



Appropriate Technology and Sustainable Development: A Research Study in El Salvador

Centro de Estudios Ambientales y Sociales para el Desarrollo Sostenible (CEASDES)

Poverty, population expansion, and civil conflict in El Salvador have placed pressure on an already diminishing and fragile natural resource base. Between 1971 and 1988, El Salvador's population expanded by 36 percent, but the country's cultivated land area increased by only 7 percent (Chapin 1990).

Mangrove and brackish forests constitute one of the country's most important and threatened ecosystems.¹ Rich in fauna and flora, it provides a valuable source of income and protein to coastline communities. Approximately 112,000 Salvadoran families depend directly on the 26,772 hectares of these forests for timber, fuelwood, and plant, fish, and animal life (Ministerio de Agricultura y Ganadería 1990).² In recent years, however, excessive demand for firewood, illegal logging and timber sales, migration to coastal areas, and the conversion of land to aquaculture ponds has decimated mangroves.

These trends have differential impacts on women and men, who play distinct roles with regard to mangrove use. While men fish commercially in open seas, women tend to fish along the shoreline and in estuaries for household consumption purposes and are disproportionately more involved in cleaning and processing activities for the fishing industry.

In an effort to integrate women's perspectives into conservation efforts, *Centro de Estudios Ambientales y Sociales para el Desarrollo Sostenible (CEASDES)* ("The Center on Environmental and Social Studies for Sustainable Development") conducted research in 1997-99 to reduce fuelwood consumption in a contested and fragile mangrove ecosystem in El Tamarindo, a small coastal community situated at the mouth of an estuary in the Gulf of Fonseca.³ Founded in 1996, CEASDES is a nongovernmental organization (NGO) that conducts participatory research and disseminates information on the human-ecosystem link and provides support to communities and policymakers to promote sustainable resource use.

Objectives

The project aimed to apply appropriate technology to help households reduce fuelwood consumption through a community participation process.⁴ Specific goals were to:

- ▶ Design, implement, and evaluate an appropriate technology intervention to promote the sustainable use of natural resources in a mangrove ecosystem.
- ▶ Develop and document gender-sensitive, participatory research methods to support the intervention.

¹ Mangrove forests are made up of tropical evergreen trees and shrubs that grow densely along tidal shores, including in brackish environments made up of both fresh and salt water. Although national legislation in El Salvador protects these areas, the Director General of Natural Resources has little authority to enforce regulations and severely lacks staff and resources.

² In addition, mangroves provide barrier protection, drainage and filtration, stabilizing the coastline and the surrounding agricultural lands and through natural windbreaks, fresh water, and conduits. Mangroves are also the breeding grounds for shrimp and fish, which contribute to annual export revenues.

³ The project was the outgrowth of earlier research (Gammage 1997) that explored human-environment interactions and mangrove management options in the Gulf of Fonseca.

⁴ Appropriate technology is both a development tool and an intervention that can improve the welfare of resource-poor populations through small-scale, easily maintained products.

The Intervention

CEASDES formed a partnership with the Asociación para el Desarrollo Comunal de Playa El Tamarindo (ADESCOPET) (“Association for the Sustainable Development of the Community of El Tamarindo”) to evaluate the needs, concerns, and priorities of the community. A modified version of a survey conducted in the area in 1993-94 provided information on fuelwood consumption, time allocation, and demographic and socioeconomic variables.

Through town meetings, focus group discussions and interviews, local residents, agriculturalists, fishers, and people running microenterprises in El Tamarindo were asked to rank a range of problems facing the community. Fuelwood scarcity emerged as a key concern. Participants were also asked to consider a range of potential appropriate technology interventions, including water purification technologies, alternative energy sources, pumps, wells, and solar dryers for preserving fish; the first choice was improved fuelwood stoves.⁵

The intervention was based on a comparison and evaluation of 60

households that obtained improved *Finlandia* fuelwood stoves with a control group of 60 households that continued to use traditional, open fuelwood stoves.⁶ The households—all with at least four members—were chosen to ensure representation of various economic activities, locations, and income levels. The stoves were then constructed in a participatory fashion using materials provided by the project but requiring labor and a small financial contribution from each household. Comparative data were collected during both the dry and wet seasons. A team of five community facilitators supported the data collection, training, and stove construction and provided assistance to ensure proper use.

