

FORESTRY, AGROFORESTRY, AND SOIL CONSERVATION
ACTIVITIES FOR THE PROMESA PROJECT

EL SALVADOR

August, 1994

J Doland Nichols

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J. Doland Nichols, 900 N. 21, No. 7 Lafayette, IN 47904
FAX 317-494-0409, telephone 317-447-8785
email: dnichols@mace.cc.purdue.edu

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EXECUTIVE SUMMARY

The PROMESA Project, a collaborative effort between ABT Associates and the Winrock International Institute for Agricultural Development, with funding from the U.S. Agency for International Development, is aimed at reversing environmental and natural resource degradation in El Salvador. The project has three major components: policy reform, environmental education and the development of a demonstration area in the Barra Santiago watershed.

The scope of services for the consultancy called for the identification of forestry and agroforestry practices which have been successful in Central America and other parts of the world and for specific recommendations on species and systems to be used.

This report is based on field work, interviews, and meetings held in El Salvador and on interviews and literature searches in Costa Rica and the United States, in July and August, 1994.

The recommendations presented here focus on the demonstration area, a 36,000 hectare watershed in the southwestern corner of the country. The area has a number of severe problems, including siltation and pollution of waterways, the destruction of mangroves, soil erosion in hillside farming of basic grains, threats to the national park El Imposible, the lack of viable farming systems for local populations, and the lack of sanitation and adequate housing in both towns and rural areas.

An overview of soil conservation and agroforestry projects in developing countries is provided, and then a review of such activities in El Salvador, based on field trips and discussions with personnel from various projects.

Conditions in the demonstration area are described and then specific recommendations are given, according to zone: mangrove/coastal area, coastal plain, lower slopes, and upper slopes. Plantation forestry is suggested in several areas, including firewood plantings in the mangrove area, management of teak already established on lower hillsides, and buffer strips of trees along rivers. Agroforestry, particularly alley-cropping with nitrogen fixing trees in combination with corn, is explained along with recommendations for specific techniques. Also, suggestions for increasing the use of native tree species in all sub-zones are made.

SECTION 1. REVIEW OF EXPERIENCES IN SOIL CONSERVATION AND AGROFORESTRY IN DEVELOPING COUNTRIES

A good review of soil conservation projects in Central America and the Caribbean is found in Lutz et al. (1994). They conclude that there is no clear methodology for evaluating losses in productivity and other negative environmental impacts of soil erosion. And they discuss difficulties of designing soil conservation projects which are really work. They review a number of case studies which conclude that expensive mechanical structures are unlikely to be profitable from a farmer's point of view and that conservation measures are more likely to be profitable when "cheap and simple". This is in accordance with the findings of other authors, including Garrity et al (1993), Fujisaka (1994), Seibert and Lassoie (1991) and Brennan (1991). The latter author found, while working in Thailand, that the cost of bench terracing was ten times that of establishing alley-cropping on contours with nitrogen-fixing trees and fruit trees. It is possible to notice in the development of one author's (Fujisaka) thinking, a tendency over the last five years to promote ever simpler techniques for soil conservation.

Yet another set of authors (White and Jickling, 1994) confirm that in Haiti mechanical measures were not adopted without external incentives and have generally not been maintained. They state that erosion control has been put into use when it results in thrift or economic gain, not when it merely saves soil. Techniques which have actually been used effectively come from a combination of indigenous knowledge and that of scientists. Without external incentives, the sorts of techniques which have spread usually "combine components familiar to peasants, are compatible with other agricultural and social activities, are simple and require low and nonfinancial installment costs, provide short-term economic returns, are adaptable to specific

site conditions, and can be adopted sequentially as farmer experience grows."

There does not seem to be a general consensus on (1) how to evaluate technically the effects of having or not having soil conservation practices in place or (2) how to judge the economic benefits of the practices. Two articles published about El Salvador by the World Bank in the same year and considering the same country, El Salvador, illustrate the range of thinking on this topic. One (Hernández, 1994) concludes that "reliable and conclusive results" on the effectiveness of different conservation measures have yet to be generated and that "without such information, economic evaluation of conservation measures is impossible." The other document (World Bank, 1994) estimates that the total economic cost to the country of El Salvador of not using conservation measures is \$5 million per year. The second article also contains tables estimating the net present value of three different soil conservation techniques, taking an average for each of four areas, as \$739/ha for live barriers with maize on 12-30% slopes, \$552/ha for live barriers plus ditches on 30-50% slopes, and \$219/ha for rock walls plus live barriers on slopes of greater than 50%.

SECTION 2. REVIEW OF FORESTRY AND SOIL CONSERVATION EFFORTS IN EL SALVADOR

1) "Reforestation" Projects.

The word "reforestation" is commonly used by foresters to refer to the establishment of tree plantations. Perhaps this word should be replaced, given that many environmentalists and members of the public feel that "reforestation" should mean the re-establishment of "natural" forests, and not refer to tree farms. But here tradition will be followed and "reforestation" refers to usually single-species plantations.

The ORE/MAG project, which concentrated on plantations on ex-haciendas, is described by Rodríguez (1989). Some 6,961 ha were planted between 1980 and 1985, on 126 haciendas. Most persons contacted had the same opinion of this activity - it was a "make work" project that accomplished little in terms of establishing tree cover or promoting reforestation in the long term. In fact, the ORE/MAG project may have served as a disincentive to long term reforestation projects. We visited two teak plantations near Cara Sucia which date from this period. They had not been maintained, would not be an inspiration for farmers to plant more trees, and furthermore the cooperative had been threatened with fines by the state for harvesting some trees on their own land.

At present the Fondo de Inversión Social (FIS) is gearing up for more than 2,000 hectares of reforestation in 1994. The consensus seems to be that its prospects are similar to those of the ORE/MAG project, since it appears that the goal is to provide jobs in the short term.

Since 1981 CATIE has been working in research and extension, first with the LENA project (1981-1986) which investigated the growth of more than one hundred species on thousands of sites in

Central America and then with MADELENA, which has promoted various agroforestry techniques. Their focus has been on fast-growing species for short term production of firewood and poles, rather than on producing fine timbers. The MADELENA approach has been to make a wide variety of options with multiple-use trees available to farmers, from the best that the gene pool of domesticated tropical trees has to offer.

Certainly, since El Salvador imports some 80% of the wood products it consumes, there is a market for timber and there would seem to be a place for plantations. But they have yet to become a major part of the landscape or the rural economy

2) Soil Conservation With Basic Grains.

In 1992, some 480,000 ha of El Salvador were planted in basic grains with probably more than half of this being on slopes. In 1981 58% of cereal production on 290,000 ha was on land with slopes over 12% (World Bank, 1994). Soil conservation efforts in the country are discussed by MAG (1992), Hernández et al. (1994) and the World Bank (1994). Forestry and agroforestry projects are reviewed by Reiche (1994).

2a) FAO Chaletenango-Cabañas

The FAO Chaletenango project was operating between 1980 and 1987 and is rather heavily criticized by MAG (1992) for not having a continued beneficial effect after the program was discontinued. The project was extended from 1987 to 1992 to Cabañas, Usulután and Morazán. There are various opinions concerning the value of these programs. According to the World Bank (1994) "farmers' interest waned once the intensive technical assistance and the special incentives provided during the project were removed." They conclude that this was so because there was an emphasis on soil conservation for its own sake, rather than on a cost/benefit basis and that conservation measures were taken in response to

pressure from extension services and the desire for incentives. But Ing Manuel Ponce of SEMA, who is familiar with the projects, believed that they were basically successful and that in many cases conservation techniques are still in place on the farms of the region (See section on talk with Manuel Ponce in meetings section, for his history of these projects)

2b) CEL-CATIE-MAG-USAID/Río Las Cañas

This project focuses on intensive use of incentives in a small watershed which is critical from the point of view of producing hydroelectric power. Farms are small, 0.5 to 4.0 manzanas, and close to San Salvador with its large markets, so these are really almost horticultural farms. Incentives provided are fertilizer, fruit trees, coffee plants, vetiver grass starts, and tree seedlings. Farms in the Río Las Cañas area feature physical conservation measures, especially drainage ditches, combined with live barriers of vetiver grass or pineapple and with Eucalyptus camaldulensis or Gliricidia sepium planted on the contour. Their hillside alley-cropping systems were just being established this year, and their success and adoption should be monitored. Also physical structures are constructed in creek beds and ditches, to slow down the movement of sediment.

The Río Las Cañas project has invested heavily in what seems like soil conservation "overkill" in an area where the country as a whole has a vested interest in preventing the silting in of a key river. At the very least, this project has established demonstration areas close to San Salvador where the major techniques used in agroforestry and hillside soil conservation can be observed and evaluated. Whether the measures now in place will actually continue to be maintained once incentives are terminated remains to be seen (See CEL-CATIE-MAG-USAID, 1993, meeting notes from field day at Río Las Cañas.)

2c) CENTA-Guaymango

The World Bank (1994) presents the CENTA-Guaymango experience as the only successful large-scale promotion of soil conservation measures in basic grains cultivation in El Salvador. Now, after 20 years of intensive extension efforts, there are some 10,000 ha under the improved system which CENTA developed. Technologies include: maintenance of crop residues for soil cover, minimum cultivation, contour planting, use of hybrid seed, and use of a package of chemical fertilizers, insecticides and herbicides. The World Bank suggests that the technology could be improved by the adding live barriers for erosion control, but that there would be conflicts with the current heavy emphasis on large amounts of herbicides.

Rather than describing the Guaymango system as a soil conservation technology, it would perhaps be more accurate to describe it as a combined "green revolution"/ conversion-to-commercial-farming system which is partially replacing traditional subsistence (low input/low output) grain production. The main soil conservation features are eliminating plowing - something that was generally not done anyway by poor farmers - and the conservation of plant residues, which can be somewhat effective in reducing erosion. Burning has been discouraged. It is difficult to encounter anyone who says that he burns or agrees that burning is a good technique to use and yet during the dry season fire is commonly seen.

