high incidences of ramon (*Brosimum alicastrum*) and mahogany (*swietenia macrophylla*), although there is also considerable species variation from area to area. The forests have been resilient with respect to natural disturbances and some human disturbances but politically driven land use change have also significant altered the Quintana Roo forest mass, as we will see more below. Although mahogany, the tropical species around which management plans have been structured, averages only 1 full-sized specimen per hectare, it can also occurs in thick stands resulting from the large clearings left by the natural disturbances. The other significant ecological management problem is the presence of large numbers of lesser known species (LKS) which, with a few notable exceptions, have few markets and unknown industrial characteristics.

The contemporary social composition of Quintana Roo was formed only in the last 150 years, the state having been virtually uninhabited since the collapse of the Mayan Civilization centuries earlier. Central Quintana Roo was settled by Mayan refugees who fled taxes and expanding sugar cane plantations in Yucatan in the mid-19th century, with an estimated 4,000 of them populating the forests of central Quintana Roo by 1869. These refugees were primarily farmers, with the cultivation of the milpa being both the center of

the economy and a pillar of their spiritual life. Their spiritual life also had a dimension unique among contemporary Mayans, that of the "talking cross", which gave them guidance in their wars against the Mexicans. This dimension of their religious life gave them the name of the Cruzob, "people of the cross" in Mayan although their term for themselves was historically “masewal”. Although the Masewal Mayans were not traditional "forest-dwellers", the forest was crucial to their existence as a source of soil for new cornfields, wildlife, building materials and medicinal plants. The Mexican army did not finally dominate them until 1902, and it was not until the 1930s that the area was fully incorporated into the Mexican State with the establishment of schools and the parceling out of Masewal land through the *ejido* system. Since the Maya occupied the area in the 19th century, their presence has sharply inhibited further in-migration and it remains today heavily dominated by their descendants.

In sharp contrast, southern Quintana Roo was settled by colonists from Veracruz and other states in the first decades of the 20th century in response to the chicle boom, the resin of the chicozapote tree (*manilkara zapota*) used in the manufacture of chewing gum. Mestizo colonists from Veracruz, Chiapas and Yucatan began arriving in 1915 to respond to the rising world market in chewing gum. In order to secure Mexico's southern border with Belize, 14 ejidos were established along the Hondo River between 1928-1940, and were given up to 420 hectares of forest per ejido member.[25] As Hugo Galletti has noted, these land allotments constituted non-timber forest product "extractive reserves" sixty years before the concept was reinvented in the Amazon. It also created an economy and culture of valuing the valuing the forest for a non-timber forest product which persists to this day.

Logging in the region also goes back to the 19th century along the Rio Hondo, but commercial logging in the interior did not begin until the 1930s, and was usually selective logging of mahogany (*swietenia macrophylla*) and Spanish cedar (*cedrela odorata*). More intensive logging began in 1953 by the parastatal Maderas Industrializadas de Quintana Roo (MIQRO), operating under a 29-year concession. MIQRO was a pioneer in tropical forest management in Latin America, being the first such entity to log with a management plan that attempted to sustainably manage mahogany, and which would serve as an important forest management technical endowment. During the 29 year period of the MIQRO concession, southern Quintana Roo underwent a wave of land use change, as the Mexican government undertook its last great tropical colonization initiatives. At the beginning of the MIQRO period there were six ejidos in this concession area, by the end there 60, many of them accompanied by massive deforestation subsidies and agricultural and cattle-ranching schemes, driving major land use change.[26] Table I below shows the impact of directed tropical colonization with reference to pastures for cattle in Quintana Roo and elsewhere in southeastern Mexico.

Table I: Evolution of Ejido Pastures in Six Tropical States

State	1970 ha.	1988 ha.	increase %	
Campeche	195,334	1,092,536	459.3	

State	1970 ha.	1988 ha.	increase %	
Chiapas	741,750	923,182	24.5%	
Quintana Roo	47,923	703,825	1,368.6	
Tabasco	336,629	568,080	68.7	
Veracruz	634,902	1,147,277	67.5	
Yucatan	159,015	1,071,637	574	
Total	2,165,533	5,506,537	154.3	

Source: Tropical Forestry Action Plan of Mexico. SARH/UFW Mexico June, 1994 p. 51. Primary: Censo Agricola, Ganadero y Ejidal, 1970; INEGI, Atlas Ejidal de los estados de Campeche, Chiapas, Quintana Roo, Tabasco, Veracruz and Yucatan. Encuesta Nacional Agropecuaria, 1988, Mexico, 1991.

As the table shows that Quintana Roo had by far the highest percentage increase of any southeastern state and, although it was from a very low base, the absolute figures show a blistering pace of land use conversion.

It was this rapid process of land use conversion in the 1980s that the PPF attempted to brake. In their efforts, they had an important history of social and organization capital on which to draw, and I will now examine this social capital endowment more closely. The Mexican agrarian land tenure system is a perpetual confusion to people outside Mexico, with its ejidos, indigenous communities and "small private property".[27] The ejido system is a result of the Mexican Revolution and has been instituted in varying degrees and rhythms in different presidential periods during the 20th century. As Janis Alcorn and Victor Toledo have noted, the ejido system created what they call a tenurial "shell", a structured interface between an internal environment and the outer operating system. The ejido system created a fixed boundary within which communities had certain latitude and security to develop their systems of natural resource management.[28] Despite the frequently analyzed deficiencies of the ejido system, it has also been a massive experiment in management of common pool resources, one characterized by a pervasive state presence and structuring. In addition to creating a space for natural resource management, it also created spaces of self-governance within legal structures mandated by the Mexican government. Defined as forms of common property with private appropriation, both ejidos and indigenous communities feature privately worked agricultural plots and, if large enough, collectively administered common areas, but with the Mexican government retaining ultimate usufruct rights over the lands until 1992 constitutional reforms, which gave ejidos the right to title as private property their agricultural land within the ejido, although not forest common lands. Within the ejido, the Mexican government's authority was historically most strongly exercised over forestlands, a point to which I will return.

