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Chris Smith

5/98

REVIEW OF FOREST MANAGEMENT IN CO-OPERATIVES AND COMMUNITY CONCESSIONS IN THE PETÉN, GUATEMALA

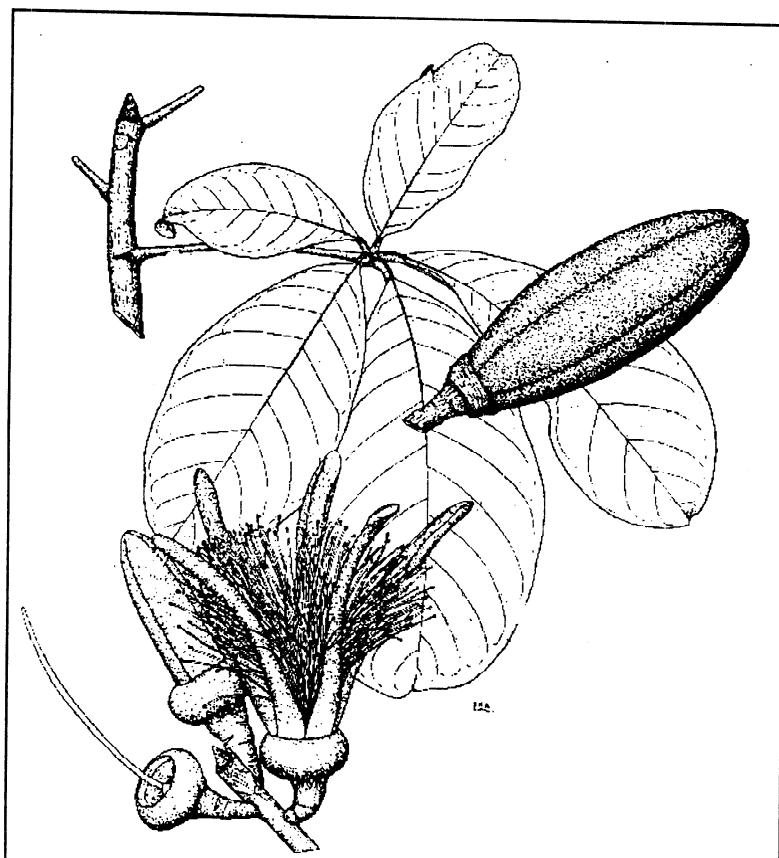


Figure 1. Amapola (Pseudobombax ellipticum) Witsberger et al. 1982

Tracey Parker, Forester, USAID Regional Environmental Advisor, Guatemala -
Central America Program

Carleen Yocom, Forester, USAID Regional Environmental Advisor, Caribbean
Program; USDA Forest Service/IITF, Puerto Rico

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ACRONYMS USED

1 \$ US	= 6 Q (quetzales) approximately
b.f.	Board foot (12" X 12" X 1")
CONAP	Comisión Nacional para Área Protegidas
EA	Environmental Assessment
FMP	Forest Management Plan
GOG	Government of Guatemala
MU	Management Unit
PACD	Project Assistance Completion Date
PEA	Programmatic Environmental Assessment
POA	Annual Operating Plan
MBR	Maya Biosphere Reserve

EXECUTIVE SUMMARY AND GENERAL RECOMMENDATIONS

Guatemala's strategy to protect the Maya Biosphere Reserve (MBR), by granting forest concessions to existing settlements, and by supporting communities with private forests, is having the desired results. In short, thanks to the forest management contracts, communities are more vigilant in protecting their assets, fewer trees are being poached, less of the forest is being invaded, either by current community members or newcomers, and steps are being taken to control forest fires and other threats to the forest's integrity.

The work we saw in the forests of the Maya Biosphere Reserve of the Petén is an excellent beginning in forest protection and management. However, since forest management has been in existence for only a few years (and in some cases months), the communities are not very far removed from the old tactics of tree poaching, or slash and burn agriculture. Such activities have continued unabated outside of the MBR and concession areas. Although the system is not yet perfect, either from a social, economic and ecological standpoint, it holds the promise of maintaining the Reserve under forest cover through the next century.

The ongoing diversification of products harvested from the forest estate (both timber and non-timber) and the adding of value to the products (milling, furniture making, processing of medicinals, basketwork, etc.), appears to be helping more individuals take advantage of the benefits of being forest owners, and generates support from broad segments of the community, fostering the feeling that the forests should be protected and well-managed. However, more needs to be done to market secondary timber species. From an economic point of view, the present situation relies too heavily on two precious, world-renowned timber species: bigleaf mahogany and Spanish cedar (*Swietenia macrophylla* and *Cedrela odorata*).

From an ecological standpoint, much remains to be understood of the requirements of all floral and faunal species in the Petén forests, including the most valued and studied commercial species. Information on endangered faunal species of the area is limited, although studies have been conducted for some: scarlet macaws, orange-breasted falcons and other raptors, tapirs, moreliti crocodiles, and heavily hunted mammals such as tepesquintle and deer. These studies, and the guidelines proposed by researchers for managing hunting and maintaining their critical habitats, need to be formalized through policy and regulations for the Maya Biosphere Reserve. This information should be widely disseminated and included in forest management plans and environmental assessments in the future.

The first step has been taken: the community forests are intact, there is a natural canopy, understory and fauna of native species. But many questions arise on how to best assure long-term maintenance of biodiversity of the forest. How will the harvesting pressures over

the years change the structure of the forest? What are the requirements of different plants and animals, including resident and migrant endangered species? What are the requirements of mahogany and cedar? If a community can sustain itself on forests harvesting less than one such tree per hectare, why couldn't they double that number, through silvicultural practices, or even have 10 trees per hectare to harvest? What would that mean to the rest of the forest structure? How could the community improve its own health, education and housing situation with ten mature mahogany trees per hectare?

In these first years of forest management, the players have bent over backwards to use "minimum impact" methods of harvesting, and focused on having as little change in the canopy and disturbance to the soil as possible. These minimal impact techniques are not what is silviculturally required to maximize natural regeneration of cedar and mahogany, which prefer large openings in the forest canopy and a vigorous disturbance of soil. At this point, harvesting systems in use are not those that will encourage the establishment of today's most economically valuable species. Exactly what these harvesting systems would be is currently under debate by the scientific community (CITES 1997), as is the desirability of such management on a large scale.

From a social point of view, residents of the Petén have a reputation as individualists. Most older communities have historically been fractious and divided, and many of the communities are new, very heterogeneous, and unorganized. The high value and power associated with timber, land control and resources that a forest concession brings, create a potentially explosive situation. All organizations involved in forest management in the Petén need to evaluate the process of community decision-making, the awarding of forest jobs, and the distribution and reinvestment of forest revenue, to assure the system is democratic, fair, and not captured by a powerful group. Disgruntled community members make very effective saboteurs. The questions are many, but the most critical work has been done: now, for the first time, there is a functioning framework for communities to have legal tenure rights over large, productive tracts of forest.

Although our recommendations are numerous, and detailed, in summary we emphasize:

- **USAID Environmental Regulations.** The forest management concessions are meeting our goals, and the requirements that tropical forests not be destroyed, and biological diversity not be reduced. This report documents, that for each community forest, management plans (including environmental assessments) exist, and are being followed to a high degree; cutting is within the forest block designated in the management plan; mitigation measures are being implemented; and there is effective prevention of encroachment on forests by agriculture or other land uses. These are

tremendously significant and important achievements in comparison to historic use of the Petén's forests.