The assumption driving the intervention was that, in the majority of cases, per capita fuelwood consumption and household expenditures on fuelwood would decrease. It was also hoped that the amounts of fuelwood gathered would last longer; that time would be saved because the improved stoves allow women to combine cooking activities; and that health indicators



would improve due to reduced exposure to smoke, ash, open flames, and heat.

It was assumed that some of the beneficiaries might change economic activities as a result of having more efficient means of cooking, for example by producing and selling tortillas or bread. For this reason, both the intervention and control groups were sampled on three separate occasions to obtain information about fuelwood consumption, energy efficiency, time allocation, income, and expenditures.

Results

Data and information on life in El Tamarindo provided a context for assessing differences between the intervention and control groups with regard to fuelwood consumption. Both aspects are summarized below.

The Context

Living Standards. A comparison of data from 1993 and 1997 reveals that total weekly household income

(in real terms) declined from US\$118 per month to US\$68 per month.⁷ Further, the number of income earners per household declined from an average of four to only one. This is most likely due to migration prompted by the collapse of the fishing economy, in turn a result of “El Niño” climate patterns, overfishing, and the loss of coastal mangroves. Economic opportunities

appear to have declined even further as a result of the natural destruction caused by Hurricane Mitch in October 1998.

Gender and employment. The baseline household survey showed that 54 percent of men fish as their primary occupation. Among women, 76 percent defined their activities as “domestic work” or “housework,”

⁵ Demonstrations were held by communities with experience with improved fuelwood stoves, and several demonstration models were constructed in El Tamarindo.

⁶ A *Finlandia* closed-hearth stove was selected for the intervention because it could be adapted to the size and location of each site and to the individual pots and pans owned in the households. It can also be tiled, providing many households with a hygienic surface on which to prepare food. In contrast, the traditional fuelwood stove in Central America is made of brick or mud, allows air to circulate freely, and does not concentrate or retain heat. Pots are suspended over an open flame, with smoke and airborne ash particulates seldom contained. The control group received materials to build improved fuelwood stoves once the monitoring and evaluation period had ended.

⁷ Values are based on the exchange rates of 8.7 colones per U.S. dollar in 1993 and 8.8 colones in 1997-98.

despite the fact that nearly half (over the age of 15) regularly earn income and more than a third of all work done by women is remunerated. On average, men in El Tamarindo earn US\$53 and women US\$41 per week, while within the fishing industry, a woman earns about 38 percent of a man's income. In all cases, earnings fluctuate dramatically throughout any given month, with little assured financial stability.

Fuelwood use. It was found that approximately 31 percent of participants used fuelwood exclusively as their source of domestic energy for cooking and heating water, while 58 percent used a gas propane stove supplemented with a fuelwood stove for cooking some food. Although some fuelwood was brought in from other parts of El Salvador and Honduras, the majority used was mangrove from the El Tamarindo estuary.

Per capita weekly use of fuelwood increased from about 37 pounds in 1993 to 43 in 1997. Fuelwood is less expensive than propane gas, perhaps explaining why declining incomes appear to foster environmental degradation. Further, households whose members are employed in the fishing industry are particularly in need of fuelwood, since they smoke and cook much of the fish and shrimp they catch for sale or domestic consumption.

Men and women engage differently in fuelwood and timber-gathering activities. Men tend to gather large amounts infrequently, using boats and animals to haul the loads, and to sell fuelwood to cover shortfalls in household income. Women instead gather smaller amounts of fuelwood on a regular basis, meeting immediate or short-term household needs.

Estimates of “shadow wages”—whereby market prices are applied to the time invested and quantities gathered—revealed that men gather larger quantities of fuelwood in less time than women. Calculated in these terms, men had a shadow wage of US\$0.91 per hour and women US\$0.54 per hour.⁸

Impact of the Intervention

With only two little logs and some corn cobs, I can grind and cook four pounds of corn daily.⁹

Fuelwood consumption and expenditures. Data revealed that households with Finlandia stoves consume less fuelwood per capita than those with traditional stoves. For example, per capita weekly fuelwood consumption for domestic purposes was about 6 pounds less during one of the dry seasons and 5 pounds less during one of the wet seasons. In addition, the households with improved stoves used half as much fuelwood to generate each US\$11 worth of income (21 pounds versus 49 pounds per week during a dry season).