In our visits to the Demonstration Area, we found that the Guaymango technology seems to be generally used. This needs to be substantiated as the project contacts more farmers in the zone. Apparently most farmers buy hybrid seed, usually H-5, use two sacks (100 kg) each of 16-20-0 and ammonium sulfate, and apply Gramaxone two or three times per year. These methods yield from 10 to 60 quintales (46 kg) per hectare per year in the DA, with the lower yields being found on steep hillsides near El

Impossible and the higher yields coming from more level fields at lower elevations. The Guaymango technology produces more corn and millet with more inputs, at least in the short term. However, it does not appear to be a sustainable system, may have negative environmental impacts and apparently - at least in the case of cooperatives in the DA - is not profitable.

SECTION 3. NOTES ON FIELD TRIPS AND MEETINGS

7-26-94 office visit with Ing Modesto Juárez, Erik Streed, Tom Gardiner. Madeleña/CATIE, San Salvador.

Contact: Ing Modesto Juárez, MADELENA-3
1a calle pte y 61 Av. norte, Edificio Bukele, San Salvador
Tel 23-8224, FAX 98-3282.

MADELENA has a network it works with, and has agreements with the following organizations - CENTA, DGRN, CEC, DJC, ISTA (FIS)

MADELENA also provides support to CRS, CARE, WORLD VISION, PRODAP, Prochalate.

MADELENA has test plots, demonstration plots and provenance trials throughout the country, in association with network organizations

They support communal nurseries which have the following features 1) participation of community members 2) they make the community aware of environmental problems and 3) give a sense of ownership of nurseries and trees to the community.

MADELENA works with PROSEFOR, the CATIE-DANIDA seed project in Central America. Seed bank in El Salvador is at km 32 5 on the highway to Santa Ana.

MADELENA has 21 seed stands in El Salvador Seed production is a problem, last year greater demand than supply for reforestation seed.

Their extension approach is: take farmers along with extensionists to several sites during a field day

- 1) a demonstration farm with a number of options on it, of which farmers may choose to adopt one or more, and
- 2) to test plots of plantation species, where they can see the behavior of well-managed trees

MADELENA has nine demonstration farms in the country the MADELENA office has a document with detailed information on demonstration farms with maps, drawings, data

Species MADELENA works with. Teca, Eucalyptus camaldulensis, E. citriodora, melina, flor amarilla, Acacia mangium, Leucaena, madrecacao

Some systems they work with trees in borders around the farm, single lines of trees, cercos vivos, trees on edges of fields, plantations. The products they are oriented to producing are roundwood (poles and posts) and firewood, which are what rural populations generally need

In plantations. MADELENA promotes thinning by showing thinned vs. unthinned plots, and the dramatic effect on growth rings They also work with managing coppice growth in teak, thinning at four years for firewood and roundwood, clear cutting at 6-7 years.

Utilization of teak: according to Modesto trees with diameters as small as 3 cm are utilized Calderón-Sol uses small pieces in his teak furniture business

MADELENA has 3 data bases in its MIRA system MIRASILV (silvicultural information), MIRASE (socio-economic), MIRAEXT (extension) They have information on extension activities accomplished MADELENA sponsored a workshop on incentives (1989) They have folders, booklets, posters, videos, an array of useful materials containing technical information for agronomists, foresters and farmers

August 12, 1994

All-day field trip with D Nichols, Erik Streed, Ing. Modesto Juárez of MADELENA and Ing. Faustino Portillo of CENTA-Izalco. Modesto has one assistant. Modesto is the CATIE representative for the country, in addition to being the leader of MADELENA

Site Visits:

Santa Teresa-Armenia - some of MADELENA's oldest planted tree stands in the country. They were originally established as provenance tests of E. camaldulensis, A mangium, now being managed as a demonstration and long-term growth measurement plots, and as seed production stands, planted 1988. A mangium is now about 18 meters tall. Also the farmer's own stand of Teak planted 15 yrs ago at 2x2 meters and not managed a classic example of a farmer who is not convinced that thinning makes sense.

San Juan Opico plots are planted with Neem, agroforestry in conjunction with integrated pest management, with GTZ Faustino Portillo has a recipe for "gramoxone botánica" that involves 1 liter gramoxone per 4 liters water/manzana, in contrast with the normal dose which uses 3-4 liters of gramoxone per manzana mixed with neem seed and madrecacao leaves. They try to use para-técnicos, farmers from the vicinity to give demonstrations

Faustino's supervisor is in Sonsonate/CENTA, Ing. Miguel A. Martínez Ing. Portillo has nursery at CENTA Izalco, wants to give trees to PROMESA, and to work together on demonstration areas. Apparently CENTA has demonstration plots already active in the DA.

Plots of madrecacao, planted 1992, near San Juan Opico, were

going to be in alley-cropping but farmer chose to leave as small firewood producing forest Madrecacao is fairly drought-resistant, seeds can be safely planted in ground until end of September. For alleys they recommend that Leucaena have one pruning the first year, and 3 per year afterward, for madrecacao one the first year and 3 or 4 per year in following years

E. citriodora tends to be a little straighter from original planting of seedlings (than E. camaldulensis) but grows more slowly and resprouts poorly

When purchasing seeds, PROMESA should coordinate either with Modesto or directly with the seed bank at CATIE (Mario Alvarez, 556-64-31)

There is large stand (40 manzanas) of A. mangium and E. camaldulensis in Zaragoza, on the road to the international airport, owner Guillermo Mason.

La Red (the MADELENA network) consists of DGRNR-MADELENA-CENTACEL-ISTA-DJC-CARE

Modesto thinks it is very important to consider the needs of farmers, whatever they may be, for firewood or timber. Projects should be oriented toward meeting those needs and not to imposing a preconceived agenda

Modesto's rule of thumb for thinning teak at a height of 9 meters, first thinning (50%) should take place, at 13 m take out another (50%), leave for final harvest 200-250 trees/ha at 20 yrs. Another design is to thin at 6, 12, and 16 yrs (50% each time), with final harvest at 20 yrs. For management of sprouts, cut trees at 10 cm height above ground level

1984 MADELENA tree test plots in Candelaria de la Frontera - E

camaldulensis, melina, quebracho (Lysiloma divaricatum, Leguminosae) Cassia siamea, madre cacao, Melia azedarach ("paraíso") Melina is not well liked because it produces a lot of shade, poor firewood, but may be used more for artesanía as supplies of pine dwindle

Modesto has serious doubts about root trainers (as used in the FUPAD project), mainly that seedlings in the containers are too small and cannot compete with aggressive brush/grass when outplanted.

The MADELENA demonstration farm, above Candelaria de la Frontera, is at 930 meters elevation - 3 separate farms with a total of 5 manzanas MADELENA has detailed information on this farm and on all of their demonstration farms, including socio-economic data The farm is managed by Eliberto, his wife and son, with a bit of contracted assistance. Woodlot next to farmhouse was planted in 1987 with E. camaldulensis. Farmhouse has a beam from a 6 year-old Eucalyptus Original stand was cut at four years, now three- year-old sprouts are about 10 meters tall The farmer uses Eucalyptus for firewood, roundwood, stakes (tutores) for tomato plants; the farmer and his wife seem generally very pleased with the species.

MADELENA (USAID funded) is due to end in mid-1995, no support from Finnish because of human rights violations by government of El Salvador. If MADELENA were to continue it would work with species like cortez, laurel (natural regeneration) marillo, volador, conacaste, cedro (30 yrs). They are now starting to bring in seed of pochote (Bombacopsis quinatum) from Costa Rica, to test the species in El Salvador

Río Las Cañas

July 27 Field trip with CEL/Río Las Cañas employees

Contact Ing Luis Alberto Campos, Director Proyecto Río Las Cañas Tel. 28-1022. Home Tel 74-2292.

Acequias - ditches approximately 30 cm deep on the contours - are promoted by the project They are at variable distances, usually 6 or 12 meters apart They estimate that 42 person days are needed to build 350 meters of ditches, or those needed for one manzana First stop was with a renter, Jose Antonio Pérez. Conservation measures were constructed in the dry season when there is little else to do, planted in 1994. Vetiver grass is given away in reds which consist of 6 sacks, in total containing 3,000 stolons, for a cost of C50. Vetiver grass is planted at a density of 6 per linear meter, so 3,000 plants, C50's worth, are sufficient for 375 meters.

On this farm madrecacao was planted directly from seed from the DGRNR seed bank, using 3 lbs of seed per hectare, planted in double lines, 30 cm within and between lines, 6 meters between lines For slumps they planted guinea, squashes Corn is planted in May, madrecacao shortly thereafter - seedlings were about 30cm tall in 2m tall corn Pollarding plan is 3 per year, in May, July and September Every four meters one madrecacao 2 m high is left for firewood Shade is provided over dry season by madrecacao plants.

Widely spaced and high pruned pines. Don Antonio saw no problem with competition with corn for light or water

Second farm visit with Mauricio - traps for torrentes CEL pays for placing of rocks and screens to keep sediment out, cost C500 per m3. Live bamboo is also planted in creeks to hold back sedimentation

Incentives are fertilizer four sacks total, two of 16-20-00 and two of 21-0-0, which is what is needed for one manzana of corn, for 350 meters of acequias (drainage ditches on contours).

Project technicians claim that residents of zone are adopting measures without incentives now.

