The Central American Energy Problem: Anthropological Perspectives on Fuelwood Supply and Production

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ABSTRACT

Fuelwood is the single most important fuel source in Central America; in total energy consumption, it is slightly more important than petroleum products, and the majority of all Central Americans use fuelwood for cooking, heating and home lighting. Nevertheless, the production mechanisms for fuelwood are not well understood; recent research makes clear that farm-lands play an important part in fuelwood production, through the management of agroforestry systems, where tree production is combined in some form with agricultural or animal production. These management systems are now being researched for their biological components, but their socio-economic aspects have yet to be clearly defined.

Fuelwood is the single most important fuel in Central America, and the major output of forestry production for the area. Its major sources are farmer managed on-farm tree formations. This crucial area of "social forestry" (Brokensha 1982) is poorly understood. An understanding of patterns of farmer decision making (Barlett 1980) in the plantation and management of trees and woody shrubs on farms is necessary for the formulation of strategies and policies to increase fuelwood production.

This report presents results of the CATIE-ROCAP Central
American Fuelwood Project (Contract # 596-0089) (CATIE 1979). The project began in 1979-1980 working in Panama, Costa Rica, Nicaragua, Honduras and Guatemala. Recently, El Salvador has been included in the project. Interviews were conducted with 2,000 small farm operators in the five original project countries, gathering information regarding quantities and species consumed for fuelwood, methods of collection, costs, etc.

In view of Central America's image as a tropical jungle area, it hardly seems possible that a fuelwood shortage could exist. Nevertheless, a series of factors have combined to create scarcity for the consuming population in much of the region; the scarcity producing factors are a large demand and a regionalized pattern of agricultural land use accompanied by deforestation.

Fuelwood is the most important fuel for the Central American Isthmus; in 1979 47% of all energy consumed was in the form of fuelwood making it more important than petroleum derivatives or electricity as a fuel. It is likely that the figures for fuelwood consumption are still too low; since fuelwood is consumed in many cottage industries such as brick works, lime kilns, black smithies, salt production, bakeries and tortilla producers, it is difficult to arrive at reliable numbers for industrial consumers, and for their consumption (See table).

The majority of all fuelwood consumed is for household use, mainly for cooking. The 14.5 million people who cook with
<table>
<thead>
<tr>
<th>Country</th>
<th>Total estimated energy consumption (Tcal)</th>
<th>Total fuelwood (Tcal)</th>
<th>% of total energy consumption</th>
<th>Residential and commercial (Tcal)</th>
<th>Industrial (Tcal)</th>
<th>Charcoal (Tcal)</th>
<th>Other biomass (Tcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSTA RICA (1979)</td>
<td>14493.0</td>
<td>4438.0</td>
<td>30.6</td>
<td>4163.0</td>
<td>189.0</td>
<td>86.0</td>
<td>1350.0</td>
</tr>
<tr>
<td>EL SALVADOR (1979)</td>
<td>23675.6</td>
<td>13990.0</td>
<td>62.3</td>
<td>13696.5</td>
<td>294.0</td>
<td>14.5</td>
<td>1671.0</td>
</tr>
<tr>
<td>GUATEMALA (1979)</td>
<td>33610.0</td>
<td>19260.0</td>
<td>57.3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1520.0</td>
</tr>
<tr>
<td>HONDURAS (1977)</td>
<td>13917.9</td>
<td>9488.8*</td>
<td>68.2</td>
<td>9488.8</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>NICARAGUA (1978)</td>
<td>13627.7</td>
<td>5770.7</td>
<td>42.3</td>
<td>5077.4</td>
<td>568.4</td>
<td>125.3</td>
<td>1448.1</td>
</tr>
<tr>
<td>PANAMA (1978)</td>
<td>12617.5</td>
<td>2957.1</td>
<td>23.4</td>
<td>2869.2</td>
<td>82.7</td>
<td>125.3</td>
<td>1033.0</td>
</tr>
</tbody>
</table>

1/ 1 Teracalorie = $10^9$ kilocalories = $0.252 \times 10^9$ BTU

* This data only refers to domestic energy consumption.

--- Data not known ---

Sources: República de Costa Rica, 1976
Republica de El Salvador, 1979
Republica de Guatemala, s.f.
Republica de Honduras, 1981
Republica de Nicaragua, 1980
Republica de Panama, 1981
fuelwood in Central America constitute nearly 3/4 of the population of the area (Table 2). The total consumption is more than 22 million cubic meters annually, and continues to grow.