- **Ecological Issues.** Numerous studies on wildlife and plant species have been recently completed, are in progress, or planned. This information needs to find its way into applicable norms and regulations, including incorporation in forest management plans and annual work plans. Sensitive species and their habitats should be listed in forest management documents.

Recent studies on mahogany in the Petén indicate growth rates can be greatly increased (doubled) using simple release techniques Pinelo (1997) (*Dinámica del bosque Petenero: avances de investigación en Petén, Guatemala*). Employment of silvicultural systems that encourage the establishment and growth of high value species should generate greater profit potential in the future.
- **Archeological Issues.** Although no harvesting areas we visited fell within archeological sites, targeted surveying and better documentation should be made of their existence or absence, along with plans and mitigations for their protection in the future. This is especially important considering the apparent correlation between sites disturbed by previous human activities and occurrence of mahogany (Snook 1993). Most forest management plans do not mention nor adequately identify the locations of archeological sites, nor mitigations for their protection. An exception in one cooperative left a buffer surrounding a site with tourism potential.
- **Social Issues.** Efforts should be redoubled to include the entire community, not only select individuals, in managing and benefitting from the forest. Jobs, benefits, training, and yearly dividends should be distributed fairly. The forest management and business decisions of the community should be distributed among several committees. A model to consider when prescribing this is that set by the ejidos working in forest management activities in Quintana Roo, Mexico. Forest communities should be encouraged to invest in schools, teachers and health facilities.
- **Utilization and Marketing.** Emphasis should be put on finding markets for the tropical timbers and non-timber forest products in the Petén. Communities should investigate the benefits of organizing themselves to sell their products as a unit, in order to bargain for a higher price. A certification of the timber should be pursued, by an organization recognized by the Forest Stewardship Council. Sawmill owners should be encouraged to ally themselves with the marketing of "green wood" (environmentally friendly); milling and exporting wood that brings a higher price to

all involved.

- **Value Added.** For timber sold, as much processing as possible should be done by the community (felling, sawing, skidding). These activities have positive social, economic and help mitigate or reduce negative environmental impacts of harvesting. This will involve credit for equipment, and training.
- **Training.** Although much training has been done to date, due to the growth in the number of new concessions, and the continuing advancement of communities in managing their timber, a multitude of training needs exist. From training local individuals as foresters, continued training in harvesting operations, use of Alaska saws, and portable saw-milling, to more training and support for carpentry classes and facilities, the demand is high. Training in making high quality baskets, hats, and furniture from bayal and mimbre (Desmoncus spp. and Philodendron spp.) could produce quick results, if linked with marketing efforts. Older children and youths, both boys and girls, should be encouraged to attend trainings.
- **Regulation.** Care should be taken by CONAP to not burden too heavily with requirements and fees, or over-regulate, either the cooperatives that own their forests, or communities with concessions. The bureaucracy should not be so cumbersome that new communities are deterred from protecting their forests, or that those participating decide agriculture is a much easier occupation! CONAP (Cosejo Nacional de Areas Protegidas) and the Government of Guatemala (GOG) policies need to be reviewed to remove present disincentives for forest management in comparison to conversion of forest for agriculture. However, regulations must be adequate in order to guard against the illegal timber poaching and transportation so common in the recent past; and all should strive to achieve and maintain a system free of corruption.

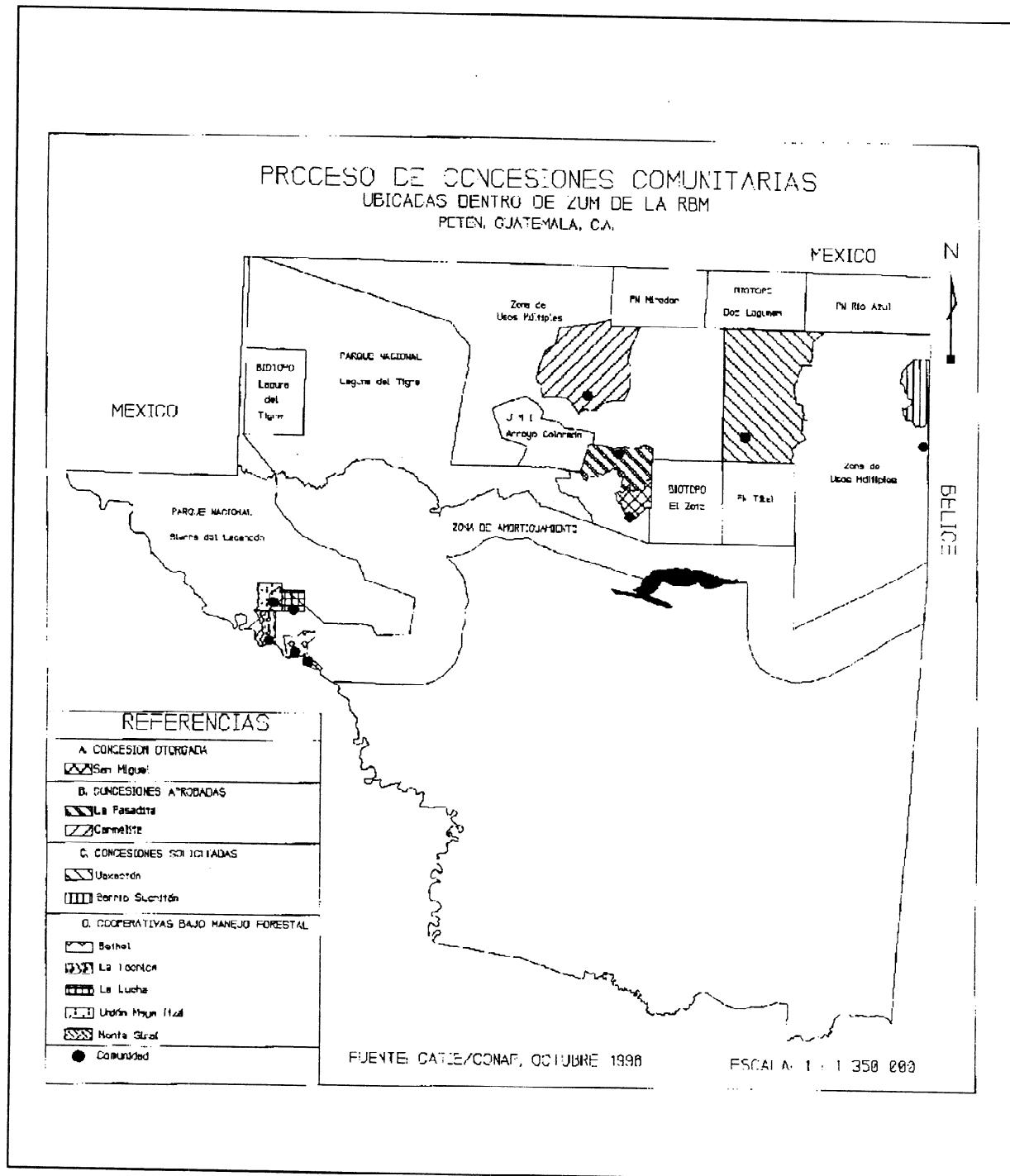


Figure 2. Locations of community forest concessions and cooperatives in the Petén.

INTRODUCTION

The Maya Biosphere Project (MBP) (USAID Project 520-0395) requires monitoring of compliance with mitigation measures, concession requirements, and USAID environmental requirements periodically. In order to fulfill these requirement six communities practicing community forestry in the Petén were visited between May 6-12, 1997. Activities included extensive document review, meetings and discussions with government counterparts (CONAP - Consejo Nacional para Areas Protegidas), NGOs (international and local), and local communities. Site visits were made to harvest areas for the current year in all six forests, and where possible to areas harvested in past years.