Both ejidos and indigenous communities are, at the same time, instruments of political control, a means for the organization of production, and a body of peasant representation.[29] Both land tenure forms were endowed with juridically prescribed forms of internal political organization and external representation, which sometimes operated conjointly with others forms of traditional community organization. The legally mandated apparatus for governing local communities includes General Assemblies, Commissars, Consejos de Vigilancia, and Juntas de Pobladores, all elected by the

community in a secret vote.[30] These offices and their functions have become the basis of "self-governance" in rural Mexico. Although commonly corrupt and manipulated, these land tenure-based forms of community political organization nonetheless gave peasants experience in leadership and in negotiating issues with external authorities, and some percentage of them even represented a genuinely participatory community democracy.[31] Given that the ejido system has governed most of rural Mexico for most of the 20th century, it would be hazardous to make any generalizations about the impact of the ejido system on natural resource management. However, it is not at all clear that the ejido form of organization has been any more destructive of natural resources than private forms, and in at least some cases it has been clearly superior.[32]

Besides the ejido level of organization, the Mexican government has historically encouraged extra-ejidal levels of organization, albeit heavily corporativized ones. In the first decades of the Revolution, the Confederación Nacional Campesina (CNC) served this function, but since the 1970s, successive Mexican presidents have created a welter of new extra-ejidal forms of organization as they grappled for ways to modernize the countryside while continuing to exert political control. Thus, from 1970 to the present, a bewildering array of ejido unions (*uniones de ejidos*), Rural Collective Interest Associations (*ARICs*), Agro-Industrial Units for Women (*UAIMs*), social solidarity societies (SSS), Social production societies (SPR), civil associations (*AC*'s-the non-profit equivalent status, which some peasant organizations also use), and civil societies (*SC*-a common legal form which permits a wide variety of commercial activities), among others, were formed. As has been noted, "Even if it was not the original purpose, creating these organizations augmented the negotiating capacity of the ejido, giving birth to a new generation of peasant leaders".[33] Further, these various extra-ejidal forms of organization have, over the last 25 years, progressively placed natural resource management issues on their agendas.[34] The community forestry organizations in Quintana Roo, for example, were all incorporated as *Sociedades Civiles (SC).*

Thus, despite a history of authoritarianism and vigorous co-optation, the Mexican government, in interaction with local governing traditions, also created institutional and social capital at the community and inter-community level which has provided an important foundation for the emergence of grassroots common pool resource management organizations.

The PPF: The Emergence of a Donor-Initiated Common Pool Resource Community and Second Level organizations.

What most people know as the PPF is one organization, the Sociedad de Productores Forestales Ejidales de Quintana Roo (SPFEQR) based in Chetumal, Quintana Roo, historically composed of ten ejido members, and geographically focused in southern Quintana Roo. However, three other organizations in Quintana Roo were also directly formed by or inspired by the PPF Process.[35] At about the same time as the Sociedad was formed, the Organización de Ejidos Productores Forestales de la Zona Maya (OEPFZM) was created out of the Masewal Mayan communities in central Quintana Roo, based in the town of Felipe Carillo Puerto. In 1990, two additional

organizations were formed under the "Plan Piloto Estatal", an initiative taken solely by the state government of Quintana Roo.[36]

The PPF emerged due to an unusual confluence of state, federal and international actors. The Acuerdo-Mexico Alemana (AMA), which had been working in Chiapas with little success since the 1970s, brought in substantial foreign financial and technical assistance support from the German government foreign aid agency Geselleschaft fur Technische Zusammenarbeit (GTZ). The Subsecretaria Forestal y de la Fauna (SFF) of the Mexican government was, during this period, dominated by progressive bureaucrats with a real vision of community-managed forests they had been implementing elsewhere in Mexico since the mid-1970s, and provided crucial support at the federal level. At the state level, a progressive young governor who was developing the megaresort of Cancun, was convinced that community forest management was a means of keeping a deforested Quintana Roo from greeting tourists. At the same time, communities were protesting a 29 year logging concession that had been granted to a parastatal logging company, Maderas Industrializadas de Quintana Roo (MIQRO), although there was not the intense grassroots mobilization that occurred in other states during the same period. Thus, the PPF, although it was able to draw on community restiveness, was substantially initiated by government actors, both foreign and national, who were, to be sure, unusually enlightened bureaucrats and extension workers.[37]

The young team of foresters and sociologists who formed the PPF had a clear vision of organizing communities into a second-level organization with a natural resource management strategy of logging high-value timbers such as mahogany and Spanish cedar and a variety of LKS. In silvicultural terms, they envisioned a polycyclical system that, based on a 75-years-to maturity growth rates, a figure inherited from MIQROs management plan, would constitute a sustainable yield. They used their political clout to try and force open markets for the LKSs and thus diversify forest production, a strategy that would prove largely unsuccessful. They began with two hypotheses, both of which are commonplaces today but can be considered visionary in 1983 when this process began: that the forest must provide an economic alternative for the local population in order not to be destroyed, and second, that forest owners are the social actors most interested in the conservation of the forest.[38]

This effort could not build on traditional patterns of natural resource management for at least two reasons: 1)Most of the populations they worked with in southern Quintana Roo were recent colonists who were primarily farmers, and who did not have traditional knowledge of ecosystem use and 2) None of the populations they worked with had *any* cultural or economic tradition of commercial logging. In the Center in particular, the Mayans had systems of forest management for milpa and management of secondary succession, although these have not been well described in the literature. It is also not clear what influence these pre-existing systems of common pool resource management have had on commercial forest management, but the latter clearly represents a major departure from the former.

