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FUELWOOD AND CHARCOAL SUPPLY, DISTRIBUTION AND

CONSUMPTION IN THE CHOLUTECA RIVER BASIN

PETER HUGHES HALLETT

May 1980

I N T R O D U C T I O N

In the context of ever-rising oil prices, it becomes increasingly important for non oil-producing countries to investigate and develop alternative energy sources. In Honduras, fuelwood has traditionally been the fuel-source for cooking and for some industries. Recently, the price of fuelwood has increased and it has become more difficult to obtain it. Certain production areas are being depleted, while at the same time demand continues to increase.

The object of this study has been to calculate the supply and demand for fuelwood and charcoal in the Choluteca river basin, with a view of analyzing the feasibility of establishing fuelwood plantations.

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1.1. USE OF FUELWOOD FOR COOKING IN THE WATERSHED AREA-GENERAL

Despite an increasing use of Kerosene and butane fuel stoves, fuelwood remains by far the major energy source for cooking. In the rural areas fuelwood is universally used, and in the small towns an average of less than five per cent use kerosene or butane. In the cities however the use of fuelwood for cooking has declined and in Tegucigalpa nearly two thirds of the households use alternative fuels.

Fuelwood too is an energy source for some industrial processes. Salt production, brick-making, lime production, bread making, coffeedrying all utilize considerable quantities of fuelwood. Unfortunately precise figures on quantities used for industry are impossible to calculate due to the dearth of information about small industries, especially in the rural areas. In view of this, some very broad estimates must be made.

In the small towns and villages fuelwood is still relatively cheap and readily available. Kerosene is usually available too, but it is more expensive than in the cities and it is often diluted. In the cities the converse exists. Fuelwood is more expensive and kerosene is relatively cheaper. Additionally there are also butane gas suppliers and a constant supply of electricity.

Another reason for a comparatively lesser use of fuelwood in the capital city is that the kitchens of the houses in the popular housing estates are much too small to permit the use of fuelwood stoves and the roofs are made of asbestos sheets which would not permit the smoke to filter through. Also many houses are rented and owners discourage the use of smoky fires which reduce the value of the property.

Consequently, viewing the watershed as a whole, the major users of fuelwood are the villages, which account for almost 80 percent of the total consumed.

The cities and the small towns combined consume a mere twenty percent of the total.

Consumption of fuelwood for cooking in the Choluteca Watershed

Cities	1,570,000 cargas	(196,250m ³) *
Small towns	500,000 cargas . .	(62,500m ³)
Villages	<u>7,500,000 cargas . .</u>	<u>(937,500m³)</u>
TOTAL	9,570,000 cargas .	(1,196,250m ³)

1.2 USE OF FUELWOOD IN VILLAGES

At four a.m. the housewife has already got the water for the coffee on the boil. In order to light the stove she uses dried corn sheaths and the driest firewood. In the wet season some wood is stored overnight in the fireplace with the purpose of drying it out to make lighting it easier the next morning.

Typically wood burning stoves in the rural areas of the Choluteca river basin are made in the following manner.

A base is built up from the floor with a mixture of stones and mud. The width is usually about two and a half feet and the length about four feet. The height depends on the person who will use it: they are generally built to be waist high. On top of this base the stove is formed.

A length of about one foot is left on which the fire wood will rest when it protrudes from the stove. The sides are built up of mud and the top is reinforced with pieces of tile. Sometimes pieces of iron (usually an old machete) are used for the divisions between burners.

A typical stove has three burners. There is considerable variation in stove design and some are made with ovens.

Chimneys are not used; the smoke being allowed to filter through the tiles of the roof and to escape through the window.

According to F.A.O., Honduras, 1 cubic meter of fuelwood is equivalent to 8 cargas.

Shortly after heating the coffee, the first of about one hundred tortillas are made and at the same time the beans are heated up. Four hours later, at about 8 a.m. this breakfast cooking is finished, but the fire is not allowed to die out because soon it will be used for preparing lunch.

After lunch the maize meal and beans are cooked. This is a lengthy process and slower burning wetter wood is used. In the afternoon no more fuelwood is used until about five o'clock, when the evening meal is prepared.

Adding up, the kitchen fire is blazing between eight and ten hours per day, which results in a considerable usage of firewood. Field interviews indicated that one carga (125 kg) of fuelwood lasted an average of three days. A years supply would be approximately 125 cargas (15,625 kgs.) or $15,625\text{m}^3$ of fuelwood per household.

The type of fuelwood used is very variable and is more dependent on availability than choice. No one type was common to all the communities visited, although the lowland communities displayed a wide range of different species used. The communities at higher altitudes had a more limited selection.

