THE IMPORTANCE OF FUELWOOD IN CENTRAL AMERICA: AN APPRAISAL AND A PLAN FOR ACTION

By N.J. Gewald

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CENTRO AGRONOMICO TROPICAL DE INVESTIGACION Y ENSEÑANZA, CATIE
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Introduction

The Eighth World Forestry Congress held in October 1978 in Djakarta, Indonesia, emitted a declaration of important recommendations for forestry activities in the near future (3). The Congress was particularly concerned with the "poor man's energy crisis", the growing firewood shortage brought about by population pressures, dwindling forests and the increased cost of alternative means of cooking and heating. The Congress urged all governments in countries with a major requirement for fuelwood and not well endowed with forest resources to give the highest priority to its production in appropriate locations, with full participation of local people and suitably integrated with agriculture.

Following this declaration, the Central American Energy Commission (COMENER) recognized "The desirability of promoting the use of natural energy sources, mainly those which are renewable to diminish dependance on imported energy and the utilization of non-renewable resources". They also stressed "the need for improved international cooperation in the transfer of technology and experiences on tapping new energy sources which are within the reach of the majority of the Central American countries".

It is difficult to say if and to what extent the publications of Worldwatch Institute have created more interest in this matter. Eckholm wrote the first World Watch Paper on this topic in 1975! (2).

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* The author is coordinator of the regional fuelwood production project carried out by CATIE (Centro Agronómico Tropical de Investigación y Enseñanza), Turrialba, Costa Rica.

Concern for reduction in petroleum use and development of energy substitutes in Central America is reflected in ongoing Central American programs. Electrical interconnections between the five republics and current expansion of the region's hydroelectric and geothermal potential is underway as part of the Central American Energy program. Major large-scale hydroelectric programs are planned in all countries of Central America and Panama. Nevertheless, projections of future energy import costs for the region are alarming. In 1960 the region (excluding Panama) paid $40.5 million, equivalent to about six percent of traditional exports. In 1977 the cost rose tenfold to $463 million, or about 20 percent of traditional export earnings. At current prices and at current demand trends, the region will pay $754 million in 1985 (27 percent of traditional earnings). Recent OPEC pricing trends give scant hope that current prices will hold constant during the period. In addition to impacting on foreign exchange, increasing energy costs also impinge on national budgets, such that, other things being equal, fewer resources are available for socio-economic development expenditures, especially for the rural lower income population.

Central America's energy consumption

The total energy consumption in the Central American Isthmus has increased 6.7% annually during the last decade. This figure is nearly twice as high as that for the U.S.A. In 1975, 60% of the total energy was derived from commercial sources (such as electricity and petroleum derivates), the remaining 40% being provided by non-commercial energy which includes wood, charcoal, sugarcane bagasse and sawmill wastes (Table 1.).

Table 1. Percentages of total energy consumption in Central America Isthmus.

	Oil	Geothermal and Hydroelectric	Fuelwood and Charcoal	Bagasse
Guatemala	49%	3%	41%	7%
El Salvador	48	6	37	9
Honduras	45	4	45	6
Nicaragua	53	5	25	12
Costa Rica	50	8	28	14
Panamá*	79	2	13	6
Central America Isthmus Unweighted Average	55	5	31	9

*Does not include the Canal Zone

Source: March 1978 SIECA Energy Planning Publication and Economic Commission for Latin America data.

Approximately one third of the so-called non commercial energy is consumed by industries. In rural areas it is mainly used for the production of bread, sugar, salt, tiles, bricks and lime. Sometimes it also finds applications in the drying processes of agricultural products such as coffee. When the supply of firewood diminishes, the small rural industry, consumer of firewood, may increase the prices of this commodity, in detriment of the local population. Developments in Costa Rica however, indicate that the same rural industry is more eager to change to harder technologies than households (9, Sisson), especially when the supply of firewood in sufficient quantities becomes unreliable. It is thought therefore that the negative influence which a firewood consuming industry in stress periods is exercising on local price developments has a temporary character.

The lower income groups -rural as well as urban- depend nearly exclusively on firewood for their energy needs. In absolute terms the rural population is by far the largest group of firewood consumer as can be seen in Table 2, using Panama as an example. In this country 50% of the number of households is in rural areas, but for the whole of Central America around 70% of the population lives in rural areas.