The PPF itself never formally constituted itself as an organization, depending on its network of political and social support for its legitimacy. It was thus, in Carley and Christies, terms, a “linking-pin organization”, one that that serves as a center of communication, coordination, and motivation, even if it is not formally constituted.[39] It set about creating new organizational forms at both the ejido and supraejidal level, organized around forest management for timber, but as I have noted, it did not do so in a vacuum. There were many models and traditions of organization available in rural Mexico by the 1980s, beginning with the ejido itself. The forms of organization for forest production were integrated directly into the ejido structure, using both existing forms and creating some new ones. For example, the organization of production was based on "committees", which sprouted as new entities, but remaining dependent structurally on the figures of the *Comisariado* and the Oversight Council *(Consejo de Vigilancia*), and ultimately the General Assembly. It then used the terminology and structure of the ejido to create the new supraejidal organizations, using the existing legal framework of “Sociedad Civil”. At the level of the supraejidal organization, the form of the General Assembly was retained,and replicating, in Ostrom's terms, in a "nested" fashion the newly formed committee structures from the ejido level to the level of the second-level organization. It was these organizations that would be the vehicle for creating new, community-based rules in use for the management of timber in the region.

Thus, the PPF had a strategy composed of an uneven blend of top-down manipulation and participatory techniques. In the south, the single most obvious top-down decision was the composition of the Sociedad, with PPF organizers choosing blocks of communities with large endowments of mahogany and low levels of community conflict, and adding a few smaller ones for geographic and strategic balance. They thus formed a ten-member organization with 289,204 hectares that controlled about one-quarter of the cutting volume of mahogany in the state.[40]

Shortly after launching the PPF in the south, a team of organizers was sent into the Mayan Zone of central Quintana Roo as well, where they faced a very different situation. Here, instead of recent colonists, they found much poorer, heavily monolingual Mayans with the tradition of fierce resistance discussed earlier. These forests had also been significantly "mined" by small, independent loggers, who were decidedly not using the management plan used by MIQRO in the South. Because of limited resources and the difficulty of the challenge in the Mayan Zone, the PPF made a conscious decision at an early stage to drastically reduce support to the team in the Mayan Zone, leaving it to struggle to find its own resources. Nonetheless, the team did manage to found the OEPFZM shortly after the founding of the SPFEQR in 1986, with 13 ejidos and about 15% of the cutting volume of mahogany.[41] The founding of the OEPFZM, however, came out of a sharper social struggle than in the South. The Mayan ejidos of the area had been organized by the government into ejido unions in the mid-1970s in order to produce railroad ties for the national railroad system. Although heralded as a diversification of forest production, a new use of the LKSs, and as a new form of democratic organization in the region, the ejido unions quickly fell into authoritarianism and corruption. The OEPFZM thus emerged originally as an organization, which spearheaded the direct marketing of railroad ties, which it was then able to use as a base for entering into forest management for mahogany and Spanish cedar.[42] They also took advantage of the fact that the communities already had a decade to get used to the idea of working in a second-level

organization, and now had an opportunity to do it better. At the ejido level, the OEPFZM followed the same organizational strategy as the South, integrating new structures for commercial forest production into the ejido structure.

The PPF approach to Ecosystem Management

The PPF's initial approach was not to manage ecosystems, but to manage mahogany, and Spanish cedar and the LSKs. They saw their task as assuring the establishment of production forests, essentially adopting the MIQRO management plan of 75 year polycyclical system for managing mahogany, but also introducing some important and participatory forest management institutions and policies. This approach represents thus attempted to introduce new rules in use for both the ecological management of the forest and the social structuring of the management activities, in an explicitly linking of new management systems with new social structures.

The new forest management techniques included

- The establishment of a mechanism that attempted to create new demand for the LSKs, thus diversifying forest management.
- A focus on the commercial management of *Swietenia macrophylla*, but with later efforts at wildlife management and chicle management. The OEPFZM, with its much economically deprived and resource-poor constituency moved much more vigorously into managing their forests for a variety of values.
- The establishment of production forests or "permanent forest areas" which the communities agreed would never be subject to land use change, a historic decision in tropical America. (This is also obviously represents a new social consensus in the communities.

The new social mechanisms included

- The development of a highly participatory methodology in which the *ejidatarios* were systematically trained in all aspects of forest planning and management, from forest inventories to sawmill administration, with the goal of creating community-based enterprises.
- The design of a participatory forest inventory methodology, introducing scientific forms of forest management to the community. In a comparative study of participatory forest assessment methodologies worldwide, it was noted that the PPF "has the greatest experience in using forest inventory as a tool to achieve sustainable a forest management by and for the local community. It is the most advanced in terms of technical implementation, and of particular interest because the development of the inventory system has been a dynamic process, which has responded to new information as it has become available".[43]
- The establishment of the civil societies. These organizational vehicles would make the delivery of technical assistance more efficient but, like the ejido itself, would also serve as important means of political representation and the channeling of resources that support natural resource management.

Environmental and Social Outcomes in the Linking of New Management Practices and New Organizations-Mid 1990s

Thus, by the mid-1990s, the PPF had carved out a position for its self as one of the leading examples in the world of community forest management, and stood virtually unique in terms of tropical forest management for commercially produced timber. Although the PPFs role in braking deforestation beginning in the mid-1980s still must be quantified, the official figures from the early 1990s indicate substantial forest cover remains in central and southern Quintana Roo. In the rest of Mexico, forest area declined by 50% in the last five decades with the Mexican government actively promoted forest clearance by settling ejidos in forest areas and providing support for ranching.[44] However, the two states of Campeche and Quintana Roo have 46% of the remaining medium and high rainforest of Mexico (28% in Campeche and 18% in Quintana Roo). [45] In terms of percentage of land dedicated to forest, Campeche is 68% forested; Quintana Roo is 63% forested. By comparison, Chiapas has only 42% forest cover. Quintana Roo has the highest percentage of forest on ejido lands of any state in the country, by far, with 61.9% of all ejido lands with forest cover (1988 figures).[46] The municipio of Felipe Carillo Puerto has a forest cover of 75%, possibly the highest of any municipio in tropical Mexico, and this percentage has barely diminished in the last thirty years. While the high retention of forest cover is clearly due to factors beyond community forest management, particularly poor soils in the center, community forestry organizations have clearly played a role in forest maintenance.

Socially, the PPF process had given an organizational and thus a political presence and voice to impoverished peasants, and has given them crucial entrepreneurial training for people who otherwise would have most likely continued cutting down the forest in order to live. Economically, Nohbec, the most advanced ejido in the state, as of the early 1990s had capital assets of 2.5 million dollars and generated six months of employment for 125 people.