E. camaldulensis best for zone Ingas seen on nearly all farms
Flor amarilla popular for firewood.

Río Las Cañas project used microcuenas (small watersheds) and complejos (complexes of several neighboring farms) to aim for a multiplier effect, range in farm size is 0.5-4 0 manzanas
Individual terraces are used with fruit trees E camaldulensis is planted on contours with acequias and vetiver grass on uphill side, trees on downhill side, absorbing water. Project personnel claim that trees planted every 12 meters will continue to be seen as compatible with crops, as trees get larger. Lessened runoff means crops and grasses have more moisture and nutrients - better yields can be expected where there are acequias CEL and other associated institutions provide seeds and seedlings. Ing. Campos worked for MADELENA in the early 1980's, established many of their species and provenance test plantings; he knows the location of good seed stands in the country

Río Las Cañas project has had a small budget, from C20,000 in 1991 to C124,000 in 1994, according to Ing Campos 7,500 ha are in the watershed, of those about 700 ha or 1,000 manzanas have conservation measures planted. The accomplishments of the project from 1991 to 1993 are listed in CEL (1994) and include 66,631 meters of construction of absorption ditches, the planting of 141,000 trees and the promotion of the project to 720 agricultural families The project plans to eliminate incentives slowly CEL employees with this project felt their jobs were on the verge of being eliminated

Cooperatives: Demonstration Area

July 28 DA. CLUSA (Cooperative League of the United States of America) with Ing José Miranda, D. Nichols, T Gardiner, E. Streed

Contact: Ing José Miranda, CLUSA, Avenida Las Acacias 130, San Benito, San Salvador. Tel. 98-2765, 98-2806. FAX 98-3476

Projected FIS reforestation projects are Cooperativa Cara Sucia 80 manzanas, Nueva Guayapa 50 manzanas, La Union 78 manzanas, for 1995. Three species to be used are E camaldulensis, Cassia siamea, and teak FIS pays only for first year of project. Management and selection of species is apparently under the direction of consultants from AGROFOR. (Efforts to contact this consulting company in San Salvador were unsuccessful) One of the problems with FIS reforestation programs is that the private consultants preparing plans are inadequately prepared technically

Cooperativa Nueva York is looking for a source of neem seed Reforestation projects through FIS are planned for land adjacent to two lakes - Pimiental (20 manzanas to be planted) and Gamboa (30 manzanas) The cooperative was fined for cutting teak 15 yrs old, not managed. The cooperative's understanding is that trees belong to the state but the land is owned by the cooperative It appears that they were fined illegally, since it is completely legal to harvest plantation trees, using a management plan. Lake Gamboa borders on private property - landowner's name is Castillo Parceleros - the cooperative members farming along the edges of the lakes - are to be relocated. Cooperativa Cara Sucia - has a nursery with mano de león, cenizaro, membré, Leucaena, madrecaao, for live fences. very dry, Cerro Escondido is an area of 30 manzanas, badly compacted

and degraded, where one of their reforestation projects will take place in 1995

La Union - calle de los asaltantes - very degraded looking land where FIS reforestation to go, not particularly steep but dry and with heavy soils. We briefly attended a meeting in La Unión - tierra terminado, degraded land is how they describe some of their land. Coop members are assigned plots for basic grains on a year-to-year basis, a practice that discourages establishing soil conservation measures. Land is owned by the cooperative collectively, not by individuals.

July 29 With Cooperativa Nueva Guayapa, Ing Juan Francisco Avalos A. Tel 30-93-41

Observed trees along irrigation canals. Leucaena dies at 5 yrs, according to some coop members, although it was not explained why. They have about 5 manzanas along field edges and irrigation canals planted in trees, mainly Leucaena.

Nueva Guayapa "Forestry garden", about 33 species planted in 1993 and 94, usually 2 rows of each, including quebracho blanco, conacaste blanco y negro (sawdust of these two is toxic to fish), cenizaro, mangoyano with spines (sprouts well), cortez negro, tihuilote, cortez blanco, cedro, caoba, iguano, madrecacao, Eucalyptus camaldulensis, copinol, melina, leucaena, quisquin, maria (marillo), maquilishuat, cerezo, chaquirio o cachiro para madera rolliza (poles and posts), flor de africa, carao tecomasuche (Cochlospermum vitifolium), árbol del fuego, neem, paraíso, ojuste (Brosimum), laurel negro (larva attacking shoots), bálsamo. Ing Avalos would like to have a small building with a library at the forest garden site, and use the site for environmental education

Cooperativa Nueva Guayapa has 45 manzanas of badly degraded land,

primarily in brush and pasture, on the Carreterra Litoral Juan Francisco Avalos does not think standard plantation forestry is appropriate for this site, i e , cutting back native vegetation to establish exotics He says most trees on site sprout and these are resistant to damage from grazing animals Wants to go in after one or two years of regeneration and plant trees in open areas. Cooperative has a small nursery in shade with melina, leucaena, madrecaao -

much of Gliricidia sepium in Guayapa and Cara Sucia from Ingenio in Sonsonate, which apparently produced seedlings in their nursery and transported them to the site.

Firewood in whole area comes from manglares (mangrove swamps). Pastures were observed in areas formerly occupied by mangroves - a strip approximately 200 meters x 15 km has been cleared Crops grown by Cooperativa Nueva Guayapa include melons, vigna, marigold, maiz, jalapeño Corn seed production is declining, cannot compete with other producers, given the cooperative's low labor efficiency

SALVANATURA Nursery

SALVANATURA nursery at San Francisco Menéndez - 8 employees, first year 1994 Goal is to produce about 5,000 trees of each of 21 species Under shade of conocaste and volador, there are seedlings of mulo, tempisque, ojuste, copinol, volador, nispero, jocote jobo, tizón, marillo in bags, some in standard 8 x 20 cm bags and others in 30 x 12 cm (large) bags One worker can only carry 4 trees to planting site, in the large bags Establishing plantations will be very labor intensive Forest guards collect seeds.

San Carlos Nursery

Silbergio Martínez Ramoz, nurseryman at San Carlos, cooperative member of San Carlos, grows corn and millet He lives in Morro de Abajo, earns C1,000/month as nursery manager

San Carlos (east of the DA) Roottrainers from Canada are being used to produce *Leucaena*, Cassia siamea, madrecaao. 300 seedlings are found in one bandeja, nursery has 348 bandejas or 104,400 seedlings for first year Each lot weights about 25 lbs, 20 cm deep, 2.5cm wide x 3cm, 5 in a set (300 seedlings) Nursery is about 11 meters long. Two 2 soil mixes, one richer with gallinaza, carbón, rice hulls and tierra negra were used He reports lots of trouble with damping off, so switched to a lighter mix with tierra blanca, sandier soil They did not fumigate soil before planting, but when they observed damping off used Manlate, Benlate or Manzate, every 3 days Trees are under plastic and screening, watered with hoses Are seedlings too small for outplanting? Apparently seedlings are to be planted with a digging stick, which loosens up very small volume of soil Transplant shock from going directly from fairly heavy shade to sun may be a serious problem with these seedlings Tops and roots appear to be underdeveloped for seedlings about to be planted in a difficult environment Soil mass not entirely filled by roots when taken from nursery. Some outplanting has already been done, was stopped temporarily by drought.

San Carlos-Jujutla-Guaymango

August 1 With Tom Gardiner in San Carlos, just west of DA Plastic cover stolen the night before, removed from above root trainers, from FUDAP nursery Silbergio Martínez, nursery manager, and a neighboring farmer spent morning with D Nichols and T. Gardiner. Cooperative members are given parcels to work for a few years. Silbergio plants maize, hybrid H-5, with 2 sacks 16-20-0-14 (Formula) and 2 of ammonium sulfate. Fertilizer is applied at planting and at 35 days May get 30 quintales/mzna this year, but in a good year 60 Up in the hills 10-12 quintales/manzana is more common Agronomists from the bank provide technical assistance. Gramoxone is applied 2 or 3 times, before planting, as corn emerging, later on, with care One person works about 3 manzanas (21,000m² or 2.1 ha) this way. Beans don't seem to work here, just above the coastal plain,

according to Silbergio.

FIS project is planting *Leucaena* at 2 x 2 m in degraded pastures. What are pHs here? Why did they choose this species?

Catholic Relief Services has been active in La Unión area, have passed out small folder with drawings; they are donating pineapple, izote, and pigeon pea and encouraging soil conservation measures.

Cooperative San Carlos has C1.5 million debt for 668 ha, 81 members. An individual would have to acquire mortgage to buy a piece of land for himself. Much of DA seems to be in Cooperatively-owned lands.

Pasto de corte - a private farmer, fattening cattle from Costa Rica to go to Mexico, along Guaymango road. The DA seems to have a number of independent cattle ranches

Near Platanares Manuel Mejilla has a small plantation of madrecacao at 2 x 2 m, planted for forage and firewood.

Some native species in small lots - conacaste negro, iguano - are planted along the San Carlos road. Management consists of taking out trees with poor form and leaving the rest for timber production. Need to locate landowners and talk to them.

Jujutla - 520 m elevation. Guaymango mayor is Armando Vallejos Aquirre. he sees primary needs as electricity, potable water, cholera prevention, wants trees to plant. He added that security situation is "grave".

Enrique Fuentes-San Francisco Menéndez-Cara Sucia

August 2 - with Enrique Fuentes of SALVANATURA, D. Nichols, T Gardiner. Enrique has a map of actual uses of land around San Miguelito (some forest left around this community). Houses generally do not have bathrooms

Cooperativa Cortijo - teca had just been cut at the time of our visit. They sell a tree for around C70, have 40 manzanas of teak. They also have small citrus orchards

Visit with Jorge Sanabria, mayor of Cara Sucia and San Francisco de Menendez He is on the Directiva de la Escuela, working on getting garbage truck for Cara Sucia, wants to have garbage dump in town He is owner of and can be found at Farmacia Santa Fe in Cara Sucia

San Benito-Parque Nacional El Imposible

Trip to Demonstration Area, Erik Streed and Doland Nichols
August 7-9.

August 7 Visit to farm of Paulino Marroquin in San Miguelito, near boundary of park He owns his farm (7 manzanas), has been there 26 years. He earned C11,000 from selling wood last year. Don Paulino has his own small chainsaw, cuts boards on his farm, negotiates prices and transportation in San Salvador Species which he manages. ron-ron, caoba, cedro real, nispero, cortex blanco, pochote, laurel, conocaste. copalchi Many of these trees seem to be growing well above coffee, benefiting from fertilizer given to plantation 60+ families are in the area, he knows them well, would be an ideal farmer/extensionist.