Evidence exists however that urban firewood needs in Guatemala, San Salvador, Tegucigalpa and Managua have created commercial firewood trades. A striking example is Managua, where the firewood is mainly collected from the area around "Las Maderas" a village some 50 km east of the capital. The majority of the population of this village lives from the firewood trade.

Table 2. Energy sources for cooking in rural and urban Panama (1970) expressed in percentages of total number of households.

	Number of houses	Energy sources for cooking				
		Firewood Charcoal	Gas	Kerosene	Electr.	No reply
Rural	143.560	74.8%	13.9%	8.7%	0.2%	2.4%
Urban	141.761	5.2	76.1	11.0	2.0	5.7
Total	285.321	40.2	44.8	9.8	1.1	4.1

Source: Censo de Población y Vivienda. Dirección de Estadística y Censo, Panamá 1970.

Though the absolute and percentual figures for 1980 will be different from the 1970 data presented in Table 2, there is no reason to assume that drastic changes have taken place towards the utilization

of kerosene, gas or electricity. A survey carried out in 1978 confirms this as can be seen in Table 3, although it is not known if the sample presented permits country wide extrapolation.

Table 3. Percentage of households in Central America using fuelwood for cooking. (Based on Household Survey).

	Number of Households Surveyed	Fuel-wood	Elec-tricity	Kerosene and Gas	No response
Costa Rica	231	66%	25%	5%	4%
El Salvador	654	77	2	16	5
Guatemala	801	88	1	8	3
Honduras	463	81	1	15	3
Nicaragua	302	75	1	19	5
Panama	Not available	-	-	-	-
Average	2.451	80%	3.5%	12.5%	4%

Source: November 1978 SIECA Renewable Energy Report, based on household census.
NOTE: Totals are weighted averages.

Fuelwood or charcoal was used in 4 out of every 5 houses surveyed (regional average). In most of the countries gas and kerosene were second, except for Costa Rica where a high frequency for the use of electricity was observed.

The rural population of Central America consisted of 12.3 million people in the year 1970, equivalent to 71.2% of the total population. Tendencies are that the last figure will drop to 68.5% and 65.4% for 1980 and 1990 respectively. Nevertheless, as shown in Table 4, the absolute rural population will increase over the same period of 20 years with more than 50%, to a total of nearly 20 million people in 1990.

Table 4. Total and rural population in Central America for the period 1970-1990 (in thousands).

Country	Total Population year 1970	1980	1990	Rural Population* 1970	1980	1990
Guatemala	5679	6940	9108	4249	5037	6309
Honduras	2897	3595	4997	2212	2659	3529
El Salvador	3549	4813	6595	2640	3483	4626
Nicaragua	1878	2609	3672	1216	1608	2945
Costa Rica	1872	2286	2954	1297	1570	1987
Panama	1428	1931	2532	704	862	1035
Total	17303	22234	29859	12318	15219	19530

*Population living in villages with less than 10.000 inhabitants.

Source: Fox, R.W. and Huguet, J.W. Tendencias Demográficas y de Urbanización en América Central y Panamá. BID 1978.

Actual importance of firewood and some trends in changes

The figures cleary demonstrate that the vast majority of rural populations depend highly on firewood for their cooking. It is alarming that reliable data on production and consumption of firewood do no exist for the Central American Isthmus. The figures for fuelwood and charcoal production presented by FAO are surprisingly high, but they are not more than estimates (Table 5), and they are the only data readily available sofar.

Table 5. Fuelwood production and total timber production in Central America (1977).

Country	Fuelwood & Charcoal (1000 m^3)	%	Other timber production (1000 m^3)	%	Total Volume (Exploited) (1000 m^3)
Guatemala	5120*	91	486	9	5605
Honduras	3000*	72	1175	28	4175
El Salvador	2947	97	79	3	3026
Nicaragua	2135*	71	880	29	3015*
Costa Rica	2371*	62	1434	38	3805
Panamá	1400	92	120	8	1520
TOTAL	16973*	80	4174	20	21147

*FAO estimates
Source: FAO 1977 Forest Products Yearbook.