The OEPFZM, in particular, has also dramatically expanded the range of ecosystem management activities, driven by the fact that only two of its 23 ejidos have significant stands of mahogany, and the consequent greater poverty of the region. Here, wildlife management, agroforestry, artisan production, and the search for alternatives to railroad tie production, (an extractive activity much less common in the south), have flourished in recent years. We see here an evolving complexity of common pool resource management, a movement that, while not conceptualized as such, is towards managing the whole ecosystem. However, the diversification of the portfolio of activities in relation to an overburdened staff, has also meant that that there is little ongoing attention to improving logging management.

Adaptive Management in a Turbulent Policy Environment:

The history of the PPF since the early 1980s can be viewed as a series of adaptations to a changing policy, political, and social environment and to new information coming from the ecosystem as a result of both informal observations and systematic scientific research. The PPF has not consciously adopted an adaptive management perspective, but their policies and practices were conceived on the basis of a particular conception of their socio-political reality, and as their operations have tested that reality, information flowing from the social and biological environment has guided their evolution. The PPF, among other things, has been an on-going experiment in social design of a system that sustains an ecosystem while delivering a flow of economic benefits to the people who inhabit the ecosystem. However, as we shall also see, the concatenations of time and events have in the past few years forced more thoroughgoing transformations, more "surprises" on the PPF system than ever before. I will look first at how the PPF has adaptively managed with respect to the physical environment and then with respect to the social environment. This interpretation of PPF as adaptively managing is an important first step in introducing adaptive management as a tool in the region.

Adaptive ecological management. As mentioned, PPF, in both the south and center, instituted methods for systematically collecting information on the stocks and flows of the forest through participatory inventories and sample plots for measuring the growth of trees. By the early 1990s, the PPF foresters in the South realized that, because of measurement problems in the inventories, timber harvests had been set too high, and would have to be reduced by 35%. This finding represented a major crisis in the resource management system, since it pitted sustainable yields against the incomes of the ejido members. However, after several difficult meetings the ejidos decided to lower the logging volume and redo inventories, a decision that helped ensure the longer-term sustainability of the resource and their income streams. A similar process occurred in the Mayan Zone, where logging volumes were reduced some 45%.[47]

The OEPFZM also made an important shift in its reforestation programs, albeit a much-delayed one, on the basic of new scientific evidence of the low survival rate of the method they had been using. Research carried out with the collaboration of the OEPFZM has demonstrated that a large number of 2 million seedlings planted in ten years did not survive because of lack of knowledge about the most propitious conditions for mahogany regeneration. In brief, reforestation in forest shade conditions, in the gaps created by selective logging, does not reassure regeneration. Mahogany does regenerate in larger areas left by hurricanes, fires, clearing for agriculture, and other such events.[48]

Negreros Castillo and Mize have carried out a study of survival rates of some of these plantings. Samples in two ejidos of plantings in 1986, 1989, 1990, 1991, 1992, 1993 on the edges of logging roads, logyards, access roads, and in the selective logging gaps were taken. Average survival rate for all locations was just 18%. The highest survival rate was in logyards (*bacadillas*) at 52% , but these constituted only 2% of the area reforested. Conversely, while planting in the gaps constituted 90% of the area reforested, survival rates here were only 16%. Since 1995, and as result of this study, the OEPFZM has begun to carry out reforestation in compact areas of secondary growth.

This type of area is more open and the growth conditions for cedar and mahogany more favorable. These reforestation efforts have not yet been reevaluated. Studies have also begun to look at plant production quality in the nursery as another means of assuring higher survival rates.[49] The struggle to maintain the organizational forms and institutional practices that assure on-going adaptive management continues however. More recent observations have suggested that the improved planting practices may have lapsed because of lack of resources and an overwhelmed grassroots organization (Negreros Castillo, personal communication). At the same time, and despite the lowering of logging volumes in the early 1990s, continued ecological research on mahogany regeneration has put new pressure on the communities to consider lowering the volumes even further. Forest ecologist Laura Snook has argued that the polycyclical harvest system should be based on at least a 120-year maturity period for mahogany.[50] Foresters working with the communities argue that Snook's measurements were taken in a small atypical plot, and other forest ecologists have expressed informal disagreement with Snook's conclusions (Frank Wadsworth, personal communication). This is a typical case of scientists disagreeing on the basic facts on which sustainable ecosystem management should be based, forcing land managers to make decisions which could have impacts for a hundred years under conditions of uncertainty. Faced with this uncertainty, it will be crucial that the managers continue to collect and analyze data from the sample plots[51]

The Turbulent Policy Environment and its Impact.

Since 1986, forest management in Quintana Roo, and elsewhere in Mexico, has been heavily affected by a series of legislative and administrative measures, whose principal features are here summarized.

- *The 1992 Constitutional Reform to Article 27.* This reform allowed ejidos to divide up and title their agricultural lands, although forestlands cannot legally be divided and, if the ejido elects to dissolve itself, forestlands must revert to the state. Nonetheless, the impact of the law has been to create new pressures towards defacto divisions of forestlands as well.
- *The 1986 Forest Law.* Its most crucial feature for our purposes was the concession of forest technical services to second-level community forestry y organizations, a new right that drive the formation of the SPEFQR and the OEPFZM, among others.
- *The 1992 Forest Law.* This law dramatically deregulated the forest sector, attempted to promote plantation development, and deregulated forest technical services almost entirely to the market, removing the former rationale for the creation of the second-level organizations.
- *The 1997 forest law*. This law re-regulated various aspects of forest management, in order to halt a rise in clandestine logging. It was accompanied by two new administrative programs, PRODEPLAN, which subsidized plantation development, and PRODEFOR, that subsidized community forest management.

- *PROCAMPO*. An agricultural subsidy intended to be compensation for the negative effects of the North American Free Trade Agreement (NAFTA) for Mexico's poorest farmers.[52]

Added to these is the impact of state-level politics in Quintana Roo, where the governorship of Mario Villanueva Madrid (1993-1999) brought a more intensely authoritarian political style to the state than had been the case with earlier governors.

