Restoration Alternatives for Mexico's Sky Islands: Examples from Guatemalan Forestry

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Abstract.—Guatemala is the most populous country in Central America and 63% of the energy consumption is fuelwood. However, land clearing for shifting agriculture, timber harvest, and cattle production have resulted in fuelwood scarcities. Thus, a large percentage of labor and income are devoted to fuelwood gathering. Since 1960, over 48% of the forest has been lost. Without successful management and alternatives to current practices, less than 2% of the original forest will remain by 2010.

The government of Guatemala has entered into a limited but successful partnership with the private sector to reforest many areas. The Guatemala Forestry Law of 1979 which has a fiscal incentive (FI) provision has not only reforested thousands of hectares, but has also provided a viable alternative to continued harvesting of the native forest.

The FI program of Guatemala could be a model for the management of the Sky Islands. Guatemala's successful reforestation programs are: a) restoring deforested sites, b) providing employment, and c) creating alternatives to continued cutting of native forests. Case studies will be examined which represent distinct ecosystems, using both native and exotic tree species, and producing multiple wood products. The environmental, social, and economic benefits of these programs will be discussed in the context of applying these principals to the Sky Islands.

BACKGROUND ON MEXICO

Mexico is the fifth largest country in the Americas and the third most populous. The population is estimated at over 85,000,000 with as many as 30% still living in rural communities (Sharma, 1992). Furthermore, the growth rate is 2.1%, ensuring increasing demands on natural resources. These demands have resulted in serious degradation of native forests over the last four decades (Anon., 1994). Approximately 25% of the landbase of Mexico, or 55,000,000 ha, is classified as forest land. The state of Chihuahua contains 24% of these forests. Since 1960, 30% of the forests in Mexico have been lost. This amounts to 370,000 ha deforested per year. These losses in forests have been attributed to shifting agriculture, illegal harvesting of timber, and forest fires. As a consequence of the deforestation in Mexico, production of forest products has declined 29% since 1989 (fig. 1). Continued demand for wood products will increase the rate of deforestation, threaten the livelihood of indigenous communities, and increase migration to the cities of Mexico and the United States.

The reforestation program in Mexico has been slow to respond to this deforestation. From 1983 to 1988 the reforestation program averaged 42,000 ha/yr. In 1992 and 1993 over 210,000 ha were reforested. While this is a substantial improvement in reforested lands, it does not equal the amount of land deforested nor does it attempt to reclaim the land lost to deforestation over the last four decades. In 1993, the federal government of Mexico developed 23 new nurseries on military reservations. These nurseries produced 123,000,000 seedlings in 1994. These trees are used for reforestation, restoration of disturbed lands, and urban planting programs. However, few attempts to involve industry in reforestation

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programs have been made. Thus, the majority of reforestation activities are either state or federal programs.

BACKGROUND ON GUATEMALA

Guatemala is the third largest country in Central America. With a current population of 10,500,000 people, and a growth rate of 3.3% that will double the population in approximately 22 years (Cooley et al,, 1981), Guatemala is faced with serious demands on limited resources. Agricultural employment, including forestry, accounts for 60% of the employed labor force. The unemployment rate is 6.5%, but underemployment is 30-40% (Anon., 1993a). Much of the population relies on the forest for fuelwood needs. In fact, fuelwood represents 63% of the energy consumption of the country. However, land clearing for agriculture, timber, and cattle production has resulted in fuelwood scarcities.

While Guatemala has the most diverse forest in Central America, with 16 species of conifers and 450 species of broadleaf trees (Cooley et al., 1981), it is quickly depleting these valuable resources. Currently, 71% of the native forest has been lost, and it is estimated that less than 2% of the original forest will remain by 2010 without serious intervention (Anon., 1993c). Serious erosion and flooding have accompanied the destruction of Guatemala's forest. The 125 megawatt hydroelectric plant at Chixoy is threatened by siltation; and the flow of the Rio Motogua, a major river in Guatemala, has been reduced by one-half in the last 20 years due to deforestation (Cooley et al., 1981).

In an attempt to reverse these destructive land use practices, the Guatemalan government enacted the Forestry Law of 1979. This law provides a mechanism for establishing a partnership between the Guatemalan government and the private sector in reforestation. Specifically, the Guatemalan Forestry Law provides financial incentives to encourage reforestation. The fiscal incentive law (FI) provides tax rebates over 5 years to cover the first year establishment costs, and the succeeding 4 years plantation management costs. The program currently funds up to 5,000 ha/yr, but less than 1400 ha have been reforested each year. This level of activity is too small to totally reforest the areas cleared for cattle and shifting agriculture. However, the model is very promising, and may have application in other countries.