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Apparently a practical system to determine the levels of production and consumption of fuelwood has not been developed for this region. The main obstacle is that fuelwood and charcoal hardly enter the normal marketing processes from which reliable statistical data could be derived (10, Arnold and Jongma, in Unasylva). Supposing the FAO figures are correct, this does not imply that in Central America, except for some very specific areas, a direct relationship exists between the cutting of trees for fuelwood and deforestation. The main cause of deforestation is the clearing of land for agricultural purposes. Once a "virgin" area has been made accessible by opening a road, timber extraction takes place (creaming off), immediately followed by uncontrolled colonization. The land is cultivated for some years and then its use changes frequently from agricultural crops to extensive cattle grazing. This means that after the timber has been harvested the remaining forest is felled and burned, without further utilization of the trees. This explains why in Table 5 the percentual figures for fuelwood production are high: the forest that has been felled has not been fully exploited, and in most parts of the region, fuelwood is still available, but on sites too far away from the actual consumer.

The pattern of changes in the use of energy sources for cooking is fairly complicated. In countries with a slow rate of progress in development the changes seem to be very gradual from firewood via charcoal to kerosene, gas or electricity. Where progress is taking place at a slightly faster rate kerosene and gas are preferred and charcoal is not considered as an attractive alternative (except for barbecueing). Even in Costa Rica, one of the most prosperous countries of the region, firewood remains the most important energy source for cooking. Often a combination of different energy sources is used: gas or electricity to prepare "quick meals" and/or drinks, and firewood for the preparation of main dishes where more cooking time is needed. Cultural and practical reasons seem to be prevailing over economic considerations in the choice of the energy source for cooking purposes The housewives claim frequently that the meals have a better taste and are hotter when prepared with firewood. Others say that it is impossible to prepare good "tamales" or "tortillas" if the flames do not spread around the pan. The tendency is that the people are receptive for new "soft" technologies and accept "hard" technologies only in isolated cases.

An additional aspect has been pointed out by Sisson (9), who found out that in a village not far from the capital in Costa Rica, people were ashamed to admit that they were cooking on firewood, even though 60% of the population actually used it. In this case the utilization of firewood was associated with a low status level. All the households visited had electricity and most would prefer gas or electricity to firewood for cooking, because they are easier and faster to work with. Other reasons are that they are cleaner and avoid having to get firewood.

Costa Rica is the only Central American country where electricity holds the second place in importance for cooking purposes. This can be explained by the advanced stage of development of hydroelectric schemes in this country. Since the construction cost of these schemes is extremely high, the investments will have to be financed by foreign banks. In their turn, the banks require a certain policital stability before substantial investments will be financed by them. This policital stability is weak in some of the Central American countries so that hydroelectric schemes get implemented at a slow rate or in some countries, do not pass beyond the planning stage. In any case electricity has the drawback that it only reaches as far as the electricity lines run and that a relatively high investment has to be made to obtain the necessary kitchen equipment. It is unnecessary to say that the housewife also needs to change her cooking methods when changing from other energy sources to electricity. This is one of the reasons why electricity for cooking purposes may be considered as a fairly "hard" technology.

As has been mentioned before, economic reasons are not always prevailing in the choice of energy source for cooking in Central America. This may be illustrated by changes observed by Sisson (9). Present households or their parents' households used to have earthen Stoves (fogones) made of bricks with metal bars on top, or a more simple system consisting of three stones. In order to reduce smoke they switched to more sophisticated stoves. Most of the households interviewed use cast iron stoves and some have stoves with an enamelled metal exterior and cement interior. Both stoves have ovens, several doors and a chimney; and they appear quite wood efficient. The cast iron stove costs between $100 and $175 and the other type $250 - $320. These prices are relatively high if compared with the cost of a gas or an electric stove which can be obtained for $300 -350.

In other Central American countries where the use of three stones for cooking is still very common there seems to be interest in the Lorena stove and similar models. The stove is fairly simple to build but it is sometimes difficult to obtain a clay mixture which resists high temperatures without cracking, thus requiring frequent repairs (4). Furthermore it has not been clearly proven that the Lorena stove is more efficient than the "fogon" or the open fire. The efficiency of a heat source, whether it be an open fire or a stove, depends to a great extent on the skill of the housewife who uses it.

A plan for action: The Central American Firewood Project

The Tropical Agricultural Center for Research and Training (CATIE), in Turrialba, Costa Rica, started a project for the study of agricultural cropping systems in the region more than five years ago. This project evolved in 1977 and 1978 into more projects including animal husbandry and mixed agricultural systems. At the same time agroforestry was getting more attention and in 1979 a project was prepared called "Fuelwood Production and Development of Alternative Energy Sources for the Central American Isthmus". CATIE will implement the fuelwood production component. The alternative energy sources development will be carried out by ICAITI*. The project will have a duration of 6 years and is financially supported by ROCAP (Regional Office for Central American Programmes of AID). Each country will have its proper project, tailored to its specific needs and interests, but within a general framework which has been set out in the Project Document (1). The fuelwood production part of the project became operational in January 1980.