Work focused on reviewing forest management plans and environmental assessments, including mitigation plans, and their application in the forest. Other questions considered included:

- 1) to what degree do concessions/cooperative forest management serve as effective mechanisms for forest conservation by reducing the rates of spontaneous colonization and associated slash and burn agriculture?
- 2) how can monetary income from the concessions be increased, without damaging the resource base? and
- 3) what other constructive improvements can be made in the system and its administration?

An analysis of approaches used by different NGOs was requested, including conclusions and recommendations. Several other communities were listed for review, but due to a shortage of time only six communities could be visited. Those receiving USAID support, or soon to receive USAID support, were given priority.

FRAMEWORK FOR REVIEW

The Programmatic Environmental Assessment included an attached Mitigation Plan, which was approved by the Bureau Environmental Officer (Brokaw Cable 2 May 1995). The same cable states that "The effectiveness of the EA process and compliance with mitigation measures should be evaluated in Semi-annual reviews and in project evaluations." The following Table (1) includes the resulting Mitigation Plan, and a summary of our assessment of compliance.

Table 1. Mitigation plan for the Maya Biosphere Reserve, and compliance (Attachment 2 of Kline to Brokaw letter, February 8, 1995).

Mitigation Plan - Forest Management	Assessment ¹
I. PLANNING	
1. Support a systematic program of local consultation related to the proposed concession system in order to create widespread understanding and support and to base the system on detailed local knowledge of the forested areas and with respect for traditional management and use by communities.	Not formally evaluated (although much divisive rumor exists at a community level on what's really going on.)
2. Provide technical assistance to CONAP and municipalities for comprehensive zoning of the MBR, taking into account parks, non-timber extraction zones, wildlife corridors, archeological sites and areas with high volume of commercial timber.	Not evaluated, but efforts are underway through the CATIE/CONAP agreement.
3. Develop logical plans for forest management unit location and size in the commercial forest, by municipality, and with full consultation of stakeholders, including: -Designation of commercial forest in the multiple-use zone based on site specific conditions.	Not evaluated, but efforts are underway through the CATIE/CONAP agreement. Done
-Systematic definition of forest management units within the commercial forest, to assure that each unit has a net volume and value of resources, which permits sustainable, integrated forest management by concessionaires.	This has been accomplished to a degree, hence the 6 community forests were visited and evaluated.

Table 1. Mitigation plan for the Maya Biosphere Reserve, and compliance (Attachment 2 of Kline to Brokaw letter, February 8, 1995).

Mitigation Plan - Forest Management	Assessment ¹
-Participatory planning of integrated forest management units in close cooperation with the municipal governments, CONAP, communities and other stakeholders affected by the forest concession system.	Not evaluated in detail, some evidence of dissatisfaction. This goal also included in CATIE/CONAP agreement.
II INSTITUTIONAL STRENGTHENING	
1. Assist CONAP to focus its responsibilities:	
-Support development and implementation of institutional development plan.	Not Evaluated.
-Provide technical assistance to CONAP to facilitate delegation of on-the-ground management and supervision to more qualified parties.	Appears CONAP is effectively taking over much of this role.
-Support the GOG to develop viable oversight and control systems considering roles for municipalities and international entities.	At present, CONAP is applying oversight and control.
2. Provide support for the preparation of forest management plans which incorporate site specific EAs using a process that involves full local consultation and in accordance with the PEA.	Accomplished and ongoing, but need to check local consultation, and improve site-specific mitigations.
3. Provide financial support to establish more effective and efficient forest management oversight (at least through PACD).	
-Technical assistance for establishing a reliable system in CONAP for review of concession applications and forest management plans.	Being provided by CATIE.

Table 1. Mitigation plan for the Maya Biosphere Reserve, and compliance (Attachment 2 of Kline to Brokaw letter, February 8, 1995).

Mitigation Plan - Forest Management	Assessment ¹
-Forest management training for GOG institutions, NGOs which will work with communities and wood workers.	Training by CATIE; ongoing need
-Complement CONAP oversight with an independent, international forest management entity.	Not done yet; CATIE has in work plan for 1998.
III MITIGATE ENVIRONMENTAL IMPACTS OF FOREST MANAGEMENT ACTIVITIES	
1. Provide TA to CONAP to help assure that the "best management practices:" are included in forestry management plans and applied.	Included, for the most part in FMPs, applied in the field.
2. Assist the GOG to revise the official guidelines for concessions to be more consistent, flexible and simple:	
-Contracts should be improved to clarify conditions for collection of payments, resolution of conflicts, imposition of sanctions, cancellation and supervisory roles.	CATIE/CONAP team working on this.
-Procedures for management unit lay out should be revised to reflect the mitigations presented in Section I "Planning," above.	Needs work.
-The role of municipalities should be clarified and their share of income defined.	Needs work.
-The role of an independent oversight entity should be explicit.	Not yet defined.
-Assure critical habitats within forest management units are identified and legally protected through concessions contracts.	Not yet done in a consistent manner. Needs more work.
-continue to review and update list of protected tree species within best management practices.	Few, if any, mentioned in the FMPs.

Table 1. Mitigation plan for the Maya Biosphere Reserve, and compliance (Attachment 2 of Kline to Brokaw letter, February 8, 1995).

Mitigation Plan - Forest Management	Assessment ¹
3. Support demarcation and protection activities in core zones.	Not evaluated, but project has increased emphasis here.
4. Support mapping and demarcation of all archeological sites and support the incorporation into all forest management plans of the archeological mitigations (W.Williams memo of 10/20/94).	Mentioned in some FMPs. Requires more work.
5. Assure site-specific FMPs include mitigations to control access toward parks and sensitive areas.	Not mentioned in the FMPs, but seem to be effective in controlling access.
IV MONITORING	
1. Support a system of annual certification of compliance with minimum concession requirements (e.g. forest estate is without encroachment by unauthorized land use and timber cutting is limited to designated block) as prerequisite to continued activities.	The current study helps verify minimum compliance. More work is needed to institutionalize system of certification (outside USAID).
2. Provide technical assistance to establish long-term financial and administrative mechanisms for forest management research, monitoring and certification/control.	CATIE has presented one report to CONAP; more work required.
3. Fund a quick assessment to investigate composition and distribution of wildlife in the area of Arroyo Colorado and include appropriate mitigations in final FMP.	No longer relevant. GOG does not plan to go forward with the proposed industrial concession.
V OTHERS	

Table 1. Mitigation plan for the Maya Biosphere Reserve, and compliance (Attachment 2 of Kline to Brokaw letter, February 8, 1995).

Mitigation Plan - Forest Management	Assessment¹
1. Plan for long term TA to GOG and communities (through PACD) to support this mitigation plan.	Done through CATIE-CONAP agreement.
2. Continue to support value-added processes and marketing for forest products in communities.	Need to do more.
3. Use local firms trained in EA development, and continue to train others as necessary, to conduct future site-specific EAs following guidelines presented in PEA and "best management practices;" approve at USAID/G-CAP level.	The current study supports/provides G-CAP approval of FMPs and their EAs.
4. Clarify the role of NGOs in MBP vis-a-vis support to specific concessions and/or aspects of concession development.	Done. NGO's supporting concessions on community (geographic) basis.
For more detailed discussion, see the Recommendation section of the PEA (pp. 37-50).	