The preferred types were encino (*Quercus laurifolia*) and quebracho, not only because they burned better but also because their ash is added to the maize (nixtamal) so that it boils faster, can be used to make soap, to wash dishes and to kill chicken lice. For all these purposes encino (*Quercus laurifolia*), quebracho and oak (*tabebuia rosea*) ash were recognised as being better and more potent.

If there are an estimated 60,000 rural households in the watershed area, their total annual fuelwood consumption for cooking can be calculated at 7.5 million cargas or $937,500\text{m}^3$.

1.3 USE OF FUELWOOD IN SMALL TOWNS

According to both the national census information and the data collected by the National Economic Planning Council (CONSUPLANE), more than 95 percent of the households in small towns use fuelwood for cooking.

Some of the information obtained displays such variability as to doubt its accuracy, but there does appear to be greater consumption of fuelwood per household in the lower areas. This can be explained by the fact that firewood used in the lowlands usually has a smaller diameter and therefore burns faster.

In comparison with fuelwood use in the villages, there is a lower consumption level per household. A carga of wood, instead of lasting just three days as it does in a village, lasts four or five days in a small town. This is for three basic reasons. Firstly, most of the wood is bought which means that it must be used more economically. Secondly, on average, the people in the towns get up later than the people in the villages, which means that the stove is lit later and burns for a shorter period. Thirdly, people in the small towns eat comparatively less tortillas and beans, which require more cooking time.

Stove design is little different from that of the villages, though there is an increasing tendency to use brick instead of mud, which reduces maintenance. There is a greater variation of species used for fuelwood in the lowland areas than in the highland areas, where oak and pine are used almost exclusively.

If there are an estimated 6,000 households in small towns in the watershed area, their total fuelwood consumption for cooking can be calculated at 500,000 cargas or 62,500M³.

1.4 USE OF FIREWOOD IN THE CITIES

During the study, four cities were visited, three, because they fell directly within the watershed area, and one because it uses wood cut in the watershed area (Danlí). There was so much difference between them as regards percentage of households using fuelwood, type of wood used etcetera, that each one must be considered separately.

1.4.1 Choluteca:

According to the 1974 national census, 78 percent of the 5,700 households in Choluteca used fuelwood for cooking. The types used are mainly carbon (Mimosa tenuiflora), Salamo and carreto.

Daily use can be calculated at 0.226 cargas per family, which means that total annual consumption for the city is approximately 350,000 cargas or 43,750M³.

1.4.2 Danlí:

In 1974 Danlí had a total of 1,877 households. Assuming a 4% yearly increase, the number of households can now be estimated at 2,300. According to the 1974 census, 81% of the households used fuelwood for cooking. This percentage has probably declined slightly since then.

The average household uses about one carga per week, according to the CONSUPLANE figures, though this may be under-estimated. The types of wood used are oak logs (Tabebuia rosea) and off-cuts of pine (Pinus oocarpa) from the lumber mills.

Total annual consumption for cooking can be calculated at about 100,000 cargas or 12,500M³.

1.4.3 El Paraíso:

In 1974, El Paraíso had a total of 1,096 households, of which 89 percent used fuelwood for cooking. Household use is approximately one carga of oak logs every three days. This gives a total yearly consumption for cooking of about 120,000 cargas per year or 15,000M³.

1.4.4 Tegucigalpa:

The 1974 census showed that 41 percent of the 47,031 households in Tegucigalpa were using fuelwood for cooking.

Since then that percentage has undoubtedly declined, but at the same time the total population has grown. Individual interviews indicate that in many cases fuelwood is only used when continuous heating is required, as with beans or maize meal (nixtamal). Also fuelwood cooking is concentrated in the lower income areas of the city. There are some parts that use no fuelwood at all, since the high income permits people to use the more convenient alternative energy sources (butane, kerosene and electricity).

Additionally, less beans and tortillas are consumed in the higher income families.

The type of wood used is waste from the lumber mills and oak, pine and encino logs. Personal observation indicates that small quantities of other species also find their way into the wood pile.

Consumption can be estimated at approximately one carga per household per week. Assuming no increase in the total number of fuelwood burning households since 1974, then total annual consumption for Tegucigalpa is about 1 million cargas or 125,000M³. Unfortunately these figures do not tally with the forestry Departments records of fuelwood permits (total 27,247M³). A part of the difference can be attributed to the use of saw mill waste and to contraband fuelwood. Also, the price of kerosene was maintained

artificially low until 1978. At the same time, the price of fuelwood was rising steeply because of increased diesel and transport costs. It is possible that a considerable number of people could have changed from fuelwood to kerosene, and the total annual fuelwood consumption estimate could be reduced by a third for Tegucigalpa.