The goal of this project is to improve the welfare and productivity of low income groups and increase the supply of low cost energy for rural and urban poor.

The purpose of the project is to develop, demonstrate and make available for transfer:

a. improved cultivation practices to improve fuelwood production and supply, (CATIE component), and

b. efficient low-cost domestic, small community and small/medium industrial fuelwood and non-conventional energy technologies, (ICAITI component).

In this project CATIE will cooperate closely with national research agencies to:

1. identify critical and potentially critical fuelwood availability areas in the region;

2. identify for testing as fuelwood, species of fast growing trees and provenances that are already known and have been

*ICAITI Instituto Centroamericano para Investigaciones en Tecnología Industrial.

or are being tested in Central America and Panama;

3. identify improved management practices (e.g. planting distances, pruning/thinning systems and weeding practices) for selected fast growing trees identified in (2) above;
4. conduct demonstrations of various methods to produce increased supplies of fuelwood on small farms, village or community woodlots and fuelwood plantations, and
5. strengthen its own and national professional and institutional capacity to conduct research, carry out demonstrations, and provide training and technical assistance in improved fuelwood production systems.

During the first phase of the project, emphasis will be given to activities 1, 2 and 5, including baseline studies and formal training. On the other hand, interests of the countries are concentrated on demonstration plantations in the field (activity 4).

ICAITI will concentrate its activities in the following fields:

1. improve the design of woodfuel stoves and charcoal burners for higher efficiency.
2. biogas digesters.
3. solar energy pilot projects for water heating and drying of agricultural crops.

Description of activities

Activity 1. Critical and potentially critical fuelwood availability areas. (CA's and PCA's)

A socio-economic survey will be conducted in the more densely populated and cultivated areas of the region to identify CA's and PCA's. The survey has to provide information on the following aspects:

1- the importance of the presence of trees in existing farming systems.

2- fuelwood consumption patterns and preferred species.

3- limiting factors for the plantation of trees on small farms and suggestions to overcome these constraints.

4- fuelwood consumption habits of the small rural industry and their future needs.

Activity 2. Identification of suitable species for fuelwood production.

CATIE will locate existing plantations and trial plots of fast growing trees and collect basic data on plantation and management history, species and seed source, as well as characterization of soil and ecological conditions for each plantation or trial plot. Data will be obtained providing information on tree growth, as well as wood characteristics. In addition, the potential impact of these species on the environment will be examined. Growth data and harvest characteristics will continue to be obtained for these plots during the life of the project in order to refine the basis for estimating annual production for each species under study.

A preliminary social and acceptability survey in areas contiguous to the pre-1980 plantings will be undertaken to determine receptivity by potential consumers to those species identified under this activity. New species will be compared with those presently being used to determine such potential problems as drying and burning characteristics, undesirable odors, noxious oils or resins and smoke.

Activity 3. Identification of improved management practices for fuelwood production.

Experiments involving known species recommended in activity two (above) will be carried out under this activity. If plantations of adequate species do not exist already. New trials will be planted on small farms, experiment stations and in other secure locations and will be designed to further refine silvicultural practices that maximize production of fuelwood.

CATIE, in conducting these experiments, will focus on such management practices as site preparation, intensive weed control, green manure, mulching, planting distances, pruning and thinning practices, coppice management, fertilization, and pest control.

Activity 4. Fuelwood Demonstration Units.

This output is primarily designed in order to provide data for use by small farmers and communities and for fuelwood planning by national agencies. It will also serve as a set of tests and demonstrations around which training courses and other awareness seminars will be developed by CATIE, national research and extension technicians and

private organizations. Demonstration units will use the most promising, known, fast growing and consumer acceptable species of fuelwood trees that were selected in activity 2. The demonstrations will focus on five types of plantings:

-Natural Fuelwood Production Units will be established in existing primary or secondary growth natural forests from which fuelwood is now being harvested. In fenced areas, protected from fires and uncontrolled grazing, replanting of presently unproductive areas, cleaning, pruning, thinning and selected harvesting are among the silvicultural practices to be demonstrated. Management of patches of remaining savanna type woodland on farms will be included under this item. Silvicultural practices in mangrove forests will probally also be carried out. Multiple use management will be stimulated; a high fuelwood production is not expected from these units but on the other hand the investment costs will be low too.