FOREST MANAGEMENT

Current Forest Activities

The following reviews, in general, current forest activities in concessions and cooperative forests in the Petén. We visited three community concession areas (San Miguel, Pasadita and Carmelita) and three cooperatives (Bethel, la Técnica and La Lucha) for this review. Representatives from the Flores offices of CATIE/CONAP, the respective NGOs and CONAP organized the field trips and accompanied us. In all but one of the sites we spoke with community members and/or officials of the local Forestry Committee, and the responsible NGO technicians. Table 2 indicates the areas visited and the responsible NGO.

The sequence of events for a community to become licensed to manage forest lands, and (in the case of privately owned forest lands) to qualify for harvesting and transport permits is as follows. First, a community, with the help of an NGO, and the blessing of CONAP, makes an inventory of the designated forest land, to determine marketable trees, and the age structure of the forest. This process has gone smoothly in the communities thanks to the work of CATIE and other NGOs, using a methodology published by Carrera (1996) *Guía*

para la planificación de inventarios forestales en la zona de usos multiples de La Reserva de La Biosfera Maya, Petén, Guatemala. With this inventory, a Forest Management Plan is drawn up, with an Environmental Assessment (EA) (or *Evaluación Ambiental*) either attached or separate, and submitted to CONAP for approval.

Community Name	NGO	First Harvest	Status	USAID Funding
San Miguel	Olafo/CATIE	1994	4 units cut to date	pending ¹
Pasadita	Olafo/CATIE	1997	Completing first harvest	pending ¹
Carmelita	Propetén/CI	1997	Just began in May	pending ²
Bethel	Centro Maya/Rodale Inst.	1994	Currently logging	approved
La Técnica	Centro Maya/Rodale Inst.	1996	Currently logging	pending ³
La Lucha	Centro Maya/Rodale Inst.	1997	Four days of cutting	pending ³

Table 2. Community forests visited. May 1997

After approved by CONAP, the community takes a more detailed inventory of the first year's harvesting unit, mapping each tree to be harvested, and designating seed trees to be left. This Annual Operating Plan (POA, or *Plan Operativa Anual*), includes predicted

¹ USAID funding expected to be approved based upon recommendations of this report and an agreement with CONAP-Centro Maya, on LOP costs, results, and annual work plans.

² USAID funding to CI has supported planning and studies; formal support for FMP is approved based on this report.

³ USAID funding to Rodale-Centro Maya has supported planning and studies; formal support for FMP is approved based on this report.

volumes to be cut, by species; price estimate for each; budget of expenses; time table for activities; a layout of roads and skid trails; and a list and description of mitigation measures to be taken before, during and after harvesting to minimize negative environmental impacts to the site. After approval of the POA, construction of roads begins (or should begin), trees are felled, cut to length, sometimes sawn into boards or cants at the site; skidded as logs to decks or loading areas, or if boards, may be hauled by humans, oxen carts, or trucks. After loading onto larger trucks, the wood is hauled to the mill, for further processing, and possibly export. These activities are carried out using a methodology of low-impact harvesting described by Carrera and Pinelo (1995) *Prácticas mejoradas para aprovechamientos forestales de bajo impacto*.

During this time, wood volume is calculated by a community representative, the NGO, CONAP, and perhaps by the buyer (unless the community delivers the wood to the buyer). This is when CONAP tallies up the amount of taxes to be levied, and issues "guías" or transport authorization, stating that the wood was legally harvested. (A more complete description of monitoring of forest concessions by CONAP can be found in the document by Stanley (1996) *Monitoreo estatal en concesiones forestales comunitarias en La Reserva de La Biosfera Maya, Petén, Guatemala.*) Later, the community is informed by the forest committee of the income and expenses for the year's forestry activities, and decisions are made on the use and/or distribution of revenue.

In addition to planning for the annual harvest, the POA details forest protection, including marking and maintaining boundaries, patrolling the forest for illegal extraction of timber, and making fire breaks between agricultural fields and forests.

Between the concession forests and the cooperative forests, the main difference observed in forest activity was that the concessions were using slash saws ("Alaska saws") to make cants and random dimension boards at the stump or a short skid distance from the stump. The cooperatives, on the other hand, were selling raw logs. In the concessions, "skidding" (mostly of sawn wood) was done by man-power, oxen or a car. Two of the cooperatives relied on the timber purchaser to skid, load and haul the logs. The third cooperative, Bethel, used a farm tractor to skid logs to a deck where they were loaded by the purchaser, using a front-end loader onto tractor trailers. The first scenario, in the concessions, where the communities were handling all movement of timber in the forest, caused less damage to residual timber, generated greater up-front revenue per board foot of wood and created greater employment opportunities for individuals of the community. We know of no

economic studies that compare the value of the wood lost in the slash saw kerf⁴, to the increased local employment and lower damage to standing timber, but such a review should be made before restrictions are considered on the use of slash saws. In any case, the communities themselves should maintain control over harvesting and processing to the greatest extent possible. The eventual, inevitable, rise in the price of mahogany and cedar will convince the communities to use more efficient harvesting methods as years go by.

A brief review of CONAP's system for letting, managing and supervising concessions (under the CATIE/CONAP Project) was made. The frequent turn-over in CONAP personnel is a detriment to the institutionalization of forest management activities. In recent years there have been numerous heads of the Flores office. The chief of the Petén Region (VIII) forestry division, and the technician who accompanied us to the field in May, had both left CONAP within four months of our visit. With this kind of staff turnover, it will be nearly impossible for CONAP to maintain effective monitoring. Also, CONAP's monitoring of regeneration and environmental impacts is minimal. It seems that the post harvest field checks are conducted to determine the execution of the Annual Operating Plan, but no such reports were provided to us. Reviews in the future should check this internal documentation.

Overall, we found CONAP's public image has improved, due to its recent management and pro-active work in concessions. During our review, CONAP appeared to be completing its responsibilities regarding reviews and approvals for forest concessions, and providing a forestry technician during harvest operations. The various NGOs contribute important organizational and technical leadership to the communities, although an occasional villager expressed interest in more autonomy.

Forest Management Plans

Technically, from the stand point of timber production, there is little to criticize regarding the forest management being practiced. However, it should be noted that knowledge of management of natural tropical forests is limited within the profession, and will evolve as more is learned about managing the Petén forest. The best methods for accomplishing some goals, for example in biodiversity, are still uncertain. The social side of the equation too is tenuous.

The Programmatic Environmental Assessment (PEA) recommendation that timber concession sizes range from 4,000 to 10,000 ha (section 2.2.2) is being applied, except for Carmelita which has 12,000 ha suitable for timber management. Not all of the community forests are

⁴Kerf is the area of wood turns into sawdust during sawing. Chainsaws (slash saws) have a wider kerf than sawmills.

utilizing the PEA-recommended cutting cycle of 25 years. Rather, there is a variety of cycles being tested and this may provide interesting comparative data in the future: Bethel prescribes a 20 year cycle; San Miguel prescribes 20 years for secondary species, and 40 years for mahogany/cedar; Pasadita uses a 25-year cycle. The Forest Management Plans should include a discussion of the "desirable future condition" for which they are managing the forest, i.e. stand composition, health, basal area, etc., along with a time frame.

Silviculture: In a silvicultural sense, much work remains to be done on the over 300 tree species in the Petén. Indeed, our knowledge is not even adequate to prescribe forest practices that would with certainty regenerate the two most valuable, and most studied timber species, mahogany and cedar.