2. FUELWOOD USE FOR INDUSTRIAL PURPOSES

2.1 General

The following industries are the principal users of fuelwood: Bakeries (13,125M³), salt producers (2,500M³), brick works (60,000M³) and coffee driers (26,750M³).

Other industries that use lesser amounts are ceramics (450M³) and tile producers (1,875M³). Lime kilns also use fuelwood, but the lime suppliers for the watershed area are situated outside it, in Talanga. Total fuelwood use for industry can be calculately very roughly at 85,000M³ or less than 7 percent of the total.

The types of wood depend on availability and the industry. The coffee driers in El Paraíso which require large quantities, use specially cut large pine logs for which they pay L.12.00 per cubic meter (L.2.00 per carga). Brick kilns on the other hand make use of lumber mill waste, which can be bought very cheaply in some areas. Bakeries must use only oak logs, since pine logs, though cheaper, are smoky and not so steady burning.

2.2 Bakeries

In Tegucigalpa there are at least 50 bakeries, and only a small percentage (8%) do not use firewood. The smaller ones are completely dependent on fuelwood, but others have diesel or electric ovens. The type of wood used is oak or encino in most cases, but the quantities used are very variable, depending on the size of the enterprise.

One problem experienced with fuelwood in comparison with other fuels is the un-uniformness of the way it burns. Also, in the wet season fuelwood, being damper, burns slower than in the dry season.

An average bakery uses 5 cargas per day to bake 12 quintales of flour. Assuming that baking is done at least 300 days per year, annual consumption

per bakery can be calculated at 1,500 cargas ($187.5M^3$). In the watershed areas there are approximately 70 large and medium sized bakeries, which together require about 105,000 cargas ($13,125M^3$) of fuelwood per year.

2.3 Salt Producers

The gulf of Fonseca supplies salt for all Honduras.

The total number of households is approximately 500,000 and the average household consumes about 2 pounds of salt per week. Total salt production in Honduras is probably about 500,000 qq. Most of the salt is produced in the department of Valle, but a certain amount (5 - 10%) is made in the Monjarás area.

Salt is produced during the last four months of the dry season (January-April). Pools of sea water are cut off from the sea by dikes and left to evaporate by the heat of the sun. After reaching a certain concentration, the concentrated salt water is heated in drums, boiling off the water and leaving the salt.

Some of the fuelwood is obtained from the nearby mangrove swamps, but the rest must be brought by truck and ox-cart. It takes about 2.5 cargas of wood to produce 1 quintal of salt. Total fuelwood requirements for salt production in the Choluteca River basin can be estimated at 20,000 cargas or $2,500 M^3$.

2.4 Coffee Driers

In the town of El Paraíso there are thirteen different coffee drying establishments, with a total of 60 wood burning metal ovens. Each oven consumes about 500 cubic meters of wood during the three month long harvest season (December, January and February). The wood used is pine, and must be brought from cutting areas about 35 kilometres distant. Wood carting takes place in the dry season, since from May onwards the rains cause the access roads to become impassable.

The wood is bought from the truckers for L. 12.00 per cubic metre, a truck load being worth about L.144.00. The truckers expenses are the following:

COHDEFOR	L. 12.00
Cutting and splitting	24.00
Saw costs	12.00
Other costs	6.00
Truck costs and diesel	60.00
Helper	<u>10.00</u>
TOTAL	L.124.00
Profit	20.00

2.5 Brick Manufacture

The houses in the villages are usually made of sticks and mud or adobe bricks. In the small towns too, the use of adobe is general, but in the larger towns many houses are made of baked bricks and concrete blocks.

Baking the bricks is done with firewood. The type used depends on availability. Danlí has 10 saw mills and waste from these mills is used to fire the brick kilns. Depending on the oven and the wood, it takes about 1 cubic metre of wood to bake 1,000 bricks. An average brick works produces between 10,000 and 20,000 bricks per week, for which it would require between 10 and 20 cubic metres of wood.

In the watershed area there are probably around 75 brick works, which would require a total of 60,000M³ of fuelwood per year.

2.6 Roof Tiles

Tile making is often a seasonal activity, although there are some producers who work the whole year through.

In the wet season the process takes longer, the wood being wetter and the whole process more difficult. The tiles are formed and then sun dried.

After this they are baked in an oven that may contain between a thousand and two thousand tiles.

It takes about 1 carga of wood to bake a thousand tiles. A small manufacturer might bake once a week or more, the baking part of the process only taking a day.