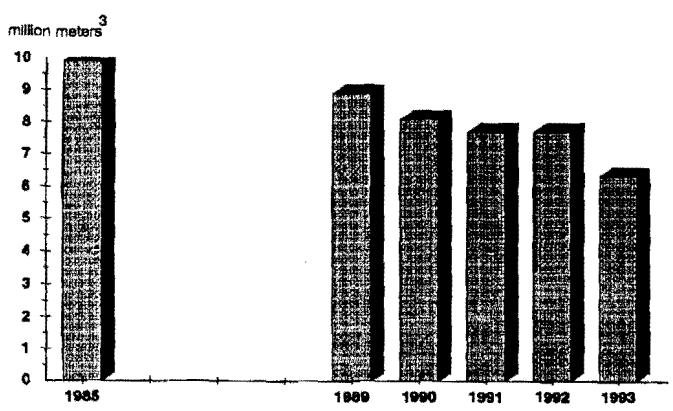

Figure 1.—Changes in harvested roundwood (million cubic meters) in Mexico since 1985 (Anon. 1993).

This government/private sector partnership has resulted in the formation of new reforestation companies (Table 1). Many of these companies are subsidiaries of large Guatemalan corporations. These companies have access to professional specialists and they utilize the organizational skill and financial resources of the parent company to successfully manage their reforestation activities. Since 1979, these reforestation companies have planted over 13,190 ha (fig. 2), requiring an investment exceeding $12,000,000.

The reforestation companies provide technical services to the landowner to ensure successful establishment and management of these plantations. A unique and positive feature of this law is that third parties can invest in reforestation without owning the land. The reforestation company can arrange an agreement between willing landowners and private companies to invest in establishing plantations. The investor provides the funds and receives the tax credits in addition to the favorable publicity associated with successful reforestation. Oversite responsibilities for plantation success and fiscal accountability rest with DIGBOS (Dirección General de Bosque) the Guatemalan forest resource management agency.

REFORESTATION CASE STUDIES

Three examples will be given to illustrate the effectiveness of this program to bring about successful reforestation in Guatemala. AGROBOSQUE is a subsidiary of Cementos Progreso, S.A., one of Guatemala's largest industries. Agrobosque was formed in 1985 with the objective of promoting reforestation by establishing plantations and educating the general public about the need to protect and manage the country's forest resources.

AGROBOSQUE has planted over 1,200 ha across a wide range of sites in the dry region of Guatemala. These sites are characterized by dry, rocky, calcareous soils. The topography is mountainous, the elevation ranges from 760 to 1048 masl and the precipitation is 500 - 1000 mm/yr. AGROBOSQUE has conducted suitability studies with 18 species including; *Eucalyptus, Melia, Pinus, Gmelina,* and *Leucaena.* The most promising species to date is *Eucalyptus camaldulensis.*

AGROBOSQUE has established fuelwood plantations near the primary cement production facility. Cementos Progreso plans to utilize the fuelwood as a substitute for bunker oil for its drying ovens. Their research indicates that 1 m^3 of fuelwood can offset the need for 150 liters of imported bunker oil. They estimate it will require 200-400 ha to produce 40% of the energy required by the cement factory.

AGROBOSQUE also has developed a public education program on the importance of forest resources for Guatemala. Since 1992, Agrobosque has visited 34 schools and conducted environmental and reforestation awareness programs for over 3,200 students. They also have met with 30 communities and 342 community leaders. As part of the community education program, they have donated 150,000 seedlings.

The second example of the FI program is FORESA. FORESA is a subsidiary of Licores de Guatemala, Guatemala's largest distiller, and employs 2,400 people in reforestation efforts (Anon., 1993b). FORESA has reforested over 3,000 ha. It concentrates much of its reforestation efforts on land that had previously been forested but had been cutover to establish pastures for cattle production. These sites are in eastern Guatemala where rainfall averages 850 mm/yr. FORESA has both container and bareroot nurseries producing 250,000 seedlings/yr for reforestation. The major species that they plant are *Pinus caribaea* and *Cupressus lusitanica.* Their objective is to produce saw timber.

Table 1.—Reforestation companies formed in Guatemala as a result of the Fiscal Incentive (FI) law.