Typically, the Forest Management Plans are using 30 cm as the minimum diameter to qualify a tree as a seedtree. Pasadita Operating Plan applied a 30 cm minimum for seedtrees for mahogany, and removed all trees with 60 cm DBH or more. Carlos Navarro's work on *Phenotypical variation and preliminary results of the collection of Central America Swietenia macrophylla* (presented at International Conference on Big-Leaf Mahogany, in Puerto Rico, October 1996) indicates a "strong exponential relationship" between seed production and tree diameter: "Trees under 40 cm do not produce more than 50 fruits each year," as compared to more than 100 fruits for trees over 60 cm in diameter. He records up to 1000 fruits for large diameter trees. In addition, the height of a tree is a primary factor in determining the distance of seed dispersal. Santiago et al. (1992) indicate that in Mexico the typical maximum dispersal distance is equal to twice the tree's height. In light of the marginal regeneration of mahogany in the MBR (Maya Biosphere Reserve), it is recommended that the strict application of 30 cm minimum diameter be reevaluated.

In addition to the obvious prerequisite of adequate seed supply for natural regeneration, scientific studies indicate that the condition of the seedbed and the amount of canopy cover are instrumental in determining actual establishment of seedlings. Therefore it is recommended that more research emphasis be placed on soil scarification, and manipulation of shade as a means to increase regeneration. Assuming that the mahogany regeneration is most likely to occur in areas of exposed soil and canopy gap (skid trails & landings) caution will need to be taken to not reuse these areas during the next stand entrance. Regeneration studies should continue to gain a better idea of how detrimental compaction may be to germination and survival. For example, in some decks where logs were being loaded, the compaction may be so severe as to prevent any regeneration.

Although today the communities are harvesting truly impressive mahogany and cedar trees, the forest inventories indicate this will not be the case on most cutting units in 20 years,

when the communities return to harvest the next round. Inventory data from every forest show a lack of intermediate sized trees to be harvested in the next cutting cycle. Regeneration data appear to indicate that mahogany and cedar are not coming back into the harvest sites in the numbers required to stock future harvests. From the data currently available for mahogany throughout its range, diameter growth rate is about 0.5 cm/year. With a minimum diameter breast height (DBH) of 55 to 60 cm for harvest, it will take about 120 years for any surviving seedling from today's harvest to reach merchantable size. Fortunately, new information and current research in the Petén indicate that greater growth rates can be had for mahogany with liberation cuts (Pinelo 1997). Hutchinson's work (1993) indicates that growth can be increased three-fold with the use of liberation thinning. In any case, to maintain a community's interest in forest management the economic benefits must be clear: either new products, other than wood for lumber, will need development, and/or old products will require nurturing.

Parts of the forest management plans are not being followed due to the limited market for certain species and smaller diameters. This will have an effect on the stand composition which has not been anticipated in the management plans. Harvest volumes and species are dictated not by forest management requirements, but by the particular demand for wood and the community's capacity to execute the harvesting activities. For example, the San Miguel Plan prescribes half of the allowable cut quantity for the first cutting unit. Of all the units cut to date in San Miguel and Pasadita, only the current San Miguel cutting unit has had the prescribed volume and species actually harvested. Every other year was dictated by what the purchaser would agree to take, and what the community could manage to prepare and cut. In Pasadita the purchaser was only interested in six of the eight prescribed secondary species, and only 50% of the prescribed volume of santa maria. (See Appendix 1 for tree names.)

Economics: An important element of the PEA that needs to receive immediate focus is that of marketing and value-added activities. Although several economic analyses have reportedly been proposed, none of the forest management plans incorporated an economic analysis of the management alternatives. At least a basic economic analysis should be included in each forest management plan.

Roads: The Programmatic Environmental Assessment (PEA, Synnott report, Annex III, section 26) suggests that all roads to be constructed and maintained should be determined and identified in the Management Plan, and included in an Annex to the concession contract. The Management Units visited fell short of this objective. The Special Foreign Assistance Act (10/86) requires an indication that these kinds of activities will be done in an environmentally sound manner. Therefore is important that they be identified, and mitigations planned.

Communities: The Plan should be developed with as much participation of the community as possible. The description of the future desired condition can stem in part from feedback of the community in terms of their long-term plans for their forest resource. Also, discussions of employment opportunities can help direct the forest management objective. The community members with whom we spoke were happy with the forest activities and seemed positive about continuing on a long term basis, but we were able to speak with only a few. We recommend better documentation that decisions made represent the entire community, and that benefits flow to all community members.

Every AID document (regulations and PEA) stress the importance of involving the community in the decisions on concession activities. Though we did not personally encounter any negative comments from community members, there are indications that this involvement has not been sufficient. Most of the management plans do not indicate that community members were interviewed or that their opinions were considered in the decisions. Ironically, the FMP that most develops this kind of community participation is Carmelita, which has experienced the most serious social conflicts. The planning process, however, directly involved a limited number of the households (5.5%). Even with excellent methodologies and participation, one can easily run into social conflicts and problems when dealing with serious land/resource issues in such isolated communities.

Forest Management Plans - Recommendations:

o Baseline Data In order to maintain biodiversity and ecological function, dedicate more emphasis to design and completion of inventories to establish baseline data. Design and implement monitoring to determine effects of concession activities on biodiversity and ecological functions. The publication by Whitacre (1997) *An ecological monitoring program for the Maya Biosphere Reserve* will be used for this important activity. (The Center for Monitoring and Evaluation (CEMEC/CATIE) is assembling much of this information, and is coordinating ongoing research in the Petén. The status of this needs to be reviewed in the next assessment.)

o Road Construction and Maintenance Employ infrastructure planning as an integral part of the management planning process. A map showing at least the first five years of timber harvest and the road system to facilitate this should be included in the FMPs. Type of road work prescribed, i.e. new construction, reconstruction; type of road, i.e. primary, secondary (typically related to the amount of use and its relationship to the system as a whole); life of the road (temporary, permanent); design vehicle; construction and maintenance specifications (aggregate, bridges, slope etc.) should be included.

Also, timber harvesting contracts should be very clear about any road work that will be required of the purchaser.

A road maintenance fund should be established by each community. This is one of the reasons better infrastructure planning is needed. Those roads that will serve as long term haul roads within the management unit should be scheduled to receive regular maintenance.

o Community Involvement Develop conflict resolution strategy, both short and long term. This expertise should be sought out among consultants (preferably local) who focus in this area of discipline. The management plans should include a social analysis that stems from wide community representation. Utilize the USFS video tape entitled **Environmental analysis: a decision making process**, which was filmed in Guatemala and is available in Spanish, to demonstrate a community-integrated process of analysis.

o Future Harvests The Forest Management Plan should include a division of the already identified forest types into areas for proposed harvesting, by year. Criteria for selection of order of entry should be clearly described, i.e. existing infrastructure, stand maturity, etc. A map indicating this should be part of the Plan.

o Standardization Terminology and classifications should be standardized for all plans, i.e. forest types, species codes. (In San Miguel numbers 1-5 were used to indicate merchantability value of species, in Pasadita, abbreviations like "SINVAL" or "VEDADO" were utilized.) Pasadita divides the forest into two numbered stratum by topography or land use, and then further by species associations and geology. As CONAP must approve the plans, the responsibility for establishing and enforcing standardization rest with that agency.

Environmental Assessments (EAs) and Mitigation Plans

A review, in general, of environmental assessments, and mitigation plans is discussed below. Environmental Assessments are typically a part of the Forest Management Plan, and included as an annex. Some have handled the concept of the purpose of an environmental evaluation better than others. For example, the Pasadita and San Miguel EAs display a list of potential impacts of forest harvesting, and a corresponding list of mitigation measures. The Carmelita EA identifies mitigation measures corresponding to the identified significant issues.