There are very many small producers and tiles are used for roofing in the villages and in the small towns.

Fuelwood use for tile manufacture can be guessed at 15,000 cargass. ($1,875M^3$)

2.7 Ceramics

Ceramics is another industry that uses firewood for heating the ovens. Producers use an average of three cargass per baking, and normally bake twice a month. The total number of potteries is approximately 60, with an average consumption of 60 cargass per year ($7.5M^3$).

The total quantity of fuelwood used by ceramics industry is approximately 3,600 cargass ($450M^3$).

3.1 FUELWOOD SUPPLY - General

Total fuelwood consumption for the Choluteca River Basin is calculated to be approximately 1,300,000 cubic metres or the equivalent of 100,000 truck loads. The major part of this is merely carried by the campesinos from the place of cutting to their back yards, an average distance of 2 kilometres. Consequently this very considerable proportion of the fuelwood used in the watershed area does not enter into a more complex supply system.

Of the remainder, only twenty percent of the fuelwood used in the small towns is brought in directly by the consumer. 331,250M³ are either sold directly by the producer to the consumer or through middle men. The latter is the typical case for the cities, where production areas are up to 40 kilometres distant from the market.

The price of fuelwood is variable, being two and a half times greater in Tegucigalpa than in the small towns. This reflects the much greater distance that the wood must be transported in the case of the capital city and the number of hands it must pass through. Also the price is variable according to the type of wood, oak and encino logs being worth more than pine logs. The cheapest fuelwood is waste from the saw mills.

3.2 FUELWOOD SUPPLY - VILLAGES

In the villages an average household uses one carga of fuelwood every three days. Only on rare circumstances is it bought, in which case a person is hired to cut and fetch a number of loads. Such a case would be a family with no boys of seven or older, when the man is away working.

The general rule is that fuelwood collecting is an activity carried out by all members of the family in different degrees, with the major responsibility falling on the father and sons.

A considerable proportion of the fuelwood used in the villages is produced from the land clearing (descombros).

The farmer prefers to sow in land that has a thick stand of undergrowth. This must be hacked down before, ~~burning and then sowing.~~

When the land is being cleared, all wood that can serve as fuelwood is thrown into the bare border around the edge of the field (la ronda). This wood is then left there until needed, or alternatively carted immediately to the house. The decision to take it all at once or remove it bit by bit depends on the nearness to the village. The nearer the field is to the village, the greater the possibility that the wood would be robbed.

Fuelwood resulting from land clearing can last a family four or five months. However not all land has to be cleared before sowing. Low scrub (quamil), produces no firewood at all.

Consequently much firewood must be cut specially. This is a big problem in the more densely populated areas. About a third of the families have no land and must rob all their fuelwood, and many others have such small amounts of land that the fuelwood on it is quickly exhausted. Thus they must go and cut down branches and trees in very sloping land belonging to others, and which at times have been allowed to grow by the owners with a view of producing posts.

Boys, on being ordered to fetch a load of firewood do not ask the owners permission and nor are they respectful of their wishes. The best wood is taken first and sometimes fence posts are removed as well.

This is often the cause of disputes and hostility between people in the communities.

On a much smaller scale, some fuelwood results from the pruning of trees bordering fields. This is done with a view to reducing the shade which limits plant growth. The cut down branches are used for posts and firewood.

In the event of fuelwood running out at home and non-one else being available, the wife goes out with a machete to cut down and gather a bundle of wood.

3.3 FUELWOOD SUPPLY - SMALL TOWNS

In the small towns households use approximately one carga of fuelwood every four or five days. The percentage of people buying fuelwood varies from 95% to 54%, with an average of about 75%.

Prices varied between L.1.00 per carga (L.8.00 per M^3) in a small southern town to L.3.50 per carga (L.28.00 per M^3) in Valle de Angeles with an average of about L.2.00 per carga (L.16.00 per M^3).

The wood for the small towns is cut in the nearby hills or brought in from neighbouring villages.

In a small town there are a few people who can be hired to cut and fetch fuelwood, though generally this is not their full-time job. At other times they work as day labourers (mozos).

A person can cut between 6 and 7 cargas ($0.8125M^3$) per day, but another day must be spent on transporting the product from the place of cutting to the town. Thus an average of 3.5 cargas ($0.4375M^3$) are cut per day, which produces an income of L.7.00. However mule costs must be subtracted from this (L.2.00 per day) and so the average daily income would be L.5.00. The value of the tree itself is not taken into account.

Campeños in neighbouring villages also supply the small towns with fuelwood. This can be brought in on mules or on ox carts, depending on the ease of access. In 1979 an ox cart load of fuelwood was worth about L.12.00 which is the equivalent of L.1.10 per carga or L.9.60 per cubic metre.