Paulino pointed out that the area is not particularly suitable for coffee, being at the lower marginal of the range appropriate for coffee and having long and somewhat unpredictable dry periods

August 8 with Guardaparque Francisco Pérez ("Paco"), D Nichols, E. Streed

There is a breakoff in land uses at El Refugio, from there down to the south, milpas for subsistence and some income are planted From there up it is mainly forest, small plots, mixed

timber/firewood/fruit trees over semi-abandoned coffee. It is common to leave trees, especially laurel, and prune their lower branches, as at Francisco's farm. He thinks barreras vivas take away space where crops can be grown

Few sources of money are to be found above El Refugio - work as a park guard or sell timber

Jorge Alberto Morina - FUCRIDES promotor around Jujutla, lives in San Miguelito. His job around Jujutla involves meeting with farmers. He and his four brothers own 25 manzanas, in 3 pieces. He is enthusiastic about trying demonstration on a small scale on their farms. He is at home on weekends.

FUCRIDES promotes minimal use of herbicides, especially trying to lessen use of "Gesaprin" They make low-interest loans to farmers. Their recommendation for Gramoxon is 50cm/4 gallons before planting corn and no more over the course of the season - not the 2-3 applications which are normal

Entrance to Molina's farms: Profamilia sign, at yellow church entrance turn right when going up to El Imposible, about 500 meters before park entrance

Cooperativa Cortijo

Visit August 9, D Nichols, Erik Streed Contact Board of cooperative meets every Friday at 1 pm.

TechnoServe Lic Rene Rodríguez.

75 manzanas of teak being exploited (51.7 ha), of 1321 6 ha (1,890 mnzas) in total cooperative, 472 hectares in maize, maicillo and 330.8 in pasture There are 221 members, most of land managed as cooperative holdings but individuals given temporarily - plots of 20 tareas. Coop began in 1982, teak planted then.

They seem interested in working on the protection of riparian zones along Río Aguachapio and Río Izcanal

TechnoServe has been there eight months Lic. René Rodríguez is their representative. They are promoting the use of barreras vivas beginning this year, also the use of cercos vivos for firewood. Using madrecacao and izote. The cooperative picked 12 lbs of madrecacao seed locally, say that if bought it cost be C35/kilo They claim that no FIS financing is available to help, doing all their reforestation work with their own funds, or with loans from the bank at an interest rate of 16%

Cortijo has 50 ha of teak standing and they are planting 10,000 seedlings from bags this year (about 9 ha) Original planting from 1982, at cooperative establishment, from seudoestacas (raices), called "stumps" in English. Cortijo sell whole logs, average tree 8" diameters, 2 or 3 logs of about 3 meters each per tree They receive C35 per log or about C100 per tree X 500 per ha = C50,000 ha at 12 years or \$5692/ha or \$473/ha/yr, compares favorably with corn.

Teak is all being sold and used as roundwood, mainly in beach houses. values of el pilar 8-9" C8; vigna 6-7 5" C7, 5-6" - C6. Costanera 2.5-3 5" - C5 They are harvesting about 500-600 trees/ha.

They have a problem in marketing, claiming there is little demand for teak (???) and a greater demand for local species Calderon Sol exports teak in log form. There are apparently three teak factories in the country, including the ones at La Libertad and Izalco

Cortijo is experimenting with small plantings of laurel, maquilishuat, Leucaena

Julio Olano-DGRNR

August 11 Julio Olano, D Nichols, PROMESA office

Contact: Ing Julio Olano
Dirección General de Recursos Naturales Renovables
Servicio Forestal y de Fauna
Apartado Postal 2265, Cantón El Matazano, Soyapango
Tel. 77-0622 FAX 77-0490.

Julio works with CATIE/DGRNR/PROSEFOR, and is the counterpart of MADELENA in DGRNR. He works with and generally favors the idea of viveros comunales, as in San Jacinto and Chaletenango. They are planning to have a workshop 13-14 of September, on seed production, to create better coordination between the demand and supply of forest tree seed.

The DGRNR seed bank does not sell certified seed. Madeleña does manage 21 stands where seed is produced, 5 species, E camaldulensis, E citriodora, A mangium, Leucaena leucocephala, Tectona grandis. Higher demand for seed this year than supply - country needed (for FIS cooperative projects) 2,600 ha worth of seed, but only had 2,000 ha of seed. Main lack is with TEAK and MADRECAO. One ha of E camaldulensis could supply whole country with seed. Julio is trying to coordinate actions of government, consumers and producers of seed. Teak seed goes for C30/kilo here, El Salvador prices generally lower than rest of CA. Teak in Nicaragua costs \$10/kilo.

Madeleña works with a network - PROCAFE, CEMA, DJC, CARE, DGRNR. (See visit to Madeleña)

Ing. Olano has maps about 3 years old, which show extent of mangroves, with SNR

FIS contracts persons to prepare plans - often not technically qualified persons Julio is proposing to ISTA a follow-up financing for FIS projects after first year

ISTA doesn't have foresters, nor understanding of situation of parcel holders. First step in establishing plots, double row of trees, one each on inside along plot edge.

Cooperatives under Nuevas Opciones will be giving parcels to individuals. Could try E. camaldulensis for madera rolliza (poles and posts) as alternative to mangroves

80% of wood used in the country is imported from outside, pines from Guatemala, Honduras, Nicaragua. Demand for wood: 1) Muebles Caprí 2) Molina 3) La Montaña Aserradora 4) Maderas Tropicales There is a lot of contraband timber Prices for one cedro real: C40,000; one conacaste 106 yrs old, C35,000 Brother of Calderón Sol planted 16 ha of cedro - it was lost to Hypsipyla.

Julio believes that extension needs to avoid paternalism, he doesn't agree with giving away trees. His communal nursery project was hurt by the presence of projects giving away trees. Madeleña gives out only seeds, bags, training and lends a few tools. Field persons should be local leaders or farmers, "estable y rentable". Sees loans and gifts of food as DISincentives.

He is aware of only one experiment with alley cropping in the country - Leucaena on flat land, abandoned by farmers after study With Leucaena his advice is to use the Salvadoreña variety, adapted to local soils. Can get Leucaena seed from CENTA, or better yet, collect in local plantations. Soils information is available from Ramón Garcia in soils department of DGRNR.

The forestry department in DGRNR has 14 persons in its central

office, 200 out in the country. These are the forestales assigned to enforce forestry laws. MADELEÑA has five persons in the DGRNR office in San Salvador, extensionist Luis Guillen, genetic improvement specialist Miguel Valle, nursery specialist Juan Salinas, and an agricultural economist. These are counterparts, MADELENA/DGRNR

Costs of reforestation: Julio Olano estimates \$800-1,200/ha
Costs of plants 20-25 centavos (\$0.018-0.022). Bolsas (bags) are 6 centavos.

FIS, San Salvador

August 11. Ing Jorge Muñoz, Técnico de Promoción y Evaluación de Proyectos. Fondo de Inversión Social (FIS) Office. With Nelson, Gunars, Sara G Tom Gardiner, Gunars Platais

Contact: Ing. Jorge Eduardo Muñoz V. FIS, Centro Roosevelt, Edificio A, 55 Avenida Sur. San Salvador Tel. 79-2922 FAX 79-1759.

FIS as a whole is spending some \$60 million. This year 2,2274 ha of reforestation in 85 projects are being administered by FIS. He admits that technicians who write projects are not always adequately trained. About \$2 million is being spent of reforestation projects in 1994. Cooperatives have to put up guarantee that they will take care of the plantations. FIS projects are officially completed after one year. Ing. Muñoz agreed that there is a problem of continuity and follow-up of plantations. So there seems to be a general danger that these will be again be "make work/spend money" projects similar to ORE/MAG, and nothing will be accomplished in terms of advancing reforestation. Ing. Muñoz was quite open to the idea of collaboration with PROMESA and agreed to share reforestation plans for projects in the DA with Gunars Platais, so that cooperative efforts can be contemplated.

Manuel Ponce-SEMA, San Salvador

August 17, PROMESA office, with Ing Manuel Ponce of SEMA, and Tom Gardiner.

Ing. Ponce provided a brief history of reforestation/soil conservation efforts in El Salvador

1. Before 1980, GOES had two years of large "campaigns" to reforest hillsides, in 1977 and 1978, in Chaletenango. In each of those two years, approximately 2,000,000 trees were produced. At first trees were offered at 6 centavos each. When the nurseries were still completely stocked with trees in August, they decided to give trees away. Even then they could not get trees planted. The same thing happened again the second year.

2. In 1980 FAO began a new project, using a group of consultants. The first year in Chaletenango the project gave away food for planting trees. The conclusion was that this was a disincentive for reforestation and farmers were involved solely to receive the food. This strategy was not followed after the first year.

3. From the second to the fifth year a program giving subsidized credit to small farmers, training, and extension services was implemented. The focus was on using live barriers for soil conservation, made up of species of commercial value, i.e. pineapple, citrus trees, guinea. He has doubts about the acceptability of a system using madrecacao incorporated with basic grains, in that the trees take up space which could be occupied by crops. He also found that the taungya system, in which crops are grown for several years between rows of trees as a plantation was established, was not appropriate for the region. The system emphasized the use of demonstration plots and working with leaders in communities. Loans at low interest rates were

small, averaging \$120 per farm per year, and were targeted at buying seeds and fertilizers. Ing. Ponce said that 85% of the loans were paid back

4. FAO extended the project from 1987 to 1992 to the departments of Cabañas, Morazán and Usulután. Ing. Ponce thinks that these programs were basically successful, arguing that soil conservation practices promoted by them can still be seen on the landscape where the projects were active. He is a firm believer in technical assistance and extension as the basis for implementing changes and is equally firm in not supporting food-for-soil-conservation or other "gifts".

TechnoServe, San Salvador

August 18, 1994 Meeting in TechnoServe with Tom Gardiner, Erik Streed, Doland Nichols and Napoleón Puente.