Company	Parent Company	Reforested Land (ha)
AFOREST	Polla Campero	1,474
AGROBOSQUE, S. A.	Cementos Progreso	1,218
AGROFOREST	Avon-Colgate-Mixto Listo	1,479
CODEMA	Almacenes Paiz	550
EDCOFIASA	F.P.K. Electronics	250
FORESA	Licoreras de Guatemala	4,125
LA PARADA, S.A.	Bioteca, S.A.	322
MAYA-IZABAL	Marítimas Int'l	200
REFORESTADORA IND.	Cervecería	2,975
REFORVERAPAZ	Agro Industrias Canarias	225

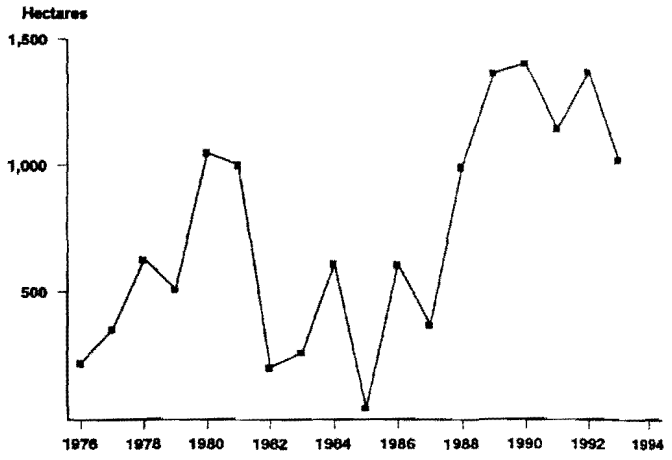

Figure 2.—Annual reforestation in Guatemala under the FI program.

Another positive example of the FI program is AFOREST, which is owned by Pollo Campero, Guatemala's equivalent to Kentucky Fried Chicken. AFOREST is working in the Rio Dulce region of Guatemala. This region, near the Gulf of Honduras, is characterized by high rainfall (4,000 mm/yr). Much of the rainforest that originally dominated the land has been cut for pastures and cattle production. AFOREST has embarked on an aggressive plantation program with *Pinus caribaea,* reforesting 1,500 ha. The major objective is aimed primarily at producing raw material for particle board production in Guatemala City.

These examples of Guatemala's reforestation efforts exemplify the possibilities of constructive partnerships between private industry and the government. Numerous other examples exist where reforestation efforts are being conducted in conjunction with local needs. While some of these programs do not qualify for the FI program, they do illustrate positive efforts in reforestation and an atmosphere of cooperation between industry and the federal government. One example is intercropping subsistence crops such as corn, beans and squash, during the first 2 years of a *Pinus tecunumanii* plantation. This technique provides food and income for the land tenant, and weed control and successful plantation establishment for the reforestation company.

Another positive example involves Simpson Paper Company's investment in fiber plantations in eastern Guatemala. This once richly forested region has been extensively deforested for cattle production. Simpson is working with the Guatemalan government and landowners to establish fiber plantations on depleted cattle pastures. This labor intensive project is providing jobs and

needed economic growth and at the same time re-establishing the land in a forest resource.

IMPLICATIONS

Reforestation companies in Guatemala rely extensively on local labor to produce the plants, prepare the sites, plant, weed, prune, and harvest these plantations. These programs represent a major source of employment within an economically depressed region. This labor amounts to 230 days per hectare per year in Guatemala (Reiche et al., 1991). The economic value of this work is $500/ha/yr. Reforestation activities require 0.6 laborers/ha/yr compared to 0.002 laborers/ha/yr for cattle production in this region (Rankin, 1994). Production income varies greatly, with cattle production earning $40/ha/yr verses fiber plantation earnings of $140/ha/yr. Therefore, these activities represent a significant source of employment for a country that has 30-40% underemployment (Anon., 1993a). Expanding the program would not only provide employment for a broad sector of the population, but would also provide needed wood and delay harvest of native forests.

The Guatemalan government has adopted a strategy for reforestation that includes the private sector as a major participant. The private sector has quickly responded to the economic and public relations benefits offered by being associated with this program. The results have been increased and improved reforestation activities, the establishment of new sources of employment in rural areas of the country, and greater public awareness of the importance of forest resources. The Guatemalan model of cooperation should be evaluated throughout Latin America. Similar programs have been successful in Costa Rica and Chile. These programs contribute to the protection of the remaining forests, while simultaneously addressing the growing need for fuel, fiber, timber and other forest benefits. Programs such as these could be useful in Mexico, assuring reforestation of lands and preserving rural communities and indigenous cultures.

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