3.4 FUELWOOD SUPPLY - CITIES

3.4.1 Choluteca

Most of the fuelwood for Choluteca comes from areas to the South and West not further than 20 kilometres. However, sometimes it is brought from places

as far away as the El Salvador frontier (85 Kms.), but only as a way of using the truck to haul something on the return journey.

The standard system is for a truck to go out and buy up logs that have been stacked up on the side of the road. Wood can be bought in this fashion for L.15.00 per Pick-Up load (10-12 cargass) in the dry season (L.12.00 per M^3). In the wet season the price rises in view of the greater difficulties experienced transporting it to accessible places. Also, during the wet season, campesinos are busy in agricultural activities, and so there is greater demand on their time.

Additionally a number of people living in Choluteca make a living taking out hand carts in the early morning and filling them up with dry wood gathered in the hills near by.

Currentlly wood is selling in Choluteca at L.4.00 per carga of 40 logs or L.0.10 per log. (L.32.00 per M^3)

Sometimes the wood is not sold directly by the hauler to the user, but through an intermediary. This takes the form of a house where logs can be bought in small quantities. The owners buy whole truck loads at approximately L.60.00, and which will yield L.80.00 on being sold piece meal.

3.4.2 Danlí

The people of Danlí are supplied with firewood by Pick-Up trucks and hand-carts. There are also some people who bring it in on mules. In Danlí there are two types of wood used, waste pine from the lumber mills that is very cheap, and oak logs that fetch L.2.50 per carga of fifty logs (L.20.00 per M^3) in the dry season and up to L.4.00 per carga (L.32.00 per M^3) in the wet season.

In the case of small operator, using a hand-cart and who does not have land of his own, the cost are the following for producing 40 cargass of logs ($5M^3$).

COHDEFOR	L. 7.00
Property Owner	<u>L. 12.00</u>
T O T A L	L. 19.00

Production 40 cargas of logs a. L.2.50/carga.

Days work 6

Wage per day L. 13.50

3.4.3 Tegucigalpa

Fuelwood use for domestic purposes is limited to the poorer barrios (districts) of Tegucigalpa. Early in the morning trucks cruise round these barrios, the helpers on the back shouting "firewood! firewood! oak and pine!".

The customers stop the truck and buy according to their needs. At present the price of fuelwood in Tegucigalpa is L.6.00 per carga of pine logs (L.48.00 per M³) and L.7.00 per carga*of oak logs (L.56.00 per M³).

The same firewood has been bought in small towns and villages up to 40 kilometres distant from Tegucigalpa at a price of L.2.00 or L.2.50 per carga (L.20.00 per M³). The wood is piled up at accessible points and sold to the trucker.

A cutter, if he does not have land, may pay up to L.1.00 per carga to the owner, and can cut about 6 cargas of wood per day.

The truck can carry between 30 and 40 cargas. The costs are as follows, the truck making one trip per day.

* In Tegucigalpa a carga consists of 60 logs.

Diesel	L. 40.00
Oil	2.50
Tires	6.00
Driver	15.00
Helpers (2)	18.00
Tax municipality	20.00
Tax COHDEFOR	10.00
Wood (40 cargass)	<u>100.00</u>
T O T A L	L.211.50

Worth of wood in Tegucigalpa: 40 x L.7.00

= L. 280.00

Profit per trip = L.68.50

In view of the profitability of transporting and selling fuelwood, there has been an increase in the number of truckers, thus creating competition between them for a limited supply of wood. Thus, not all the trucks can be used for transporting fuelwood every day, and some must find alternative work or stand idle.

It has also been noted that certain areas are being exhausted and it is now necessary to go further afield to find firewood.

About 60 percent is brought into Tegucigalpa through fire-wood producer cooperatives of which there are a total of six. The remainder is brought in through individuals who must obtain a special temporary license from COHDEFOR.

The license costs L.0.25 per carga, plus the costs of stamps and papers.

The license not only stipulates the amount of fuelwood that may be cut, but also the time it must be cut in and the place. The control is enforced through COHDEFOR check points and offenders are liable to fines and the confiscation of the load. Unfortunately the check points are not manned

round-the-clock and the truckers are in the habit of arriving in Tegucigalpa in the late afternoon or in very early hours of the morning. Receipts of quantities brought in are dropped into the check-point post box. Thus it can be seen that much depends on the truckers' honesty.