Contact. Ing. Napoleón A. Puente, Asesor de proyectos, 81 Avenida Norte y 11 Calle Poniente 4216, San Salvador. Tel 79-3577, 79-3700 FAX 98-5141.

TechnoServe has only been in DA about six months, working with Cooperative Cortijo, not with any other organizations in the DA. They are providing administrative capacity to the cooperative, helping them with administration, organization, accounting, etc. Technically they are helping with the planting of 10 ha of teak this year and encouraging the planting of pineapple and lemon grass on contours for soil conservation. He claimed that maize is generally not profitable in the country, at least on cooperative-owned land, but that it is profitable for Cooperativa Cortijo, since they have very low costs, and their members work hard. Some cooperatives are not interested in receiving the assistance of TechnoServe, since one of TechnoServe's objectives is to clarify for all members of a group how money is being managed, and obviously cooperatives with corrupt management want

to keep their members misinformed.

TechnoServe appears to be doing valuable work with Cooperativa Cortijo. PROMESA should work with the cooperative in teak management, encouragement of soil conservation in maize, riparian protection, and coordinate its activities with TechnoServe Perhaps PROMESA could help other cooperatives in the DA work with TechnoServe

Addresses and Phone Numbers:

Ing. Juan Francisco Avalos A Cooperativa Nueva Guayapa
Tel. 30-93-41.

Ing. Luis Alberto Campos, Director Proyecto Río Las Cañas
Tel. 28-1022 Home Tel 74-2292

Ing Modesto Juárez, MADELENA-3
1a. calle pte. y 61 Av. norte, Edificio Bukele, San Salvador
Tel 23-8224, FAX 98-3282

Joe Kyle, Peace Corps, Blvd del Hipódromo, Colonia San Benito,
Pasaje No 10, Casa No 110, San Salvador Telephone 23-7582 or
98-3337. FAX 79-3066

Paulino Marroquin in San Miguelito, near entrance to El
Imposible.

Jorge Alberto Morina, farmer and FUCRIDES extensionist, lives in
San Miguelito.

Ing Jorge Eduardo Muñoz V. FIS, Centro Roosevelt, Edificio A, 55
Avenida Sur San Salvador. Tel. 79-2922. FAX 79-1759.

Ing. Julio Olano, Dirección General de Recursos Naturales
Renovables, Servicio Forestal y de Fauna, Apartado Postal 2265,

Cantón El Matazano, Soyapango

Tel. 77-0622 FAX 77-0490

Guardaparque Francisco Pérez, "Paco", El Imposible

Ing Napoleón A. Puente, Asesor de proyectos, and Lic Rene Rodríguez (works with Cooperative Cortijo), 81 Avenida Norte y 11 Calle Poniente 4216, San Salvador. Tel 79-3577, 79-3700 FAX 98-5141

José Sanabria, Mayor of Cara Sucia, San Francisco Menendez, Farmacia Santa Fe in Cara Sucia

Armando Vallejos Aquirre, Mayor of Jujutla.

**SECTION 4. CONDITIONS IN DEMONSTRATION AREA
AND TECHNICAL RECOMMENDATIONS * (specific recommendations)**

General Comments

1) COOPERATIVES

Much of the lower and middle-elevation land in the DA is presently under the control of several cooperatives, including Nueva Guayapa, Nueva York, Cara Sucia, San Alfonso de MiraMar and Cortijo.

Certain generalizations can be made about how the cooperatives allot land to their members for personal farming, especially for growing corn and millet. Each member is temporarily assigned a area of 1-2 manzanas for his own use. He grows corn for 3 or 4 years, until the land is "tired", at which time the plot is used by the cooperative for grazing cattle, which often increases compaction but may allow for a recovery of organic matter in the surface soils. The advantage to the farmer is that the land is rent-free. If he were to buy it he would have to take on a mortgage. Therefore, there is little incentive for an individual to invest in technologies that will improve the use of a given piece of ground over the long run, since he does not own it and is not likely ever to do so.

Given that the management of these cooperatives can change frequently and that the status of the land - whether or not it will continue to be collectively managed or will be turned into individually-owned farms - is up in the air, it is advised that major investments in work with the cooperatives be made with caution.

Cooperative Nueva Guayapa seems to be the most advanced, in terms of administrative abilities and infrastructure, but it is not clear who will be running this cooperative even a year from now.

Cooperative Cortijo seems to be the best with which to do some preliminary work, with an advisory council of farmers who apparently are interested in improving the management of their lands. Visits were not made to Cooperative San Alfonso but it has hilly land where technical assistance is needed and possibilities for working with them should be explored.

2) SELECTING SITES

In choosing farmers with whom to work in the DA it is suggested that the following characteristics be considered

1) The stability and reliability of the farm as a site for demonstration plots. Obviously the cooperatives present a number of unstable situations. The small, stable farm with a single owner is the exception in the DA, although they do exist.

2) The interest, enthusiasm and desire of individual farmers to experiment with new agricultural practices. This is something which has to be judged on the basis of a farmer's local reputation and with one's intuition.

3) The degree to which suggested techniques may improve the farm in a year or two. With all other factors being equal, it would be better to invest in conservation farming in corn fields on steep slopes, rather than working on deep soils on moderate slopes. Often something that looks "nice", and is effective under optimal conditions, only ends up making the rich richer and avoiding the real problem sites.

4) The visibility and accessibility of farms. A group of farms directly north of the main highway and west of Cara Sucia may be a desirable site for the development of a complex of farms with various agroforestry/soil conservation components. It would be highly visible to both persons who live in the DA and those passing through.

3) Specific Recommendations for PROMESA Forestry Activities

* Coordinate forestry activities with Modesto Juárez of MADELENA, Julio Olano of DGRNR, and Luis Campos of CEL. These are three of the leading foresters in the country and among them have a tremendous store of knowledge of tree species and provenance trials, location of seed stands, and past and present efforts in plantation, agroforestry and soil conservation projects. If necessary and possible PROMESA should try to assure that they are all gainfully employed in the forestry sector.

* Any forest tree seed which is required by PROMESA or groups which the project is supporting should be acquired through Ingeniero Modesto Juárez of MADELENA. It is particularly important to be careful with seed sources of E. camaldulensis, Leucaena leucephala and Tectona grandis. Seed prices, number of seeds per kilo and number of plants which can be expected from a kilo of seed are found in DGRNR-MADELENA-3 (1994). So also are prices of seedlings in nurseries and of various types of lumber, according to species, and of chemicals used in agriculture.

* Attempt to develop positive working relationship with CENTA/Izalco and Faustino Portillo, who has offered PROMESA seedlings from his nursery for planting this year. According to Faustino, CENTA has a number of demonstration plots within the PROMESA DA, so becoming familiar with these plots, with the farmers to whom they belong, and with CENTA extensionists should be of high priority.

* Also the project should try to work with GTZ pest management project there, which is joining forces with persons giving away trees to develop less toxic pest control schemes, including the use of neem trees and herbicides systems which use 25% of standard amounts of Gramoxon.

* Maintain contact with FIS central office, and be aware of their activities in the DA, particularly in reforestation. It is generally not anticipated that their efforts - including some 200+ ha of reforestation planned for 1995 in or near the DA will be particularly successful - given the lack of serious technical preparation of projects and lack of financing after the first year. Apparently it will be another "make work" reforestation program, with the real objective to be giving out short-term jobs, rather than establishing plantations that actually function within the cooperative's productive activities. No specific suggestion is made here about how to work with FIS, but PROMESA may be able to play a role in helping the plantations be well managed in the future, if there is interest in such management

* Visit World Neighbors project in Honduras, to see corn combined with leguminous ground covers, evaluate potential for application on hillsides in the DA. Contacts. 1) World Neighbors, Honduras. 2) Cover Crops News (see bibliography) 3) David Leonard, Proyecto LUPE, Tegucigalpa, Honduras - Joe Kyle of Peace Corps-El Salvador has address 4) Gary Thompson, Programming and Training Officer, Peace Corps-Honduras. 32-8517, 32-8516 5) Dr. Martha Rosemeyer, University of Costa Rica, San José, telephone (506) 253-2658.

* Policy has an important aspect relevant to forestry activities in the DA. Often farmers are reluctant to plant trees because they associate them with a LOSS - of productive land in the short term, possibly of ownership of their land, or they believe that the government will not allow them to cut trees that they plant. According to most sources contacted, local forestry inspectors have personal and arbitrary interpretations of the forest law. Formulators of policy can assist the promotion of forestry and agroforestry by encouraging the establishment of a

clear, consistent forest law which permits the exploitation of planted trees and by supporting a systematic sharing of knowledge of the law with the public.

* Thoroughly investigate present geographic informational resources, including those held by DGRNR (through Ing Julio Olano), soils maps from Ramón García of DGRNR, and by SEMA, CENTA, and particularly the raw data used by SALVANATURA in preparing their 3-volume guide to the watershed, which was paid for by USAID. An expensive and time-consuming investment in GIS may not be necessary.

4) BEACHES-MANGROVE AREA

The mangroves are receiving pressure from both the beach and inland sides, mainly from persons cutting trees for firewood and roundwood (for posts, rafters, rough construction).

Our visit to the border of the mangroves with Cooperative Nueva Guayapa indicates that there is a long, narrow band of public land that was in mangroves which has been appropriated by several families to use as pasture and grow sugar cane. This land is now high and dry and probably not suitable for mangrove restoration.

* This strip, reportedly 200 meters wide by 15 kilometers long, would be the ideal location for the establishment of firewood forests ("bosques energéticos"), where persons arriving to cut mangroves would encounter an alternative source of wood.

Madrecacao (Gliricidia sepium) would be the logical choice for a tree species. There is also a strong demand for madera rolliza (roundwood, for poles and rafters) and for this purpose Eucalyptus camaldulensis would be optimal. But first of all, it would be necessary to define quite clearly where the boundaries of public land really are. Julio Olano of DGRNR says that he has

access to recent maps which define mangrove boundaries It would be worth investigating this possibility; otherwise GPS could be used to establish boundaries

Next it would be necessary to contact the persons actually using this land for pasture and sugar cane and attempt to work out an agreement so that these areas could be converted to firewood plantations. The actual nursery work and plantation establishment could be accomplished by the cooperatives bordering the mangroves.