-Farm level Fuelwood Production Units will contain fast growing species planted in less than two hectare plots on small or medium sized farms (5 to 25 has.). Land availability for farm level fuelwood production units will be very limited. Probably the only land that can be set aside for tree planting will be on sleep slopes and/or very marginal land. Since investment in planting should be kept at a minimum a high fuelwood production is not to be expected from these units but, as unit type 1, they may protect adjacent croplands against erosion.

-Village Woodlots will be developed to meet needs of small villages in critical and potencially critical fuelwood availability areas. These plantations of 5 to 10 hectares each, will be undertaken by cooperative village action groups assisted, where possible, by national forestry or extension service personnel. Taungya systems will be tried in some cases. Land availability for village woodlots seems to be better than on individual farms, so that a higher production is expected if compared with production of the former units.

-Fuelwood Plantations for Rural Industries intented for commercial supply of fuelwood to small rural industries e.g. ovens, kilns, and for rural communities, will be developed on cooperating private farms and municipal or national land. This type of plantation may be considered as the hardest technology offered in the project. Inputs such as mechanical site preparation, starter-fertilization, and use of some agro-chemicals could give high fuelwood yields but land availability for these

demonstration units is still unknown.

- Agro-forestry Demonstration Units will be planted especially on small farms in cooperation with CATIE technicians working on mixed farming systems. These two CATIE research teams (fuelwood and small farm industries systems teams) will design several systems which combine trees for fuel with other crops. Use will be made of fast growing species for shade, fence rows, erosion prevention and windbreak strip plantings. Systems combining potencial fuelwood species with tropical animal production will also be designed and tested.

It is expected that the majority of the fuelwood consumed by rural households is actually provided by some sort of agro-forestry system. Activity 1, the socio-economic survey, may provide valuable information on this matter. Preliminary local observations have indicated that the prunings of coffee bushes and shade trees are extensively used as firewood throughout the region. Furthermore, live fence posts such as Gliricidia sepium produce good fuelwood from pruned branches. Windbreaks composed of Eucalyptus camaldulensis and Leucaena leucocephala can be managed in such a way that fuelwood es produced as a by-product.

5. Strengthen CATIE and National Professional and Institutional Capacity in the Field of Fuelwood.

This activity is directed toward improving national institutional capacity to design and conduct research and production activities related to fuelwood. It is also directed toward improving CATIE's capacity to provide support to the national institutions involved with fuelwood production.

Capabilities will be strengthened primarily through training but also through the provision of technical assistance for research and demonstrations. Government and private organizations will be encouraged to increase the number of people working in this area and augment budget allocations to cover essential counterparts needs.

Training will be provided by the CATIE forestry staff to national counterpart technicians at various levels. Short courses at CATIE and in the countries will be given. In addition to formal training, on-the-job training will be provided to national counterpart foresters in design and conduct of area characterizations, research, demonstration

and production trials on small farms, village woodlots and commercial plantings. Other beneficial effects that will result from this project are:

-additional publications will be added to the CATIE library on all phases of project interest. The library will prepare a comprehensive, annotated bibliography of articles on fuelwood research, extension, production and harvesting published. Copies of these articles will be provided to national counterpart institutions to further increase availability of up-to-date information regionwide.

-CATIE's germplasm bank will collect and make available propagation material for species or provenances of fast-growing trees to meet regional demand for research purposes. As a result of this project, CATIE will have identified sources of seed and potential seed production.

-CATIE will have developed its data base on all phases of fuelwood production to a point where it can provide information on a wide spectrum of fuelwood problems ranging from ecological and agronomic to plant growth, small farm/community acceptance and economic considerations.

-CATIE will also have increased its knowledge of the area's fuelwood potencial as a result of this project. It also will have developed working relationships with national counterparts permitting them to further develop cooperative research, extension, education and similar programs related to natural renewable resources.

On behalf of the Direction of CATIE I would like to express our interest in the exchange of information on fuelwood production with similar projects in the tropics and thank CEGET and UNU for having invited me to present this paper on the importance of fuelwood in Central America.

Thank you for your attention.

NJG/alz
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