In Ostrom's terms, these policy changes have differentially impacted the rules of common pool resource governance in Quintana Roo at three levels of rules: constitutional, collective choice, and operational.[53] The reform to Article 27 is a constitutional change in a quite literal sense,one that fundamentally changed the range of options open to the rules of governance of the common property regime at all three levels. The changes in the forestry laws impact primarily the collective choice and operational levels. For example, the 1986 law created the rationale for organizations to form around the provision of legally required forest technical services. The 1992 law removed this rationale, and several organizations elsewhere in Mexico collapsed after the passage of the law. Finally, an agricultural subsidy program such as PROCAMPO impacts primarily at the operational level. Given state reforms and programs that impact the ejidos and organizations at all levels, it is not surprising that the recent years have been more unstable ones than the first decade of the program. A University of California-Berkeley team has carried out a sophisticated study of the impact of the reform and some aspects of other legislation on common pool resources in the ejido sector, with a partial focus on forest common pool resources.[54] As the study notes, forest income is the most frequent source of collective income in their national sample, although the fact that it was present in only 9% of the ejidos, tiny compared to the size of the forest resource, suggests widespread weaknesses in the ability to cooperate. Thus, the emergence of widespread collective action in Quintana Roo becomes a worthy problem to explain.

The Berkeley study finds that the reforms have created incentives to deforest land in order to convert the common land to private parcels, but have also enhanced common property tenure security which may promote profitable resource exploitation and sustainable forestry (12). It further notes that "In some ejidos, an environmentally superior outcome would result if the ejido were permitted to either subdivide the common land or sell all the common land to a private party or the government" (13). They study uses the following variables which are expected to influence cooperation: group size, group heterogeneity, social cohesion, border definition, exit options, and resource scarcity. One important indicator is whether an ejido has frequent (monthly) assemblies (19) (need to promote and facilitate the formation of sub-coalitions within an ejido (24). Of particular interest for our purposes is a brief case study of the Quintana Roo ejido Petcacab, a member of the SPEFQR. (In the complicated flux of Quintana Roo community politics, a village within the ejido seceded and won recognition from the agrarian authorities for its own ejido, Santa Maria in 1998. This new ejido promptly joined the OEPFZM.) As one of series of case studies of the impact of the reforms, Petcacab is defined as a modality where the collective property was retained, but with individual rights over yields (31). This outcome is what is known in Quintana Roo as *grupos de trabajo* or work groups. I will return to the subject of work groups below, but would like to use the Berkeley study as a taking-off point to make a more general

analysis of the impact of the multiple reforms on each of the second level organizations and the ejido-level organization (particularly the work groups).

T*he Evolution of the SPERQR*. Since the mid-1990s, the SPERQR, the best-known and most celebrated of the PPF organizations has clearly entered into the second phase of its existence, and is still looking for a new equilibrium. The conditions it faces include a declining volume of mahogany, endangering the profitability of sustainable forest management, persistent problems in efforts to expand markets for LSKs and disappointing results with the marketing of certified timber[55], a failure to diversify development strategies beyond timber production, corruption and serious organizational weaknesses associated with ejido production, endemic inefficiencies and decapitalization in forest extraction and primary processing, serious quality problems at each stage of production, the embedding of forest production in the ejido political structure, and constant contradictions between the business imperatives of the forestry activity and the socio-political context of ejido decision-making. The rotation of leaders, derived from ejido principles, meant that business experience has not been accumulated.[56] The disadvantages of embedding the enterprise in a community governance structure not set up to run competitive enterprises has become clearer. In addition, the AMA finally ended its years of support in 1998. These problems culminated in two highly significant new developments in 1997-98, the emergence of so-called "work groups" and the withdrawal of the ejido Nohbec from the Sociedad. Both of these events can be seen as organizational learning in the wake of the various policy reforms mentioned. These most recent events and their implications for the ongoing organizational/ecological dynamic will now be considered.

The withdrawal of the AMA signals the definitive end of what we have been calling the "PPF process" and the beginning of a new phase for common property forest management in Quintana Roo which, without the steadying influence of a well-connected foreign donor, is likely to be even more turbulent than the previous period. It marks the end of a source of consistent technical and political support, and leaves the SPFEQR in a much more vulnerable and isolated position than previously. The withdrawal of Noh Bec in 1998 (?) can be analyzed as due to a variety of factors, including the contingencies of individual personalities as they move through structures, but here we will focus on the role of the changes in forestry laws. A highly significant feature of the 1986 forestry law was allowing second-level organizations to administer the "forest technical services", the legally required forest management plans that have to be filed annually in order to get a logging permit. This new legal opening is, I would argue, the single most important factor that drove the formation of a series of important second-level community forestry organizations throughout Mexico in the late 1980s.[57] The 1992 forest law created a free market in forest technical services and the 1997 law, while attempting to more directly regulate this market, did not eliminate it. Thus, the impact of the 1990s laws was to remove the legal rationale for cooperative action. This laid bare the fact that a few, well-organized and mahogany-rich ejidos, in the SPFEQR were subsidizing the technical services for the smaller, poorer ejidos. As the best organized and the most mahogany rich member, Noh Bec decided there were no further advantages to being in the organization.