With the same amount of fuelwood I cook two or three dishes at the same time, and now I can have some time to look after my granddaughter.

Time allocation. Time-use data showed that the improved fuelwood stoves require a slightly longer time to boil a given amount of water, but take less time to light and remain lit longer. Importantly, many of the women surveyed following the intervention said that use of the Finlandia stoves had enabled them to spend longer and more careful time performing other activities, such as childcare or

mending nets. It also became clear that the stoves facilitated the simultaneous cooking of several dishes, in turn allowing for the preparation of meals more easily and quickly.

Now we don't spend so much time breathing in the smoke, and we don't swallow the ashes.

Health Impacts. Health data were collected on the reported incidence of burns, bronchial, respiratory, kidney, and vision-related ailments. Although many of these problems are chronic and incidence can reflect long-term exposure to environmental factors, such ailments were much less likely to occur in the households with improved stoves. For example, 92 percent of users of the Finlandia stoves had fewer burns and 43 percent fewer vision problems. In addition, roughly 30 percent of participants in focus groups reported overall improvements in health over the previous three-month period.

Conclusions

In El Salvador and elsewhere in Central America, improved fuelwood stoves (as well as other non-combustible devices, such as solar-powered food cookers and dryers) have been employed with varying success rates. In many cases, appropriate technologies were abandoned or inadequately used, largely because women were not sufficiently involved in identifying problems or solutions. In contrast, the El Tamarindo project involved women beneficiaries in all stages of the project design, implementation, and evaluation of the intervention, promising both immediate results that met women's needs and the possibility of replicating the project in additional households in the future.

⁸ An eight-hour day gathering fuelwood would generate for both men and women more than the US\$4.18 rural minimum wage; the high market prices and subsequent shadow wages in part reflect the relative scarcity of fuelwood. In addition, the total amount of time spent gathering fuelwood may have been underestimated, since regulations implemented in 1992 made the collection of anything but dry wood illegal, hampering truthful reporting.

⁹ All quotes are from focus group sessions with stove recipients, June 1999.

Recommendations and Lessons Learned

Since the El Tamarindo project, ADESCOPET has received several petitions for similar projects, in particular in the neighboring communities of Lomas Larga, Buena Vista, and El Jagüey. The following recommendations can help guide future work in these and other locations:

► **Encourage participation.** The success of the study can be largely attributed to the participatory methodology applied and the continual, active support of local residents and ADESCOPET. The issues raised by participating women at the outset shaped the project; for example, concern over time burdens forced researchers to look not only at the efficiency of the new stoves, but the daily lives of women. Attempts to change patterns of gathering and consumption must therefore consider the different realities and incentives that both men and women face, and the different uses to which the fuelwood is put.

► **Seek more than numbers.** Quantitative measurements cannot capture all realities, largely because they are too generic and encompassing. Shifting the focus of study to include qualitative factors (for example, cooking habits in addition to fuelwood consumption) gave a more precise picture of the impact of improved stoves. Interviews, focus groups, and informal discussions with study participants also provided nuanced information and perspectives.

Throughout the project, important lessons were learned about appropriate technology:

► **Change is always possible.** The intervention was undertaken in a context of poverty, declining income, and the collapse of the rural economy in El Salvador. It is inspiring to observe, however, that even in the face of such constraints, improvements in the way that fuelwood is consumed—as well as in individual and household welfare—

can occur. Technology transfer, which “adds value” by providing resources for training and institutional strengthening and creating opportunities for participation, can reduce environmental exploitation and dependency in fragile ecosystems.

► **The big picture is important.** Similar to communities throughout the world, El Tamarindo has long been interested in managing its natural resources more sustainably. While individual steps (such as the use of improved stoves) are always desirable, they must be part of an integrated strategy. The need to decrease poverty, promote education, provide affordable health care, and transition from subsistence to remunerative activities must all be considered if the fundamental problem of environmental dependency is to be solved. Meeting the development needs of women is critical to this process.

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