Potential environmental consequences of the proposed actions should be clearly identified in the EA's. Generally, the evaluations are weak in the area of identifying the likely impacts or

environmental consequences of the proposed activities. One reason for this is that the Forest Management Plans aren't very specific in identifying activities. The "impacts and mitigation measures" (when they are listed) are not site specific. They could easily be interchanged among the plans, and apply just as well. Reference was made in several cases to CONAP's guidelines (i.e. for road construction), which we did not see. The specificity and applicability of these should be reviewed, to determine if each EA needs to embellish more in this area.

The plans should provide more specific information on endangered species present in a forest, their associated habitats, and tree species that should be protected. The use of game meat is never mentioned, although it is known to be an important source of food for Peteneros. Areas of archeological importance, and protected waterways should also be identified, mapped and mitigations for their conservation should be clearly integrated in FMPs.

The danger new logging roads may pose in opening new routes to core protected areas, facilitating illegal timber harvesting, and new clearing for agriculture are not assessed. The possibility of closing roads during part of the year, or limiting access, should be considered.

Mitigation actions in La Lucha and La Técnica should be improved, particularly where haul roads are concerned, i.e. water diversion techniques should be applied. In some cases aggregate is needed. Streambed protection should be closely monitored in La Técnica.

The skidding operations of the timber purchaser were damaging the residual stand in La Técnica. Mitigations need to be clearly identified and enforced in order to comply with subsection 118 (Tropical Forests) of Section 301 Foreign Assistance Act: that all timber harvest operations will be conducted in an environmentally sound manner which minimizes forest destruction.

Environmental Assessments (EAs) and Mitigation Plans - Recommendations

In order to improve sustainable forest management and biological diversity we recommend the following changes to make the EA process effective, and assure compliance with mitigation measures.

o Guidelines Future environmental evaluations for forest management plans should follow the guidelines in the publication: Gretzinger, S.P. 1996. *Evaluación de impactos ambientales en Concesiones Forestales en la Reserva de La Biosfera Maya, Petén.* Manejo Forestal en la Reserva de la Biosfera Maya No. 5. CONAP, CATIE. 58 pp.

o Information and Mitigations To comply with mitigation measures outlined in the PEA, the following issues must also be addressed and incorporated into management plans and environmental evaluations:

1. List of protected and/or endangered plant and animal species, and how they shall be identified and protected within the concession area.
2. Description of habitats required by the above.
3. Description of community interactions with, and uses of, species in 1.
4. Government regulations on hunting and extraction where applicable.
5. Archeological sites within all forest concession blocks, listed and mapped.
6. Documentation of community role assessing the impacts of the management plan.
7. Documentation of mitigations (including monitoring, control, or road closure) for invasion and illegal harvesting in the community forest, surrounding forests, and especially core protected areas which could result from the opening of roads and trails in concession blocks.
8. Address other trends which threaten the size and integrity of the forest estate, in relation to the forest management plan.

Annual Operating Plans

The Annual Operating Plans (POAs) are serving the purpose of outlining the annual harvesting activities within a specific unit. This can also serve as a good opportunity for a description of the longer-term management prescription for any given site.

Generally the POAs were very complete regarding inventory, and what was prescribed for cutting. The harvest maps clearly indicated cut and reserve trees. Some included a calendar of operations. PEA/Synnott suggests that Annual Operating Plans should be done with at least 12 months anticipation. To date this has not been successfully accomplished. More typical is that the POA is submitted for approval to CONAP only a few months or weeks before harvesting is scheduled.

Often road terminology could be improved to better indicate if the roads were existing or require new construction, and maps should include the haul road, primary skid trails, landings and creek crossings. Road maintenance should be clearly defined in the POA. It is important to better schedule skidding operations and roadwork, especially when the buyer is responsible for these activities. It is unlikely that all the wood prescribed for this year's cut will be hauled out, due to a late start, lack of planning for the road construction, and the impending rainy season.

The POAs use cubic meter figures. Board-foot measurements should also be included, due

to the fact that the wood is sold on this basis. At this point in time the application of minimum diameter cuts seems to be most reasonable, because of the product demand. As better utilization of smaller diameters, and amplification of uses increases, the selection of trees should be based on diameter distribution curves, basal area and growth and yield predictions.

In addition to Annual Operation Plans (which are in essence harvesting plans), an investment plan should be elaborated. Several of the communities we visited hadn't decided yet what to do with the revenues that were being generated. The expenditure/distribution of the stumpage revenues has proven a source of conflict in several of the communities. A plan made with ample time to gather consensus about this will help avoid whimsical decisions, and power struggles.

Site specific mitigations were not indicated in the annual plans.

Annual Operating Plans - Recommendations

o Mitigation Measures Each annual operation plan should include the list of mitigation measures outlined in that forest's EA. It should also include the following:

1. List of protected tree species with instructions not to cut.
2. List of endanger plant and animal species, with instructions to respect regeneration and nesting sites.
3. Description of habitats required by the above (when known).
4. Archeological sites in the harvesting unit, listed and mapped, with instructions for protection. If there are none it should be noted.
5. Description of how community members will be chosen for forest jobs.
6. Plans for road closures and other mitigations and monitoring of road condition and use in the future.
7. Mapped location of all specially zoned areas in the plan. This should be derived from the forest management plan: streams, lakes, critical habitats, eco-tourism areas; and description of restrictions (e.g. no cutting within riparian zone, etc.).

o Roads New construction should ideally be completed before logging begins, this gives opportunity for the road to settle and dry out, and also allows opportunity to adjust felling in the event that the road layout doesn't follow what was originally envisioned. The Annual Operating Plans should include a large scale map of the unit showing the haul road, primary skid trails, landings and creek crossings. Any significant needs (i.e. creek crossings) can then be indicated on this map. What is meant by road maintenance and

road construction should be clearly defined in the POA, and included in a calendar of activities.

o Standardization and Timing Begin this process during the current year's harvest for the following year. Promote the standardized format in order to ensure the appropriate information is included, which permits expedient review by CONAP's staff.

o Scheduling Due to problems of timing related to the rainy season, non-harvest weeks due to the phase of the moon, and availability of equipment, the Annual Operating Plan should try to schedule work related to harvesting early in the season.

o Silviculture Funding Encourage the establishment of a sale area improvement fund from the revenues generated by timber sales to be reinvested in silvicultural activities in the cutting units.

o Security Provide hard-hats for woods workers.

o Regeneration Inventory Include an inventory of current natural regeneration at the time of the timber cruise for harvest.

Commercialization and Utilization

It is a very positive sign that some local buyers in the Petén are currently using more than 15 timber species. In spite of this, prices were about 1/3 or 1/2 the price of mahogany or cedar this year (1997), an improvement over earlier years. Marketing of forest products is an area for future emphasis. The sale price of the wood, whether its rough sawn lumber or raw logs, is minimal. We did not have opportunity to talk with timber purchasers or loggers during this trip but based on several elements it appears that there is a very wide profit margin at this end of the equation, at least for the primary species. One indication is the long haul distance of the wood. In the case of the cooperatives, it is still profitable for the purchaser to haul raw logs several hours to a mill in San Andreas. Another indication is that there is no fluctuation in the timber prices from one community to the next though logging and hauling conditions vary.

Utilization of the wood could stand improvement; only the best wood is being removed. The timber purchaser places a minimum acceptable lumber dimension of 2" x 7" x 7' for the secondary species, and will go down to 5" width by 5' length for primary species (mahogany and cedar). There was considerable waste left on the decks or in tops and branches, and sawdust created by the Alaska saws. Again this is a function of the low market value placed

on the wood and its products (4.5-6.25Q/b.f. for mahogany and cedar, and 1-3Q/b.f. for secondary species).