Fuelwood shortage in Central America can be more clearly understood in terms of ecological zones (see map). Although modern life zone classifications recognize at least 12 zones for Central America (Holdridge 1979) a simplified classification can be constructed with only three. The three zones are:

- Lowlands with no dry season
- Lowlands with a dry season
- Highland areas

The highland areas and the lowlands which experience a dry season have been the most densely populated and most intensively used lands agriculturally, since their climates are more congenial to human occupation and agriculture. The lowland areas which experience no dry season constitute the largest zone of the Isthmus, and up until recently were virtually uninhabited.

The most intensively utilized areas of Central America were the first areas deforested, and presently are the areas which experience fuelwood shortages. The majority of the remaining forests (estimated by FAO 1981 to make up 37% of the Isthmus land area) are found in the lowland forest areas of the Atlantic coast, where it is not accessible to the majority of the
Table 7. Fuelwood consuming population, per capita consumption (in m²) and annual rate of growth (figures of most recent census)

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Total population (around 1980) millions</th>
<th>Fuelwood consuming population %</th>
<th>Per capita consumption m³/year *</th>
<th>National fuelwood consumption Total $10^6$ m³</th>
<th>Annual increment 1975-1980 $10^3$ m³</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSTA RICA</td>
<td>1.35</td>
<td>50.3</td>
<td>0.93</td>
<td>1.8</td>
<td>2.95</td>
<td>27.1</td>
</tr>
<tr>
<td>EL SALVADOR</td>
<td>4.28</td>
<td>77.0</td>
<td>3.30</td>
<td>1.9</td>
<td>6.26</td>
<td>--</td>
</tr>
<tr>
<td>GUATEMALA</td>
<td>6.81</td>
<td>80.0</td>
<td>5.45</td>
<td>1.3</td>
<td>7.08</td>
<td>90.2</td>
</tr>
<tr>
<td>GUATEMALA</td>
<td>3.44</td>
<td>78.5</td>
<td>2.74</td>
<td>1.7</td>
<td>4.65</td>
<td>124.7</td>
</tr>
<tr>
<td>NICARAGUA</td>
<td>1.85</td>
<td>80.3</td>
<td>1.48</td>
<td>1.5</td>
<td>2.22</td>
<td>26.5</td>
</tr>
<tr>
<td>PANAMA</td>
<td>1.93</td>
<td>96.1</td>
<td>0.63</td>
<td>1.1</td>
<td>0.73</td>
<td>5.3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23.06</td>
<td>72.6</td>
<td>14.56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** The figures in this table were derived from several documents, including national energy balances, and presented in:
- El Salvador : ROCAP, 1975
- Guatemala : Martínez, 1981
- Honduras : Jones and Pérez, 1982
- Nicaragua : Jones and Otárola, 1981
- Panama : Jones, 1982 a)

* Figures only apply to fuelwood-consuming population, and on the assumption that 600 kg of air-dry wood is equivalent to 1 m³ (solid volume)
population due to poor transport on the one hand, and the simple factor of distance, on the other.

Most fuelwood must be produced in the largely deforested highland and dry lowland areas. While some fuelwood may come from remnant forests of these areas, the major sources are fallow lands, on farm forests and other agroforestry combinations, such as windbreaks, living fences, etc. Fuelwood production then, should be seen as a strategy of land management integrated into farming practices, and could be said to constitute "small farmer forestry". It is interesting to note that this small farmer forestry is by far the most important part of all forestry production of the isthmus. Gewald (1980 - see table) has noted that 80% of all utilized wood production is fuelwood; construction timber, either in the form of precious hardwoods for export, or in the form of local construction material, makes up only 20% of all wood exploited. ¹

This last point suggests the need for a reconceptualization of tropical forestry. Up until recently, virtually all forestry research has been dedicated to the improvement of management techniques, genetics and harvesting of a few tropical timber species which make up the category of construction timber. While

¹ Fuelwood production is not a major cause of deforestation, despite its large scale consumption. In Panama, for example, fuelwood would account for only 25% of the area deforested in one year (Jones 1982) if all fuelwood was extracted from primary forests.
Table 5. Fuelwood production and total timber production in Central America (1977).