Fuelwood for Tegucigalpa is brought from the following areas:

<u>Origin</u>	<u>Quantity (cargas)</u>	<u>Percentage</u>
Distrito Central	33,788	15.5
Guinope	1,600	0.7
Lepaterique	9,225	4.2
Maraita	7,226	3.3
Ojojona	71,470	32.8
Sabanagrande	1,750	0.8
San Antonio de Oriente	2,775	1.3
San Buena Ventura	16,051	7.4
Santa Ana	4,200	1.9
Santa Lucía	1,825	0.8
Reitoca	655	0.3
Talanga	56,335	25.8
Tatumbula	2,030	0.9
Valle de Angeles	9,050	6.1
T O T A L	217,980	100.0

(Data from COHDEFOR: Francisco Morazán Forestry District: 1979).

It can be seen that although the number of producing areas is large, almost three quarters comes from the Central District, Ojojona and Talanga.

Another source of firewood of considerable importance is the waste from the saw mills. This is removed from the lumber mills in push-carts and taken to distribution sites. The wood is pine and the pieces are of different shapes and sizes. The advantage for a poor person who cannot afford an oak log costing L.0.20, is that with L.0.10 he can buy enough saw-mill waste to cook a meal on.

At present the price is between L.6.00 and L.7.00 per carga (L.48.00 - L.56.00 per M³). As the rainy season proceeds the price will rise, reflecting the difficulties experienced in obtaining wood, due to poor access to the production areas. Early on in the wet season truckers have large stacks of wood, but this buffer store decreases as the season proceeds.

4. Charcoal

In comparison with firewood, very little charcoal is used in the Choluteca River basin or in any other part of Honduras. It has two basic uses - one for barbequing meat and the other for blacksmiths' forges. In the first case charcoal from oak wood is used and in the second pine charcoal can be used since it is twenty percent cheaper. The national census of 1974 found no significant number of people using charcoal for cooking.

There is no on the street selling system of charcoal as there is for firewood. Some pulperias (general stores) sell small quantities, but the normal place to obtain it in Tegucigalpa is in the San Isidro-Las Américas market where there are about fifteen stalls that sell it. The volume of sales is small, and most of the stalls also stock other products.

Charcoal retails at L.1.00 per drum for oak charcoal, L.0.80 per drum for pine charcoal, or L.0.50 per 2 1/2 lb. bag.

It is bought wholesale for L.10.00 per carga (75 lbs.) and so the gross profit per carga is L.5.00 (50%).

Average sales per stall are very small (2-3 cargas), and so total sales for the market can be calculated at about 40 cargas per day (30.00 qq).

The low volume of sales is reflected in the reduced production. In 1979 only three charcoal permits were applied for from COHDEFOR, to produce a total of 220qq. COHDEFOR permits can be obtained at L.1.00 per quintal.

In 1980 the charcoal sold in Tegucigalpa comes from Santa Lucía. No permits have been issued, and the obvious conclusion is that it is being brought in contraband. As well as the occasional truck load, charcoal is also brought in on buses.

Being contraband, and burning being done in out of the way places, reliable information is difficult to obtain.

For a producer without land, the costs involved are his own work, the cost of donkeys and the cost of buying the tree. (L.3.00) which will yield about one carga of charcoal.

Total production in the Choluteca river probably does not exceed 15,000 qq.

5. METHODOLOGY OF THE SURVEY

In view of the short time available and limited objectives of the survey, it was decided to use the following methodology:

1. To obtain information about consumption and production of fuelwood in the villages, twelve in depth interviews were carried out. Consumption per household was calculated on the basis of information obtained in 113 farmer interviews carried out during an investigation of farmer's attitudes towards erosion.
2. Data about consumption at small town level were obtained from the Energy Department of CONSUPLANE. In June of 1979, personnel of CONSUPLANE conducted an extensive investigation of fuelwood consumption, concentrating mainly at small town level with approximately 40 interviews per town. Some villages were surveyed too, but these tended to be larger and more accessible ones.

During the CONSUPLANE survey, interviewers, equipped with weighing scales and tape measures, even went to the extent of weighing and measuring samples of logs.

Unfortunately the questionnaire was so short that no questions were included that could be used to cross-check some of the answers given. Additionally, some interviewers appear to have concentrated on one aspect, while others concentrated on others. These differences appear from town and from area to area, thus making it difficult to compare them.

3. The calculations of total numbers of houses using fuelwood for cooking were obtained from the national census of 1974, where a question was included about cooking fuel. Information for this part of the census was sought at town and city level.
4. Producers and distributors were interviewed to investigate the production and distribution systems. Truck drivers and owners were

interviewed at home, since when they were working it proved difficult to obtain reliable information.