Commercialization and Utilization - Recommendations

o Marketing Obtain consultation from wood products marketing specialists to work with communities in developing a strategy regarding timing, products and packaging.

Communities should investigate the benefits of selling their products as a unit, in order to bargain for a higher price. This assistance is needed to improve the marketing of the logs and the marketing of value-added products. Execute the portion of the PEA which includes value added and marketing recommendations (2.2).

o Certification "Green Wood" A certification of the timber, by a global organization, should be pursued. Sawmill owners should be encouraged to ally with communities in the marketing of "green" wood, milling and exporting wood that brings a higher price to all involved.

o Value Added For timber sold, as much processing as possible should be done by the community (felling, sawing, skidding). These activities have positive social, economic and ecological benefits. A requirement will be credit for equipment; and training.

o Sawmills Take a good look at what, if anything, can be done to encourage the use of the community sawmill located at Bethel, including technical assistance.

Training

The numerous suggestions for improvement in forest management discussed above imply a continuation of training activities. Some trainings we feel are important are listed below.

Training - Recommendations

o Continue trainings in low-impact felling and logging, Alaska sawing, and inventory as needed at old concessions, and as required at newly granted concessions.

o Look for courses in forestry in the region, and local youths within the forest managing communities, in order to procure scholarships.

o Consider a natural resources conservation camp for young people of the communities to be exposed to careers in natural resource management, including girls.

o Support and sponsor a forester from CATIE/CONAP to attend the International

Seminar for Forest Administration and Management (Colorado State University/US Forest Service).

- o Determine what follow-up the European Union and CECI intend for the woodworking training in Bethel, and support follow-on activity if determined that their follow-up is limited.

USAID'S ENVIRONMENTAL REQUIREMENTS

The Programmatic Environmental Assessment (PEA) written for the Maya Biosphere Project (520-0395) stipulates the following requirement:

"The effectiveness of the EA process and compliance with mitigation measures should be evaluated in semi-annual reviews and in Project evaluations." (Brokaw, 20 May 1995, Approval of PEA)

This has been achieved, in the past, through the standard USAID semi-annual reviews, the external project evaluation conducted in 1994, and more recent R-4 processes within the Mission, with favorable outcomes.

In addition, the PEA Mitigation Plan (Annex 2, Letter from Kline to Brokaw, February 8, 1995) states under **IV MONITORING**:

"1. Support a system of annual certification of compliance with minimum concession requirements (e.g. forest estate is without encroachment by unauthorized land use and timber cutting is limited to designated block) as prerequisite to continued activities."

The PEA recommends a strategy based on Synnott's report (1994, Concesiones de Manejo Forestal para la Reserva Biosfera Maya, Petén, Guatemala, Section 7.2) of certification which must be highly credible and the results widely published. In the early years of the concession, *"it would suffice to document whether the concessionaire is:*

- a. *Cutting within the block designated in the management plan*
- b. *Effectively preventing encroachment on the forest by agriculture or other land uses*

Other more precise measures of sustainable management can be instituted once effective control over the concession area is achieved. These would include measures of volume harvested compared to annual growth increments, changes in biodiversity indices

compared to baseline values, and indicators of progress in implementing low-impact logging practices."

Based on this review and evaluation, and the current document, the Mission Environmental Officer verified that there is compliance with minimum concession requirements (e.g. forest estate is without encroachment by unauthorized land use and timber cutting is limited to designated block). As a result of this verification, natural forest management activities should continue. However, improvements in forest management plans, environmental evaluations and annual operating plans are necessary.

We have requested that the PEA requirement of semi-annual review of compliance (Brokaw, 20 May 1995, Approval of PEA) be amended. Due to the numerous forest concessions in the MBR, we suggest an **annual** review of the effectiveness of the PEA and compliance with mitigation measures be carried out, instead of semi-annual reviews. This brings the PEA approval guidance into line with mission reporting and internal assessment processes which now focus on an annual R-4. We also recommend that not all concessions be inspected every year by USAID personnel since they are numerous (up to 13). Instead, USAID will review CONAP's records of compliance for each forest, and verify selected sites in the field.

At this point, we can approve the forest management plans for all six communities visited. However, we believe that all of the environmental evaluations should be updated and improved. To do this, we recommend that each forest management plan (FMP) be updated after five years, along with its EA, applying the guidelines described above. (Bethel's FMP was written in 1993, and San Miguel in 1994.) In this way, critical support to natural forest management in the Petén can continue uninterrupted, while improving on the commendable work by all involved.

CONCLUSIONS

In summary, the community forest management activities we observed are positive actions which are 1) fostering conservation of the forests of the Petén by cultivating an appreciation of that standing resource, as opposed to its potential value as cleared agricultural land, 2) generating incoming for the rural poor and 3) not appreciably negatively impacting the environment or the biodiversity of the Maya Biosphere Reserve. The project design, involving four vital players: the community, CONAP, the NGO, and CATIE, can be credited with much of the positive results. The function provided by the technical collaborator (CATIE) is especially creditworthy.

Guatemala's strategy to protecting the Maya Biosphere Reserve by granting forest

concessions to existing settlements, and by supporting communities with private forests, is having the desired results. In short, communities are more vigilant in protecting their assets, fewer trees are being poached, less of the forest is being invaded, either by current community members or new comers, and steps are being taken to control the threat of forest fires.

Although this is an excellent start in forest protection and management, the system is not perfect, either from a social, economic or ecological standpoint. From a social point of view, it appears monetary benefits from the forests, in some communities, are not equally available to all segments of the community. This has led in some extreme cases to violence and death. It is very important to continue work within communities on establishing an equitable and democratic system on forest management, employment and distribution of income. A failure to bring the communities together on the management of their forests could lead to further violence and sabotage of the resources. Women in particular seem to lack standing as associates, being considered under the authority of the father or husband in the family, and rarely have the opportunity to take advantage of the jobs the forest resources currently supply. A diversification of the products harvested from the forest estate (both timber and non-timber) and the adding of value to the products (milling, furniture making, processing of medicinals, basketwork, etc.), could help more individuals take advantage of the benefits of being forest owners, and would help convince all segments of the community that the forests should be protected and managed well.

From an economic point of view, the system relies much too heavily on two precious, world-renown timber species: mahogany and cedar. Today the communities are harvesting truly impressive trees, and though the prices paid in the forest for these woods seems absurdly low, the communities are benefitting from the jobs produced from these activities, and the profit made in the sale. However, this will not be the case on most cutting units in 20 to 25 years, when the communities return to harvest the next round. Inventory data from every forest show a lack of intermediate sized trees to be harvested in the next cutting cycle. Regeneration data too indicate that mahogany and cedar are not coming back into the harvest sites in the numbers required to stock future harvests. With a minimum diameter breast height (DBH) of 55 to 60 cm for harvest, it will take many years for any surviving seedling from today's harvest to reach merchantable size. Recent research in the Petén indicate much faster growth rates are possible for mahogany with silvicultural treatments such as release cuttings (Pinelo 1997)

The question is: can a community that is not pocketing a livelihood from their forest maintain their interest in its protection and management? The answer, from historical records, indicate that without an economic, spiritual or strong ethical reason, or very low

population pressure, the forests will not be protected from invasion or trespass. The best way to counteract the potential negative economic effects of lower mahogany and cedar harvests in future years is to develop markets for other products from the forest. These include secondary timber species, non-timber forest products [xate, pimienta gorda (allspice), chicle, mimbre, game meat, etc.] in addition to the possibilities of nature and cultural tourism, and tourist hunting.