<table>
<thead>
<tr>
<th>Country</th>
<th>Fuelwood &amp; Charcoal (1000 m³)</th>
<th>Other timber production (1000 m³)</th>
<th>Total Volume (Exploited) (1000 m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guatemala</td>
<td>5120*</td>
<td>486</td>
<td>9</td>
</tr>
<tr>
<td>Honduras</td>
<td>3000*</td>
<td>1175</td>
<td>28</td>
</tr>
<tr>
<td>El Salvador</td>
<td>2947</td>
<td>79</td>
<td>3</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2135*</td>
<td>880</td>
<td>29</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2371*</td>
<td>1434</td>
<td>38</td>
</tr>
<tr>
<td>Panamá</td>
<td>1400</td>
<td>120</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>16973</strong></td>
<td><strong>4174</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

*FAO estimates
these species obviously are the most important export timbers for tropical countries, the shortcomings of a concentration of development investments in export products has been recognized by both for forestry (Westoby 1979) and for agricultural development in a more general sense (De Janvry 1981).

Most tree management in Central America is in the form of on-farm forestry production. This type of "agroforestry" production has been overlooked for many years simply due to a lack of understanding. The contribution of agroforestry to wood production was assumed to be unimportant since it did not involve common commercial forestry species, and only with the awakening of interest in more generalized problems such as watershed management and fuelwood production has the importance of agroforestry been recognized. Fuelwood project surveys (in the four countries for which appropriate data are available) reveal that the majority of small farms have agroforestry components, not only in the form of fruit trees, but also as living fences and dispersed "plantations" of valuable timber species (see table). More significantly, in Central American countries, formal reforestation in plantations amounts to no more than a few thousand hectares annually per country (as compared to an annual deforestation of nearly .5 million hectares; FAO 1981). In contrast, in Nicaragua, living fences alone represent an equivalent of 50,000 ha. in terms of number of trees planted (Jones 1981).
Table 5. Tree components on small farms of Central America

<table>
<thead>
<tr>
<th>Country</th>
<th>Fruit</th>
<th>Saw timber</th>
<th>Live fences</th>
<th>Shade for coffee</th>
<th>Shade for pastures</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSTA RICA</td>
<td>98.4</td>
<td>24.0</td>
<td>85.0</td>
<td>45.4</td>
<td>--</td>
</tr>
<tr>
<td>HONDURAS</td>
<td>53.2</td>
<td>14.6</td>
<td>19.5</td>
<td>14.6</td>
<td>1.2</td>
</tr>
<tr>
<td>NICARAGUA</td>
<td>78.0</td>
<td>42.0</td>
<td>50.0</td>
<td>11.0</td>
<td>4.0</td>
</tr>
<tr>
<td>PANAMA</td>
<td>94.4</td>
<td>42.5</td>
<td>86.8</td>
<td>6.4</td>
<td>12.4</td>
</tr>
</tbody>
</table>

Small farms have been defined as those having less than 20 hectares.

Honduras: Jones and Pérez, 1982.
Nicaragua: Jones and Otárola, 1981.
Panama: Jones, 1982.
CONCLUSIONS

While the conclusions of this research have a clear importance for energy problems, they go beyond any single issue. A primary conclusion is that fuelwood is the major fuel in Central America, and by implication, in much of the developing world. Any attempt to resolve energy problems in the third world must begin with the problem of fuelwood.

A secondary conclusion is that fuelwood production is the major, if most misunderstood, forestry activity in Central America. Agroforestry systems represent a major store of "indigenous technical knowledge" (Brokensha 1980), both with regard to the physical characteristics and the management techniques or many tropical forest species. Farmers are at the same time the major producers of timber products, and the major destroyers of tropical forests, and as such, are a group which must be taken into account in all considerations of tropical forestry research.

A series of crucial social forestry research problems can be identified. As knowledge of farm forest relationships has become more complete, it has become increasingly clear that farmers are not inevitably enemies of forest production. Farmers have an interest in on-farm forestry as evidenced by the incidence of
agroforestry combinations on farms, both for the production of fuelwood and other timber products, and for the other benefits derived, such as protection of soil, crops and animals from the effects of the elements. The common image of farmers as inveterate deforesters helps illustrate the depth of our misunderstanding of on-farm forestry, and clearly indicates a need for research.

Little research has been done on successful and stable fuelwood producing agroforestry systems, and it can be expected that the systems which are now in practice may help outline forest development strategies in the future to solve problems inherent in forestry production. One such problem which should be kept in mind is that fuelwood production is not currently economically feasible using plantation forestry techniques. Nevertheless, the decision making process of farmers in the establishment, management and harvesting of agroforestry systems is a topic which lacks baseline holistic research. On-farm forestry production produces multiple benefits, and research is required which focuses on all aspects to avoid fundamentally misunderstanding the nature of these agroforestry systems. Farmers are the most important timber producers in Central America in terms of volume, and total land area affected. Any attempt to address tropical forestry problems without an adequate understanding of farmers' activities ignores the central actors in forestry.
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