* Beach communities could also be encouraged to plant trees which would serve as alternate sources of firewood. Perhaps one of the best choices would be Casuarina equisetifolia, a species that produces high quality firewood and also is capable of growing on sandy sites It has become an undesirable tree in some areas (Florida), because of its ability to invade beach areas, but the demand for firewood is so high in the DA that there seems to be little likelihood of this occurring in the D.A. This small-scale tree planting - which would provide each family with perhaps 50 trees - could perhaps be coordinated with AMAR.

5) COASTAL PLAIN

This zone is mostly flat and suitable for intensive agriculture It is under the management of various cooperatives, some of which are engaged in highly technical export-oriented agriculture, especially melon growing. Irrigation canals are lined with Leucaena and caoba. Nueva Guayapa has a small nursery and "forest garden" with more than thirty species planted Forestry uses need to be compared with the potentially high-yielding uses presented by mechanized agriculture. Probably only small areas in intensive uses - **tree seed production stands, demonstration plots** - can be committed on the high quality soils of the coastal plain

6) NUEVA GUAYAPA

* Encourage the expansion and development of the "forest garden" at Cooperativa Nueva Guayapa where more than thirty species have already been planted. This could include transporting a few seedlings of each of the native species being produced by the SALVANATURA nursery at San Francisco Menendez to Nueva Guayapa, and sharing seeds with the cooperative.

* Link up MADELEÑA with cooperatives Nueva Guayapa and Cortijo for training in establishment and management of seed stands, especially of teak and madrecacao. This could be a profitable activity for the cooperatives, given that nationally the demand for teak seed is higher than the supply and that various soil conservation projects need seed of madrecacao

7) Cara Sucia

Cara Sucia is the focus of many of the environmental problems of the zone. It is dominated by a polluted river, the borders of which function as a public garbage dump. Vegetation growing along stream sides could filter out toxic discharges from houses and farms, and could also function as a sediment trap for runoff entering the river. Naturally occurring forests provide these services but so can planted trees. The latter may be preferable to natural vegetation, since possibly there will be more respect given to planted trees or bushes than to weeds and young woody growth. If species that grow fast and are attractive are planted there is a greater likelihood that the area will quickly be recognized as a public protected area.

* PROMESA should sponsor the establishment of a riparian buffer strip in Cara Sucia. A 20 meter wide strip along the river could be planted in trees, if and when public disposal of garbage is provided for. PROMESA could provide seeds and bags to a local

nursery in Cara Sucia, perhaps with a youth group. This group should also be responsible for the maintenance of the trees. Species to use should be fast-growing and easy to establish.

Suggested species include:

1) Terminalia oblonga ("volador") a native species found along rivers in the zone. Seed can be collected locally in the dry season.

2) Gmelina arborea, which is extremely fast growing and capable of producing forest-like cover in less than a year.

3) some ornamentals, including Cassia siamea ("flor amarilla") and Calliandra calothyrsus

4) Eucalyptus camaldulensis, fast growing and attractive

* Similar riparian buffer strips can be planted along other streams, as the project identifies sources of water pollution and areas of unvegetated riparian borders. Cooperative Cortijo has expressed interest in planting trees along the Rivers Aguachapio and El Izcanal.

8) LOWER HILLSIDES

Nueva Guayapa has forty-five manzanas of degraded pasture on hillsides which they wish to regenerate. This area is located on the north side of the highway near the Cooperative's headquarters, just above the coastal plain. The pasture is representative of one of the major challenges facing tropical foresters how to recreate a productive (and/or biologically diverse) forest inexpensively and quickly. Juan Francisco Avalos of the cooperative is in charge of managing this reforestation/regeneration project and has explained his opinion

that the natural processes of regeneration should be employed rather than trying to fight back all grasses and brush that come up spontaneously in the site, in order to establish "exotics" He has suggested combining natural regeneration with a few planted trees. This is an opportunity to work in restoration/reforestation but at present the institutional stability is not secure - it is not clear that the Cooperative is willing to make a long-term commitment to a particular plan of action. One danger is that both this site and the "forest garden" at the Cooperative's headquarters are personal projects of Juan Francisco and that they will disappear if he is no longer manager

The lower hillsides are the zone of greatest potential for the development of agroforestry and forestry projects. This area is in large part managed by cooperatives, is in moderate to steep slopes and is in basic grains, a type of agriculture which provokes considerable loss of top soil and siltation of streams In the five departments of the northern highlands 80% of 123,000 ha under cultivation are used for basic grains, planted on land classified as class IV (USDA) or steeper (World Bank, 1994). Similarly, much of the sloping lands of Ahuachapán are in corn and beans.

If PROMESA wishes to implement soil conservation measures which actually become widespread components of agricultural systems in the DA, then it should work in a common sense, empirical, farmer-participatory manner with the local population to develop and promote such techniques (Fujisaka, 1989; Chambers et. al , 1989; Brennan, 1991; López and Pío, 1994) The general sorts of activities which could be developed include:

- 1) **Plantation forestry** Management needs to be improved where plantations are already established (mainly teak) The potential area under plantations could be greatly expanded. The FIS reforestation projects with cooperatives in the DA should be

monitored, with a view to helping make them successful in the long term

2) Alley-cropping/live barriers on contours in corn fields.

Since the fields are currently without individual owners (for the most part), it is difficult to see how tree planting for soil conservation can be demonstrated effectively

3) Management of natural regeneration in corn fields and coffee plantations.

Some farmers are currently leaving laurel (Cordia alliodora) which regenerates naturally, and other native species as well, in their fields. It may be that one of the greatest opportunities for agroforestry is in the planting of low densities - 50-100 trees/ha - in fields with annual crops or coffee. The trees can utilize fertilizers applied to crops and one day provide income, although on a supplemental scale, to farmers.

4) Soil protection and buildup of organic matter with leguminous ground covers

Specific recommendations for hillsides

* Sponsor MADELENA workshop for Cooperativa Cortijo on teak management, from seed collection through final harvest. MADELENA should help Cortijo identify what area of their present plantation can be managed as a seed-production stand, and offer guidelines on thinning of trees for maximum seed production. It needs to be made clear to MADELENA that the workshop is for farmers with little experience in forestry work, and not for technicians. Representatives from each of the other cooperatives in the area could be invited to the workshop. Currently, the Cooperative is clear-cutting 12-year old teak and selling it in log form for rafters for beach houses. It would be much more profitable for them to be thinning all of their teak plantation and selling the thinnings rather than to be clear cutting some areas and leaving others unmanaged.

TechnoServe is already working with Cooperative Cortijo and has compiled a breakdown of the actual uses of the 1321.6 ha managed by the 220 members of the cooperative.

* Cortijo might be one of the best places to do a Participatory Rural Appraisal exercise, with the leadership of the group and with community members. The end result would be an analysis of the group's problems, with an evaluation of how the land's actual and potential uses compare, and a management plan for the improvement of the cooperative's land use from both a productive and an environmental point of view.

* This cooperative may also be a good place to contract with an active member of the cooperative to promote PROMESA's goals, functioning as a liaison to the group. In general, I believe this approach is better, since such a person lives in the area and should have an interest in improving conditions in the DA

* On a typical hillside site (not on deep volcanic or alluvial soils on flat sites) establish small-scale demonstration/informal experimental alley-cropping and cover crop trials, at Cooperative Cortijo This should include:

1) Several rows of madrecacao should be established on the contour in hillside corn fields. Double and single lines should be tested, planting seeds at 30 cm x 30 cm. This can be done up until the end of September (see field trip notes from Río Las Cañas and with MADELENA. Mixed rows of "flor amarilla" (Cassia siamea) and Calliandra calothyrsus and possibly Leucaena leucephala should also be planted, to evaluate the use of these species for soil conservation and production of green manure Refer to species section for more details.

2) Planting of small (10 x 10 meter) plots of leguminous ground covers which may be effectively combined with corn for various purposes Mucuna pruriens should definitely be tried These small test plots can serve to investigate growth, demonstrate the species, and to produce seeds of species which appear to be promising. Coordinate with World Neighbors of Honduras

* Just to the east of Cara Sucia, there is a group of what appear to be small farms on hillsides, highly visible from the main highway There may be potential here to work with a complex of farms with a variety of soil conservation measures, in a manner similar to that of the Río Las Cañas project

* If it appears to be possible to have a stable working relationship with Cooperativa Nueva Guayapa, assist in the rehabilitation of the degraded pasture along the main highway near the cooperative's headquarters. Two technical suggestions follow:

1) The objective here is to regenerate a forest, not establish a fast-growing commercial plantation. Plant at 10 x 10 meters, seedlings of conacaste, Enterolobium cyclocarpum. Each tree becomes the focal point for forest development, attracting birds and mammals which disperse seed of this and other species.

2) Plant widely dispersed seedlings of Calliandra and/or Gliricidia sepium. This is a sort of enriched fallow in which forest regeneration could be somewhat accelerated.

In either case, seedlings would need protection from grazing cattle and horses, probably small fences around each seedling. It is important to keep track of the widely planted seedlings, controlling grass and brush competition. This project could be an interesting study for a local student interested in forest regeneration - plots with and without the suggested species could be replicated several times and the diversity and growth of emerging forest monitored.