5. In order to obtain an information about fuelwood supply areas for Tegucigalpa, COHDEFOR Francisco Morazán Forestry District files were consulted.
6. Different types of small industries were visited to acquire information about quantities used, output, supply systems, etc.
7. Certain information was obtained from housewives about cooking with fuelwood.

6. CONCLUSIONS

A total of approximately 1,300,000 cubic metres of fuelwood are used annually in the Choluteca River Basin. Domestic use accounts for 1.2 million cubic metres (93%) and industrial use requires an additional 85,000 cubic metres (7%). The major part (937,500 M³) is used for cooking fuel in the villages, where annual consumption exceeds 15 cubic metre per household.

Three quarters of the fuelwood is cut and carried home directly by the consumers, and consequently only one quarter (331,250M³) enters the market. Of the fuelwood that is bought, 26% is for industrial use and 74% is for domestic use.

In the cities the percentage of families using fuelwood has declined considerably in recent years, and there has been a corresponding increase in Kerosene, electricity and butane gas consumption for cooking. Until 1978, the price of Kerosene was maintained artificially low for the consumer by means of a government subsidy. Since then, this support has been removed and now kerosene prices are rising sharply in relation to fuelwood prices. Viewed over a period of six years, the prices of fuelwood, Kerosene and butane have risen equally.

In the past there has always been an abundant supply of fuelwood in Honduras. The cost to the consumer did not reflect the value of the raw material - only the cutter's work and transport costs. This situation is now changing as the supply areas are being depleted of their reserves. Even in the villages, people are beginning to complain about the high cost of firewood and the difficulties experienced in obtaining it.

In some areas there has been a rapid spread in the use of fuel-efficient Lorena stoves. The introduction of this technique to other areas will undoubtedly help to reduce the problem for a while, but it will have to be complemented with the sowing of fuelwood plantations.

At present, there is no effective organization of fuelwood producers or

distributers. There are a few fuelwood producing cooperatives, buth these only serve as a way of facilitating wood transporting permits from COHDEFOR to their members.

In the future the problem of fuelwood will become more acute. With the depletion of supplies in the existing production areas, suppliers will be forced to find fuelwood in new and more distant areas. This will cause them to incur greater transport costs which will be passed on to the consumer in the form of higher fuelwood costs.

At the same time there exists the probability that diesel, kerosene, and butane will all continue to rise in price. This will deter people from switching to kerosene or butane and so the demand for fuelwood, even in the cities, will continue at existing levels or rise.

A possible solution to this problem, in addition to the introduction of fuel-efficient stoves, will be the establishment of fuelwood plantations on the steep slopes near to the greater consumption areas and where prices are now comparatively high. Key target areas would be Tegucigalpa and Choluteca.

New fast-growing tree species will have to be introduced to obtain rapid production and for which it would be necessary to organize the producers.

At present, oak trees and encino are the main types of fuelwood used in Tegucigalpa. However, there have slow growth rates in comparison with other species like leucaena which can yield $10M^3$ per hectare per year. Even at current prices, a hectare could produce an income of L.160.00 annually.

Producer organization would be necessary to improve their bargaining capacity with the distributers and to facilitate the distribution of new fast growing species.

FUELWOOD WEIGHTS AND MEASURES

A major obstacle for calculating the national consumption of fuelwood is the system of measurement. There are various units, the smallest being a palo (log). The most general is a carga (a mule load), but its composition varies from 40 to 60 logs depending on the town.

Another unit used is a tercio hombre (a mans load), but this is often called a person carga or just a carga. This ambiguity can result in considerable mathematical error.

Similar problems are experienced with the term carretada (cart load) since this can refer to a hand cart or an ox drawn cart, which is much larger.

The energy department of CONSUPLANE has elaborated the following list of weights and measures:

1 carga (mule load)	125 Kg.
1 tercio hombre (mans load)	0.36 carga
1 tercio mujer (woman's load)	0.16 carga
1 tercio niño (child's load)	0.08 carga
1 carretada (ox-cart load)	10 cargas
1 truck load	72 cargas
1 carga (mule load)	50 logs
1 cubic metre (1 M ³) deciduous	750 Kg.
1 cubic metre (1 M ³) pine	625 Kg.
1 kilogram of fuelwood	3,600 kilocalories