The impact of the 1992 constitutional reform has also taken time to make itself out, and is working itself out in complex ways. The 1992 law also appears to be interacting with organizational learning on the part of the member ejidos of the SPFEQR as to the structuring of the forest community enterprises. The reform explicitly states that ejido forest lands are not to be divided, and if a community elects to dissolve itself, the forest lands revert to the government. Despite the strictures against division of forest lands, the field implementation (by PROCEDE) has either explicitly encouraged or tolerated de facto divisions of forest lands (see Boege 1999). One of several forest division modalities that has emerged is that of the "work groups" (*grupos de trabajo*). [58]

As Armijo points out, the work groups are a kind of privatization within the ejido. They constitute a dissolution of the community enterprise, and the division of its annually calculated flow of resources among a large number of small kin-based groups. As Armijo notes that they can be viewed as both a delayed response to the reform of Article 27 and as a means of dealing with corruption within the community enterprise, an issue the PPF never addressed. It thus represents a form of social learning, an organizational innovation from the grassroots directed at solving the unacknowledged problem (by actors external to the ejido) of corruption in the community enterprises. The work groups represent a major shift in the rules of collective action at the ejido level, and are thus notable because they may be seen as the first genuinely SELF-organized aspect of community commercial forest management in Quintana Roo.[59] Observations in the Petcacab ejido demonstrate the economic advantage of the work group system of collective action, with incomes to the producers quadrupling. But resorting to this more informal method of work organization has resulted in great inefficiencies and confusion in marketing and has dealt a blow to the traditional authority of the Comisarriado, who is now just a member of one of the work groups. [60] The work group modality appears to be in a state of great flux, with frequent changes in the number of groups, their composition, and frequent struggles over how to use or dispose of equipment that belonged to the community enterprise, but now must be shared among quarrelling work groups. In this ejidos, out of the wreckage of the community enterprise, a new form of formal organization is struggling to emerge. An urgent ecological research need at this stage of organizational transformation is to understand the impact of the work groups on the sustainability of the resource and the resiliency of the ecosystem.

Organizational Evolution of the OEPFZM

In the 1980s, the OEPFZM's struggled to survive with far less external support than the SPFEQR, although foundation support became substantial beginning in the early 1990s. The OEPFZM, as mentioned earlier, in an environment of many more scarcities in than in the south. In the South, the majority of the ten ejidos in the SPEFQR had substantial stands of mahogany, higher levels of education, more experience in other parts of Mexico, had been able to observe a parastatal forest company with a scientific management plan, and had much more consistent technical support and other subsidies. In the central part of the state, the Mayan population was significantly monolingual, had little formal education, more extreme poverty and isolation, had been exploited by small

timber contractors, and were, at the time of the entry of the PPF, immersed in a corrupt ejido union. The OEPFZM always had far few ejidos with significant mahogany resources, only some four out of up to 23 ejido members, with many small ejidos with few forest resources.

The more difficult conditions and a different leadership strategy on the part of the technical team has driven a rather different organizational trajectory for the OEPFZM, even while they followed the same forest management template as the south. In the OEPFZM, leadership remained strongly focused on the original technical team, and particularly in the figure of the Technical Director and his wife, the Program Director. Education, culture, and the lack of a consistent training strategy hindered the development of indigenous leaders. Its political isolation in the central part of the state, mostly uncovered by the political umbrella held by the SPEFQR, would be a source of serious turbulence by the OEPFZM. In particular, efforts by the Technical Director to carve out an electoral political space for himself and the organization, under the administration of a particularly corrupt and authoritarian government, would cost them dearly.[61] When the Technical Director made his interests in running for the Municipal Presidency of Felipe Carillo Puerto as a candidate for the PRI in 1993 known, and continued to maneuver politically thereafter, he suffered a serious political blows from the Governor. Beginning in 1994 he was accused of being a Zapatista, and was beaten and jailed for brief periods on at least three occasions. In 1994 they were ousted from the municipally-owned offices they had occupied since they first arrived in the area, and suffered other forms of harassment, including death threats. As a part of this turbulence, two of the most important, mahogany-rich ejidos, X-Hazil and Felipe Carillo Puerto, withdrew from the OEPFZM in 1994.

In an effort to get the political cover it could not obtain at the state level, the OEPFZM came to rely heavily on its membership in a national confederation of peasant organizations called the National Union of Regional, Autonomous Peasant Organizations (UNORCA), which gave them access to high-level political figures in Mexico City who could intervene on their behalf. The creation of a state-level UNORCA, however, created a dynamic of organizing communities beyond the OEPFZM. This created a broader base of political support, but seriously diffused development efforts and organizational energies, and has relegated the OEPFZM to a secondary position in terms of development strategies.

Despite these problems, the OEPFZM maintained a loyal following of some of its member ejidos, and has had new ejidos join at different moments in recent years. The political strategy of the Technical Director continued, and after an unsuccessful run for the Municipal Presidency, he won a seat as a State Deputy in February, 1999. In the same elections, a new and apparently less controlling Governor, with whom the Technical Director was politically allied, came into power. The OEPFZM seemed to be in the unaccustomed position of being at political peace with the Governor, and being able to look to him for support. At the same time, it is not clear at this stage whether UNORCA and the OEPFZM will be able to continue a productive strategy of development strategies, or will be reduced to political vehicles for the Technical Director and his group.

It is also important to note that the "work group" modality, while present in one of the few non-indigenous ejidos within the OEPFZM, that the Mayans have remained much more cohesive in this sense than the ejidos in the south

Conclusions and Lessons

The Mexican ejido common property regime and common pool resource framework, which has existed as an institution for some eighty years, has clearly created extraordinary conditions for the emergence of formal organizational structures dedicated to new and challenging community resource management problems. While not "self-organized", the ejido system and its organizational outgrowths have clearly been infused with local traditions and become authentic expressions of the aspirations of local communities. The Quintana Roo experiences, as well as other community forestry expressions in Mexico, show that local communities, can move beyond the maintenance of subsistence traditions and can make common property management regimes a commercial presence within greatly expanded fields of relationships and stakeholders.

The adoption of an adaptive management framework to analyze the evolution of these donor-initiated common property management systems encourages an analysis that shows them as capable of making continual adjustments to shifting ecological and social realties, as organizations that learn and that have considerable "resilience" or robustness. It suggests that "design" is an on-going, never-ending process of management in a turbulent environment. The Quintana Roo experiences also show the importance of analyzing formal organizations as a crucial emergent property that channel, drive, and filter changes in “rules in use”. Organizations are more than just another kind of institution, they constitute a critical division, a transition into the complex world of multiple stakeholders, of formal legal systems, and of regional, national, and global markets. They service crucial representational and bargaining roles in interpreting rules in use, making them effective, and channeling resources that can make them effective. The

social capital present in rural Mexico has fueled an unusually rapid development of formally organized common pool resource management regimes.