10) NATIVE SPECIES

Little work has been done on the establishment of native tree species in the tropical areas of Latin America (Borja y Lasso, 1990, González et al , 1990; Nichols and González, 1992). Species which are found in the DA and some of their local uses are listed in Serrano et al., 1993. Since some 80% of the 250,000 m³ of saw timber used in El Salvador is imported, it would appear that more timber could be produced locally, most likely in combination with crops. Corn fields, coffee plantations, and pastures offer opportunities for the production of wood, even if trees are planted at low densities. In some areas species such as laurel (Cordia alliodora) are allowed to regenerate, with lower limbs being pruned to let sunlight reach crop plants. Also a variety of native species, many with high quality wood, are being managed in some coffee areas. Savanna-adapted trees such as cenícero (Albizia guachapele) and conacaste (Enterolobium cyclocarpum) could certainly be widely employed in pastures, even if at densities of 10 to 100/hectare

Fertilizers used and other cultural measures employed in agriculture can benefit both crops and timber trees. Farmers can learn from other farmers, who already manage trees how to prune, thin and harvest their trees. One impediment to the planting and maintenance of trees on farms is the idea that trees will belong to the state and landowners will not have permission to cut them. Progress in making the forest law clear to farmers will assist in stimulating them to incorporate trees into their farming systems. Another impediment to agroforestry is in the commercialization of timber: often truck drivers with chain saws arrive in rural areas and offer farmers low prices for their trees. Efforts to assist farmers in negotiating better prices and in adding value through, at least, producing boards or perhaps even furniture, should yield greater interest in on-farm forestry.

The demonstration area provides several interesting opportunities for formal or informal research on native species. Students should be encouraged to record data on nurseries such as SALVANATURA's in San Francisco Menéndez and on the performance of outplanted seedlings, and on management of trees with coffee near San Benito.

11) AREAS ADJACENT TO PARQUE EL IMPOSIBLE

Areas adjacent to the Park will be referred to as a "buffer zone" for purposes of discussion. In the San Benito area, this buffer zone consists of ex-hacienda coffee fields, with more or less continuous tree cover. Small lots are densely populated by families who have few sources of income locally. To call these lots "farms" would be inaccurate. Some of the local residents rent parcels of land farther down the road, below El Refugio, or have jobs outside of the area. Occasionally timber is sold. The coffee is poorly managed and very low yields. The zone is marginal for coffee production in any case, being between 600 and 700 meters elevation. A number of persons are employed by the park as guards, and they and their families are the "friends of the Parque El Imposible". But generally the local population sees the Park as a place where they could potentially establish corn fields, hunt and fish, collect firewood, etc., if it were not for the restrictions imposed from outside ("rich people from the city and their park").

Specific recommendations for buffer zone of Parque El Imposible

* Hold a workshop on management of high-value timber species combined with coffee. This should be done on the farm of Paulhino Marroquín in San Miguelito, if he is in agreement, and he should be the main presenter. Topics to be discussed: the shoot-borer in "caoba" and "cedro real" and how to evade it (by planting trees of the Meliaceae family at low densities; pruning

for provision of light to crops and formation of a straight, clean bole of timber-producing trees, native species and their characteristics; nursery and propagation techniques (in bags and direct seeding); criteria for deciding when to cut trees, problems of commercialization, mainly how the farmer can add value through the production of boards, negotiate reasonable prices for lumber and transportation to cities

* Develop demonstration plots on the farm of Jorge Alberto Molina in San Miguelito. He is a FUCRIDES extensionist and appears to be knowledgeable and enthusiastic about forestry/agroforestry/soil conservation. Techniques employed would be similar to those suggested for hillside corn fields in Cooperative Cortijo alley-cropping with madrecacao, Cassia siamea and Calliandra especially, established from seed and with pineapple, izote, and vetiver grass. He has already expressed interest in planting demonstration plots on the 25 manzanas owned by his family

* Consider the possibility of contracting with Jorge Alberto Molina as an extensionist for PROMESA in the San Miguelito area. He seems to be interested and motivated to improve farming systems in the area

Nursery at San Francisco Menendez. This Parque El Imposible nursery has eight employees and is producing seedlings of native species to be planted in brush fields within the park. There is potential for a research project here. If seedlings can be outplanted in a systematic way, the growth of a number of species which have never been tested before could be recorded

* PROMESA could act as a liaison between the nursery and various communities near the park, buying seedlings for small planting projects in San Francisco Menendez, Cara Sucia and for groups in other areas. Also, a few seedlings of each species could be

added to the "forest garden" plots at Cooperative Nueva Guayapa.

* The park nursery contains thousands of seedlings, many of which are planted in large bags. Carrying these to planting sites will involve large amounts of labor. Perhaps a youth group from the United States could be recruited to join in a tree planting project with the park. It would best if planting is done with park workers, visitors and local farmers and SALVANATURA. This would be a forest restoration project, as areas being planted inside the park are not for production, but are being truly reforested, with an emphasis on species which produce fruit for wildlife. Planting season is from the beginning of the rains through August.

* Sponsor a study by a student from SALVANATURA or an agronomy student to do a study on the native species being grown at San Francisco Menendez. Among data to collect would be:

- 1) Fruiting and seeding times of native species used by project
- 2) Weight of seeds.
- 3) Germination - percentage germination and over what period of time. This involves recording number of seedlings germinated at least twice a week until most of the seed has germinated.
- 4) Growth of seedlings in nursery - how long does it take to fill a standard 8 x 20 cm plastic bag with roots and develop a 30 cm tall tree?
- 5) Growth and mortality in field. Which species need partial shade when planted out?

SECTION 5.

AGROFORESTRY/FORESTRY SPECIES AND SYSTEMS FOR THE PROMESA PROJECT.

The project will have a greater chance of success if new species, seeds, seedlings and suggestions about systems are not offered as non-negotiable "packages", but are given to farmers that then use these new ideas or species to collaborate in developing technologies that truly meet their needs.

Nursery techniques are well explained in Spanish in ARBOFILA (1989), AGUADEFOR (1989) and CARE (1991)

Criteria for selecting species

MADELENA and other forestry research/extension projects have considered that multiple-use trees chosen for planting on farms should have a number of key characteristics

- 1) that they grow rapidly, with fairly short rotation lengths
- 2) that they produce products that are actually in demand by farmers, which in El Salvador means mainly firewood and roundwood
- 3) that they sprout, so a second or even third rotation can be managed without planting trees more than once.
- 4) that their crowns naturally tend to be high and relatively thin, and therefore block little sunlight needed by crops.
- 5) that they be fairly easy to propagate in nurseries and to establish and maintain in plantations.

Given the considerations outlined above, the following species could be appropriate for the D.A.

Species

Madrecacao

Gliricidia sepium, Papilionoideae, Leguminosae

Madrecacao is one of the most versatile and widely-used agroforestry species in the humid tropics. The objective with this species should be to expand its use in the zone, and especially the ways in which it is used not only in live fences (the traditional use) but in firewood plantations, for timber production, for forage plantings (to be used in combination with grasses) and for hedgerow intercropping for soil conservation and the production of green manure.

References:

CATIE (1986) Glover (1989), Vásquez (1991)

Flor amarilla

Cassia siamea, Leguminosae.

This species is promoted by both MADELEÑA and FIS in the DA. It is an ornamental, and useful for firewood and roundwood. Nair (1989) suggests that it may be a good species for alley-cropping. In the DA, it will probably be most useful for ornamental plantings, for riparian protection zones and for small demonstration plots of alley-cropping.

References: CATIE/MADELENA handout; CATIE (1986)

Teca, Teak

Tectona grandis, Verbenaceae.

Teak is one of the best known of tropical plantation species. It is planted in several parts of the DA and seems to be well liked locally, and to have a ready market. Teak planting is generally not recommended on steep slopes, where it shades out understories and can cause erosion from runoff and where trees are likely to die before reaching large sizes.

Although the literature (CATIE, 1986, Chaves and Fonseca, 1991) makes it clear that teak requires a pH above 6.0, flat or very gentle topography, and soils that are not compacted nor of clay-

dominated textures, the species is frequently planted "off-site". In areas such as the DA, perhaps teak is an alternative to even less sustainable operations, such as corn fields or heavily-used pastures. The apparent demand for young (15 year-old) trees for small pieces for furniture (which include some sapwood along with heartwood) also could stimulate the planting of teak in the DA.

It is important to encourage adequate elimination of sprouts and branches on the lower third of trees. This improves wood quality and also allows more light into the plantation, enabling some ground cover to grow. Thinning is important (see field trips and meetings section, MADELENA).

Melina

Gmelina arborea, Verbenaceae

Melina is native to Asia and is one of the fastest growing tropical trees. It is being planted in a large scale in Costa Rica for harvests on rotations of 4-6 years, for chips for paper production. CATIE, Desarrollo Campesino Forestal of the Dirección General Forestal and the campesino group AGUADEFOR in Nicoya, Guanacaste, Costa Rica, all have considerable experience working with this species. Modesto Juárez of MADELENA stated that melina is not preferred so far by farmers in El Salvador because it has a large crown and competes for light with crops. However, the species' ability to grow on mediocre sites (NOT on badly compacted pastures) would show some potential for meeting local needs for posts, poles and furniture made of soft, light, whitish wood. Apparently crafts made in El Salvador are from pines which are in increasingly short supply, and melina may serve as an easy-to-produce substitute. The success of melina in Guanacaste, Costa Rica should be monitored.

Camaldulensis

Eucalyptus camaldulensis, Myrtaceae

Camaldulensis is the Eucalyptus species most used in El Salvador. On good sites it can grow to heights of 14.6 meters with diameters of 41.1 centimeters, (producing 273.7 cubic meters per hectare) in 10 years (Martínez, 1990). This species has several desirable characteristics in addition to its fast growth: it produces firewood, roundwood useful for rural construction. It can be managed through coppices and can be manipulated to have a high, light crown. The CATIE/MADELENA project promotes the incorporation of Camaldulensis into farming systems of the region, including double-wide rows around the borders of fields, trees planted on contours, small woodlots, shade trees in coffee. Various small parcels of the species are found in the DA.