From an ecological perspective, the challenges are immense. The first step has been taken: the forests are intact, there is a natural canopy, understory and fauna of native species. But many questions are raised on how to maintain the biodiversity of the forest under the coming years of more intensive management by communities. Much remains to be done in the design of harvesting systems that will encourage the economically valuable species. And much remains to be done on monitoring the resulting changes in the extremely complex ecosystem mosaic of the Petén.

Care must be taken to include the entire community in managing and benefiting from the forest, not only a few select individuals. Jobs, benefits, training, and yearly dividends should be distributed fairly. Forest committees should be encouraged to invest in schools, teachers and health facilities. Every USAID document (regulations and PEA) stress the importance of involving the community people in the decisions of concession activities.

Although the questions are many, the most critical work has been done: there is a framework for communities to have tenure over large, productive tracts of forest.

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ANNEXES

1. List of Commercial Trees
2. List of Persons Contacted

ANNEX 1. List of Commercial Trees in the Maya Biosphere Reserve, Multiple Use Zone, Petén, Guatemala. The symbol ♦ indicated a species recommended as prohibited from commercial timber use/reserved for other uses. (From Annex 2, Synnott 1994)

Scientific Name	Family	Common Name	kg/m ³
<i>Albizia saman</i>	Leguminosae	cenicero	
<i>Alseis yucatanensis</i>	Rubiaceae	palo son	635
<i>Andira inermis</i>	Leguminosae	almendro colorado, almendro cimarrón	
<i>Astronium graveolens</i>	Anacardiaceae	jobillo	800
<i>Aspidosperma megalocarpum</i>	Apocynaceae	malerio colorado, chichique	670
<i>Aspidosperma stegomeris</i>	Apocynaceae	malerio blanco	
<i>Brosimum allicastrum</i>	Moraceae	ramón	730
<i>Bucida buceras</i>	Combretaceae	pukté, pucté	850
<i>Bursera simarouba</i>	Burseraceae	chaka, chacah, indio desnudo	430
<i>Calophyllum brasiliense</i>	Guttiferae	santa maría, mario, bari, bario	520
<i>Ceiba pentandra</i>	Bombacaceae	ceiba, yaxche	220
<i>Cedrela odorata</i>	Meliaceae	cedro	430
<i>Chlorophora tinctoria</i>	Moraceae	mora de clavo	
<i>Chrysophyllum mexicanum</i>	Sapotaceae	Caimito de montaña, siquiya	660
<i>Cordia alliodora</i>	Boraginaceae	laurel	490
<i>Cordia dodecandra</i> ♦	Boraginaceae	sircote, cericote	750
<i>Cupania prisca</i>	Sapindaceae	tzol	
<i>Dalbergia retusa</i> (<i>D. spp</i>)	Rosaceae	rosul	
<i>Dailium guianense</i>	Leguminosae	guapaque, tamarindillo	
<i>Diospyros digyna</i> (<i>D. spp</i>)	Ebanaceae	ebano	
<i>Drypetes brownii</i>	Euphorbiaceae	luin macho	
<i>Enterolobium cyclocarpum</i>	Leguminosae	conocaste	
<i>Guarea excelsa</i>	Meliaceae	cedrillo hoja grande	
<i>Guarea tonduzii</i>	Meliaceae	cedrillo hoja pequeña	

Scientific Name	Family	Common Name	kg/m ³
<i>Guaiacum sanctum</i> ♦	Zygophyllaceae	guayacán	1000
<i>Haematoxylum campechianum</i>	Leguminosae	tinte, palo tinte	870
<i>Hymenaea courbaril</i>	Leguminosae	guapinol, pacay	
<i>Licania platypus</i>	Rosaceae	sunza, socotz, cabeza de mico	
<i>Lonchocarpus castilloi</i>	Leguminosae	manchiche, kanasin	
<i>Lonchocarpus rugosa</i>	Leguminosae		
<i>Lysiloma bahamensis(L. spp)</i>	Leguminosae	jesmo, tzalman	530
<i>Manilkara zapota</i> ♦	Sapotaceae	chicozapote	900
<i>Metopium brownei</i>	Anacardiaceae	chechén, c. negro	770
<i>Pithecellobium arboreum</i>	Leguminosae	cola de coche	
<i>Platymiscium dimorphandrum</i> ♦	Leguminosae	hormigo, palo marimba	
<i>Pithecellobium lecocalyx</i>	Leguminosae	guacibán	
<i>Platymiscium yucatanum</i> ♦	Leguminosae	granadillo	660
<i>Pouteria amygdalina</i>	Sapotaceae	silión	
<i>Pouteria campechiana</i>	Sapotaceae	kanisté, zapotillo hoja ancha	
<i>Pouteria unilocularia</i>	Sapotaceae	zapotillo	830
<i>Protium copal</i>	Buseraceae	copal	555
<i>Pseudobombax ellipticum</i>	Bombacaceae	amarola	440
<i>Pseudolmedia oxiphyllaria</i>	Moraceae	manax	650
<i>Schizolobium parahybum</i>	Leguminosae	plumajillo, plumillo	
<i>Sickingia salvadorensis</i>	Rubiaceae	saltemuche, puntero, chacahuante, tapalcuite	660
<i>Simarouba glauca</i>	Simaroubaceae	pasaak, negrito	470
<i>Spondias mombin</i>	Anacardiaceae	jobo, jocote jobo	450
<i>Swartzia cubensis</i>	Leguminosae	katalox, llora sangre	830
<i>Sweetia panamensis</i>	Leguminosae	chate, chichipate	
<i>Swietenia macrophylla</i>	Meliaceae	mahogany	420

Scientific Name	Family	Common Name	kg/m ³
<i>Symponia globulifera</i>	Guttiferae	palo barillo	
<i>Tabebuia ochracea</i>	Bignoniaceae	cortéz	
<i>Tabebuia rosea</i>	Bignoniaceae	maculis, matilisquate	
<i>Terminalia amazonica</i>	Combretaceae	canchán, canxán	
<i>Terminalia excelsa</i>	Combretaceae		
<i>Vatairea lundelli</i>	Leguminosae	danto, medallo, tinco	
<i>Vitex guameri</i>	Verbenaceae	yaxnik	670
<i>Vochysia hondurensis</i>	Vochysiaceae	san juán	
<i>Zanthoxylum belicense</i>	Rutaceae	lagarto, lagarto amarillo	
<i>Zanthoxylum kellermanii</i>	Rutaceac	lagarto	

ANNEX 2. List of Persons Contacted

San Miguel

Ricardo President of forestry committee
Francisco Vice president

Carmelita

Jaime Crasborn
Silas Lopez
Brenda Crasborn
Carlos Catalán

Bethel

Carlos Chi
Benjamin
Domingo
Prospero (La Posada Maya camp/cabins)

La Técnica

Juan Ramirez

La Lucha

Guillermo Lopez Martinez

Centro Maya

Mauro Salazar
Julio Morales
Jose Chaves (Bethel)
Luis Francisco Barquin General Coordinator Proyecto Centro Maya

CATIE/CONAP

Fernando Carrera
Carlos Gomez
Gustavo Pinelo

PROPETEN

Carlos Souza
José Contreras
Walter Ponce (Carmelita)

Kevin Gold

CATIE/Olafo

Reginaldo Reyes

CONAP

Roman Carrera

Geovanni Echeverría

Justo Hoil

USAID

Keith Kline

Tobey Pierce

Others

Brian PCV

Megan Hill National Fish and Wildlife Foundation