Quintana Roo is unique even within Mexico because these organizations have developed around tropical forest management, but it is but one expression of a larger phenomenon in the temperate zones of Mexico. According to the World Bank, Mexico has 10-20 forest communities, operating under common property management regimes, currently able to "compete successfully in a highly commercialized market" and another 140-180 could compete with "greater business management acumen, better knowledge of markets, and some essential inputs".[62] It is true that the total number of these experiences in Mexico is quite small compared to the total universe of community forestlands in Mexico, but it is far more experiences than exist anywhere else in the world. In this sense, I think it can be said that Quintana Roo and the rest of Mexico are 15-20 years ahead of the rest of the developing world, and thus its problems are the problems that the rest of the world will have in 20 years if they are successful.

The social capital created by the Mexican Revolution and by successive policies of Mexican federal governments is a substantial endowment that helps fuel community-based conservation in Mexico. But these examples should also make clear that community-based conservation, when it is only based in individual communities, is doomed to failure. Local communities are too small, too powerless, and frequently too disorganized to be able to successfully mount coherent conservation and development projects. [63] Community-based conservation must include as a basic working methodology the organizing of inter-community organizations to help build negotiating capacity, to reduce the costs of technical assistance provision and training, and to increase the supply of whatever marketable product is being developed, as Gibson and Agrawal have argued.

The resilience of the communities themselves is unquestioned, they have survived where they are for substantial periods of time (although, as mentioned, none of them are ancient indigenous communities in their current locations). Further, in the most developed cases (examples such as Nohbec and Naranjal Poniente), the appropriation of community commercial timber management has gone well beyond the artifact of the outside intervention. As Leticia Merino notes, in these cases a still incipient but nonetheless clearly present “new forest culture” has emerged based on the industrial management of the forest. This is indeed a major and even historic accomplishment, and demonstrates that sophisticated common property management systems can newly emerge, in a time frame of only 15 years, from a base of very poor marginalized communities. A conclusion from 1992 is still valid, “that adequately trained campesinos, given the right sort of information and institutional support, appear to be capable of profitably managing a tropical forest under a sustainable yield management regime” .[64] The resilience and growth of the second-level organizations has also proven to be substantial. The OEPFZM continues after 15 years and has developed a highly diversified portfolio of ecosystem management activities, and the SPEFQR also continues to survive and function despite the recent turbulence in the systems.

In the analysis of emergent organizational forms, it is also crucial to note that, for the first time, a third-level at the level of Quintana Roo state has emerged as of 1999.

The Coordinadora de Organizaciones Campesinas Forestales de Quintana Roo (COCAFQRO) was recently establishing, pulling together the five major community forestry organizations in the state. While such initiatives had been attempted earlier, the power vacuum left by the withdrawal of the AMA has created a new condition that makes this level of collective action both necessary and feasible.

As the environmental scientist Kai Lee has noted, "Governing large ecosystems is a matter of learning without teachers and experimenting without a laboratory"[65]. Learning how to establish healthy and dynamic relationships between the social systems and the ecosystems of Quintana Roo have few preestablished lessons as well, and the process of constructing a dynamic should be undertaken with the humility appropriate to the magnitude of the challenge.

Endnotes

[1] This experience is part of a constellation of community-based forest management experiences throughout central and southern Mexico which place Mexico in the vanguard world-wide in community forest management. This is due, to a significant degree, to the legacy of the Mexican program of agrarian reform, ejidos and indigenous communities, which gave communities secure legal access to common property forest resources. See Bray, David Barton. 1995. Peasant Organizations and "The Permanent Reconstruction of Nature": Grassroots Sustainable Development in Rural Mexico. *Journal of Environment and Development*. 4:2 (Summer) Pp. 185-204 and Bray, David Barton and Matthew B. Wexler. 1996. Forest Policies in Mexico. In Changing Structure of Mexico. Edited by Laura Randall. M.E. Sharpe, Inc: Armonk, NY

[2] Synnott, T.J. 1993. "Quintana Roo Forest Management Project" ODA Project Memorandum, October, ODA, London Rodriguez, Silvia, Alberto Vargas, Serge Dedina, and David Stanfield. 1991. An Annotated Bibliography on Community Management of Forest Resources in Latin America. Land Tenure Center: University of Wisconsin-Madison. P.13; Kiernan, Michael J. and Curtis H. Freese. 1997. Mexico's Plan Piloto Forestal: The Search for Balance Between Socioeconomic and Ecological Sustainability. In *Harvesting Wild Species*. Edited by Curtis H. Freese. Baltimore and London: Johns Hopkins University Press.

[3] Richards, E.M. 1991. "The Forest Ejidos of South-East Mexico: A Case Study of Community Based Sustainable Yield Management. Commonwealth Forestry Review. 70(4): Pp. 290-311. See also Kiernan and Freese, 1997.

[4] I refer throughout to the "PPF process" rather than the PPF, since, as will be noted later in the text, the actual PPF had a relatively short life, but has endowed its name to an on-going organizational process.

[5] Holling, C. s. 1995, p. 13

[6] Kai Lee Gunderson, Lance H., C.S. Holling, and Stephen S. Light *1995. Barriers and Bridges to the Renewal of Ecosystems and Institutions*. Columbia University Press: New York

[7] Westley, Francis. 1995. Governing Design: The Management of Social systems and Ecosystems Management. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. edited by Lance H. Gunderson, C.S. Holling, and Stephen S. Light.. Columbia University Press: New York; For another recent view of the dynamic relationship between social systems and ecological systems, see Leach, Melissa, Robin Mearns and Ian Scoones. 1999. Environmental Entitlements: Dynamics and Institutions in Comity-Based Natural Resource Management. *World Development*. 27:2, Pp230-232.