Leucaena

Leucaena leucephala, Leguminosae

The initial enthusiasm for Leucaena as an agroforestry species has somewhat diminished, particularly due to attacks by psyllid defoliating insects (Heteropsylla spp.) and by an awareness of its limitations for forage production. Garrity et al. (1993) discuss some of the problems of Leucaena in the Philippines in the context of developing hillside agroforestry. This species can be found in the DA along the irrigation canals of Cooperativa Nueva Guayapa, and in their "forest garden". It is also being planted by FUDAP projects just west of the DA, where some 100,000 seedlings of leucaena, madrecacao or flor amarilla were produced in 1994. It is not clear what FUDAP's motivation is in recommending Leucaena - if the plantations are for soil conservation, firewood production or land restoration. For firewood and/or roundwood either madrecacao or Eucalyptus camaldulensis would appear to be a better choice. Perhaps some Leucaena is worth incorporating into mixed rows in hillside alley-cropping, according to the suggestions of Tacio (1988). Care should be taken to use the Salvadoran variety; seeds could

be collected from trees with good form on Nueva Guayapa's land
Leucaena does not grow well on acid soils

References Salazar, 1991, National Academy of Sciences, 1984

Calliandra

Calliandra calothyrsus, Leguminosae

Calliandra is native to parts of Central America and has been widely adopted for use in improved fallows in Java (National Research Council, 1983b). It is a bushy tree, which provides large quantities of small stems and is useful for the restoration of degraded sites. According to several foresters, plantings of Calliandra in El Salvador were not successful and the species is not being promoted. But this does not mean that Calliandra should not be tested on a small scale on a variety of sites in DA. It may yet prove to be of value for adding biomass to degraded sites, providing firewood and some forage, and as a component of soil conservation systems

References National Research Council, 1983b, CATIE, 1986.

Mangium

Acacia mangium, Leguminosae

Mangium has not been planted extensively in El Salvador. It has potential to be a valuable site-restoring, firewood and timber species and should be introduced in small quantities on an experimental/demonstration basis. High quality seeds are available at the CATIE seed bank.

References: Picado, 1992, National Academy of Sciences, 1983c

Casuarina

Casuarina equisetifolia

Casuarina produces one of the finest firewoods known. It is an plant which forms a symbiotic association with the microorganism Frankia and is thereby able to live in difficult environments, including sandy soils with salt spray. For these reasons its use is recommended in beach areas, where there is a

demand for firewood and pressure on remaining mangrove forests
References National Research Council, 1983a, CATIE, 1986

Pepeto

Inga spp

Inga species were observed on most farms in the buffer area along the edges of El Imposible. Serrano (1993) lists the common and scientific names of locally used Inga species. This genus has widespread uses in agroforestry and farmers should be encouraged to experiment with broadening its range of uses. It may be worthwhile to plant some Inga in rows on the contour, where its large leaves can be used as a longer-lasting mulch in combination with those of species with rapidly decomposing leaves such as Gliricidia sepium. Inga seeds are recalcitrant, which means they cannot be stored, but must be planted immediately. The genus cannot be propagated by stem cuttings

References Lawrence, 1993; Serrano et al , 1993

Native species

Volador

Terminalia oblonga, Combretaceae

This is a common riparian species in the DA, produces a high quality wood, and is ideal for riverside buffer strips. It does not appear to grow well on hillsides.

Reference Nichols and González, 1992

Maquillishuat

Tabebuia rosea, Bignoniaceae

Maquillishuat is a popular ornamental, but does not appear to be adapted to plantation forestry. Normally it forks at about one or two meters in height. Small quantities can always be included in nurseries for ornamental plantings

References: Nichols and González (1992) and Serrano et al. (1993).

Cortez negro

Tabebuia chrysantha, Bignoniaceae

This is a fine wood, but has the same sort of form problems as maquilishuat, and does not appear to be suitable for plantation forestry.

Caoba and Cedro

Swietenia humilis and Cedrela mexicana, Meliaceae

Caoba (mahogany) and cedro (Spanish cedar) are two of the most valuable tropical hardwoods. They are attacked repeatedly by a shootborer, Hypsiphyla grandella, which causes them to branch. These species cannot therefore be grown in plantations. But isolated individuals can be planted in brush fields and coffee plantations. To some extent bifurcations can be managed through pruning.

Reference. Nichols and González, 1992

Marillo (María)

Calophyllum brasiliense, Guttiferae

Marillo produces a fairly high quality wood and is one of the species to which SALVANATURA is giving high priority. It appears to need partial shade when planted out, and is not a fast grower, either in the nursery or plantation.

References: Nichols and González, 1992, Serrano et al., 1993.

Conocaste negro and conocaste blanco

Enterolobium cyclocarpum and Albizia caribaea, Leguminosae

Conocaste negro is a savanna species which develops a wide-spreading crown. It is not adapted to plantation silviculture but could be used at wide spacings in pastures.

Reference: Nichols and Rodríguez, 1990, National Academy of

Sciences, 1979

Laurel

Cordia alliodora, Boraginaceae

Laurel is another fine wood. It is actually being left where it regenerates naturally in corn fields and coffee plantations by some landowners around the edges of El Imposible Provenances from the Atlantic zone of Costa Rica are thought to produce straighter trees. It may prove worthwhile to experiment with small quantities of seeds from there (with Ing. Modesto Juárez) Laurel is well known for its tendency to grow well only on fertile, well-drained soils. (González et al., 1990).

Pochote

Bombacopsis quinatum, Bombacaceae

Pochote is a high value wood which is being widely planted in tropical dry forest in general and the Guanacaste region of Costa Rica in particular. MADELENA is planning to introduce small quantities of pochote into El Salvador PROMESA could coordinate with them the planting of a few experimental parcels
Reference CATIE, 1991.

Ron-ron

Astronium graveolens, Anacardiaceae

Ron-ron appears to be a slow-growing species; it has quite high value wood It is native to the DA and is being managed over coffee near the San Benito entrance to El Imposible.

References: Nichols and González, 1992, Serrano, 1993.

Flor de fuego

Delonix regia, Leguminosae

This is a popular ornamental species which can always be produced easily in small quantities in nurseries

Izote

Yucca spp

Izote is not a tree, but is a very useful plant for soil conservation, having a tough, fibrous root system which is known for its ability to stabilize slopes. It also produces an edible flower and stems can be exported for house plants. Its use should be encouraged.

Vetiver grass

Vetiver is being promoted by the Río Las Cañas project (see section on meetings and field trips (CEL-CATIE-MAG-USAID) for details on costs and planting instructions). It is a relatively "inert" species, in that it does not take up a lot of space and does not apparently compete heavily with crop plants. But it does cost to buy, transport and plant sets of vetiver grass, it does not grow well in all situations, and, when clumps are missing, gaps can open in rows which then become gullies. The limitations of vetiver grass are considered by Sivamohan et al (1993). It should at least be used in a few demonstration plots in the DA, planted on contours six 6 plants per meter, to see what interest farmers may have.

SECTION 6. INCENTIVES

Of the various sources which consider incentive programs, Tschinkel (1987) and Hernández et al. (1989) are detailed and specifically focus on Central America. Tschinkel reviewed some eleven forestry/agroforestry projects in the region and concluded that material incentives in general should be avoided - "the more successful cases were characterized by low material incentives or none at all". His general conclusions (pp. 262-265) are worth keeping in mind:

- 1) that species and techniques should be easy to incorporate into the existing local agriculture and not compete for land.
- 2) Use species that grow faster than others known to farmers, provide multiple products, resist neglect, and are easy to propagate
- 3) Use personal, intensive extension services, trying to integrate the use of trees into farming systems
- 4) Begin at a modest scale, with "a few successful, highly visible demonstrations".
- 5) Plants need to be inexpensive or free, and available when actually needed, incentives should be temporary and subject to change as the process of trial and error proceeds.

These points are all debatable, and some authors would not agree with many of them (Raintree, 1985). Obviously, some project designers in the years since Tschinkel's article appeared were not aware of his conclusions or not in agreement with them, notably Desarrollo Campesino Forestal of the Dirección General Forestal in Costa Rica, which has been providing \$500-1,000 (in cash) per hectare to owners of small and medium-sized farms.

Hernández et al (1989) is a compilation of presentations made at a CENREN/MADELENA workshop on incentives held in El Salvador. De Camino (1989) offers a long and thorough examination of types of

incentives and their various uses in Latin America. Specific projects in Central America are discussed in a case-study format Lutz et al (1994) and World Bank (1994) also provide information on incentive programs for soil conservation

Much of the literature and nearly all of the technicians contacted during this consultancy tended to express wariness about incentives. **The key problem with incentives is that whatever is being given away becomes the focus of the project and not the desired forestry/agroforestry/soil conservation systems.** Often, for example in the cases of ORE/MAG for tree planting or the FAO food-for-soil-conservation projects, it was felt that the incentives were seen as an end in themselves and in the long run these programs actually functioned as DISincentives. Tree planting was given a bad name - trees were planted for the short-term gain of earning a salary for planting them. Trees were either left unmanaged - with the common feeling that they were not owned by the people who planted them or burned down and an area made open for tree planting the following year, or for agriculture. If there is a need for food or cash in an area then those needs should be dealt with directly and not used as a ploy to "push" desired land management techniques. If tree planting and/or soil conservation techniques are not relatively easy to accomplish in an area with minimal incentives, then perhaps the techniques being promoted should be reconsidered. An exception might be in cases such as Río Las Cañas where society as a whole - through its need for electricity - is willing to pay for on-farm soil conservation.

It is suggested here that some incentives are essential, namely those without which the desired systems cannot be established. This means that the PROMESA project should eliminate barriers to tree planting for soil conservation, for example, by providing seed of madrecacao (Gliricidia sepium) and any other species

At present a kilo of this species costs C30 and should provide about 5,100 seedlings. For double rows at 30 centimeter spacing every 12 meters, enough seed (slightly more than one pound) to produce 5,550 seedlings would be necessary, whereas at 6 meters, 11,100 seedlings would be required. This cost would probably be prohibitive to most farmers in the DA. Similarly, seeds of other reforestation and/or soil conservation trees as well as plants of pineapple, vetiver grass, and pigeon pea should be provided in the process of developing effective and inexpensive systems with farmers.

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