[8] Holling, C.S., Fikret Berkes and Carl Folke. 1998. Science, Sustainability and Resource Management. In *Linking Social and Ecological Systems*. edited by Fikret Berkes and Carl Folke. Cambridge University Press: Cambridge, UK.p. 347

[9]Fikret Berkes and Carl Folke. 1998. Linking social and ecological systems for resilience and sustainability. In *Linking Social and Ecological Systems*. . edited by Fikret Berkes and Carl Folke. Cambridge University Press: Cambridge, UK.
p. 12
[10] Carley, Michael and ian Christie. 1993. *Managing Sustainable Development.* Minneapolis: University of Minnesota Press. P 165.
[11] Holling, C.S. 1995. "What Barriers? What Bridges?" in Gunderson, Holling and Light
[12] Adaptive management projects funded by the Ford Foundation and the William and Flora Hewlett Foundation with the Universidad de Quintana Roo, the Department of Environmental Studies of Florida International University, the Organizacion de Ejidos Productores Forestales de la Zona Maya (OEPFZM), and other Mexican and US institutions, is currently attempting to introduce more formal adapative management process to community tropical ecosystem management in Quintana Roo.
[13] Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press; See Vargas, Alberto for a systematic evaluation of the design principles with reference to the Quintana Roo organizations.
[14] Ostrom,, 1990 Governing the Commons. Ostrom, Gardner, Walker-Rules Games and Common Pool Resources
[15] Foss, Pal. 1995. "Introduction: On the Economics of Institutions and Organizations. In Economic Approaches to Organizations and Institutions. Edited by Pal Foss. Darthmouth Publishing Company: Brookfield, VT Pp. xix-xxii
[16] Morrow, Christopher E. And Rebecca Watts Hull. 1996. Donor-Initiated Common Pool Resource Institutions: The Case of the Yanesha Forestry Cooperative. *World Development.* 24:10, Pp. 1641-1657. See Berkes and Folke, 1998.
[17] The following discussion is drawn from Leach, Mearns and Scoones. 1999. Pp. 225-247 and Agrawal, Arun and Clark C. Gibson. 1999. Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation. *World Development.* 27:4, Pp. 629-649.
[18] Agrawal and Gibson, 1999. P. 639.
[19] Agrawal and Gibson, 1999, p. 640
[20] Ostrom, 1990. *Governing the Commons.* For an excellent study of "social capital" in rural Mexico in general see Fox, Jonathan. 1996. How Does Civil Society Thicken? The Political Construction of Social Capital in Rural Mexico. *World Development.* 24:6, Pp. 1089-1103.
[21] Fox, 1996.
[22] The PPF is honored by a growing literature, which includes Galletti, Hugo Alfredo. 1992. Aprovechamientos e Industrialización Forestal: Desarrollo y Perspectivas. In *Quintana Roo: Los Retos del Fin del Siglo*. Editd by A. César, D. Navarro and S Arnáiz. Centro de Investigaciónes de Quintana Roo (CIQRO): Chetumal, Mexico; Galletti, 1994. Las actividades forestales y su desarrollo histórico. In *Estudio Integral de la Frontera México-Belice*. CIQRO: Chetumal, Mexico; Lanz Herrera, Miguel, Alfonos Arguelles, and Francisco Montalvo. 1995. The Society of Ejido Forestry Producers of Quintana Roo. In *Case Studies of Community-Based Forestry Enterprises in the Americas*. Land Tenure Center/Institute for Environmental Studies: University of Wisconsin-Madison. For more recent analyses and updates of the PPF process, see Armijo Canto, 1999, Las sociedades civiles de productores forestales en Quintana Roo and Taylor, Peter Leigh and Carol Zabin, 2000, "Neoliberal Reform and Sustainable Forest Management in Quintana Roo, Mexico: Rethinking the institutional framework of the Forestry Pilot Plan" Agriculture and Human Values 00: 1-16
[23] Meave del Castillo, Jorge. 1990. *Estructura y Composición de la Selva Alta Perennifolia de los Alrededores de Bonampak*. Mexico, DF: INAH. p. 95.

[24] For a complete description of Quintana Roo forests see Whigham, D.F., Lynch, J.F., Dickinison, M.B.. 1998. Dynamics and Ecology of Natural and Managed Forests in Quintana Roo, Mexico. *Timber, Tourists and Temples: Conservation and Development in the Maya Forest of Belize, Guatemala, and Mexico*. edited by R.B. Primack, D.B. Bray, H.A. Galletti, and Ismael Ponciano. Island Press: Washington, D.C. Snook, L. 1998. Sustaining Harvests of Mahogany (swietenia macrophyla King) from Mexico's Yucatán Forests: Past, Present, and Future. 1998. *Timber, Tourists, and Temples.*
[25] Galletti, Hugo A. 1998. The Maya Forest of Quintana Roo: Thirteen Years of Conservation and Development. In *Timber, Tourists and Temples.* P. 33

[26] Galletti, 1992. Aprovechamientos e Industrializacion
[27] The ejido and indigenous community land tenure forms (both corporate, community-based systems) include 66.3% of all production units and 59% of the land area of Mexico, private individual holdings include 30.8% of the production units and 40.9% of the land area, with mixed systems covering remainder (cited in Alcorn and Toledo, p. 217).
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[30] Tribunales Agrarios. 1994. *Legislación Agraria Actualizada*.
[31] See Fox, 1996 for a view of the "coproduction" of social capital in rural Mexico. Fox emphasizes the role of indigenous institutions as the base for social capital, rather than the ejido..
[32] Bray, David Barton. 1996. Of Land Tenure, Forests and Water: The Impact of the Reforms to Article 27 on the Mexican Environment. In *Reforming Mexico's Agrarian Reform*. edited by Laura Randall. M.E. Sharpe: Armonk, NY; Toledo, Victor. 1996. The Ecological Consequences of the 1992 Agrarian Law of Mexico. In *Reforming Mexico's Agrarian Reform*. Edited by Laura Randall. M.E. Sharpe, Armonk, NY.
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[37] See Armijo, 1999, for a useful account of the history of the PPF and the history of community movilization and the importance of the Forestry Subsecretary at the time, Jorge Leon Castanos.
[38] See Galletti, 1998
[39] Carley and Christie, pp. 172-173.
[40] Vargas-Prieto, Alberto M. 1998. Effective Intervention: External and Internal Elements of Institutional Structure for Forest Management in Quintana Roo, Mexico. Ph.D dissertation. U. Of Wisconsin-Madison. Pp. 92-97
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