NAMES OF SPECIES USED FOR FIREWOOD

- Acacia deamii* = biscuite
Alvarado amorphoides = Zorra, cola de zorra
Byrsonima crassifolia = nance, nancito
Cassia emarginata = pechoncillo
Cassia grandis = carao
Cassia spectabilis = frijolillo, vainillo
Didymopanax morototoni = guarumo macho, yarumo macho, mano de león
Enterolobium cyclocarpum = guanacaste, coracaste
Gliricidia sepium = malcarao, madre de cacao
Guazuma ulmifolia = caulote, tapaculo, guácimo
Inga vera subsp. *spuria* = guama, guaba
Leucaena Leucocephala - guaje, ipil-ipil
Mimosa tenuiflora = carbón, carbón de Comayagua
Pinus caribaea = pino costanero, pino del costa
Pinus oocarpa = pino ocote
Prosopis juliflora = mesquite, algarrabo, nacasol
Psidium guajava = guayaba, guava
Schizolobium parahybum = tombar, zorra
Simarouba glauca = negrito, aceitun
Tabebuia rosea = macuelizo, roble
Terminalia amazonia = guayabillo, cumbillo, nargusta, naranjo, cochun
Vochysia hondurensis = San Juan
Quercus laurifolia = encino
Cordia allidora = laurel

HOUSEHOLDS AND POPULATION IN VILLAGES AND TOWNS (1974)

	Total Households	Total Population	Town Household	Town Population	Village Households	Village Population
Cholulteca	9,718	49,327	4,681	26,152	5,037	23,175
Apacilagua	1,462	7,935	126	671	1,336	7,264
El Corpus	2,669	15,238	167	845	2,502	14,393
Marcovia	3,190	16,619	189	965	3,001	15,654
Morolica	968	4,473	176	864	792	5,609
Namasigue	1,731	9,399	152	816	1,579	8,583
Orocuina	2,150	10,717	194	1,028	1,956	9,689
Yusguare	752	3,990	191	1,022	561	2,968
Yuscarán	1,408	6,701	286	1,835	1,122	4,866
Alauca	881	4,436	61	408	820	4,028
(Danlí)	9,666	51,271	1,877	10,825	7,789	40,446
El Paraíso	2,794	15,181	1,096	6,709	1,698	8,472
Guinope	1,137	4,259	342	1,629	795	2,630
Jacaleapa	437	2,115	307	1,609	130	506
Liure	1,279	6,722	80	480	1,199	6,242
Morocelí	1,168	5,373	264	1,442	904	3,931
Oropolí	687	3,237	166	899	521	2,338
Potreriillos	310	1,612	43	258	267	1,354
San Antonio F.	609	3,117	59	381	550	2,736
San Lucas	1,132	4,758	175	913	957	3,845
San Matías	514	2,368	120	615	394	1,753
Soledad	1,505	7,710	90	438	1,415	7,272
Texíguat	1,260	6,358	114	675	1,146	5,683
Vado Ancho	536	3,041	38	206	498	2,835

HOUSEHOLDS AND POPULATION IN VILLAGES AND TOWNS (1974) (cont.)

	Total Households	Total Population	Town Household	Town Population	Village Households	Village Population
Yauyupe		1,331		321		1,010
D.C.	57,324	305,387	47,031	273,894	10,293	31,493
Lepaterique	1,460	6,868	169	1,316	1,291	5,552
Maraita	1,031	5,013	86	476	945	4,537
Marale	1,169	5,759	122	673	1,047	5,080
Nueva Armenia	631	2,736	144	670	487	2,066
Ojojona	1,110	5,066	193	1,004	917	4,062
San Antonio O.	949	4,611	36	401	913	4,210
San Buena Vent.	455	1,944	72	324	383	1,620
Santa Ana	923	3,827	108	477	815	3,350
Santa Lucía	492	1,778	118	622	364	1,156
Tatumbla	648	2,732	87	434	561	2,298
Valle de Angeles	865	3,654	222	1,433	643	2,221
Villa San Fco.	731	3,605	423	2,493	308	1,112

Source: National Census 1974

OCCUPIED HOUSES, ACCORDING TO TYPE OF COOKING FUEL IN MUNICIPAL

TOWNS IN 1974

<u>Choluteca</u>	<u>Total</u>	<u>Fuelwood</u>	<u>Fuel Used for Cooking</u>			<u>Electric</u>	<u>Not Cook</u>
			<u>Kerosene</u>	<u>Butane</u>	<u>Charcoal</u>		
Choluteca	4,681	3,651	494	385	1	8	142
Apacilagua	126	124					2
El Corpus	167	156	2	6			3
Marcovia	189	184	3				2
Morolica	176	169	2				5
Namasigue	152	149					3
Orocuina	194	169	9	1			15
Yusguare	191	187					4
<u>El Paraíso</u>							
Yuscarán	286	258	13	1	1		13
Alauca	61	60					1
Danlí	1,877	1,524	203	100			47
El Paraíso	1,096	958	74	33		3	30
Guinope	342	330	3	3		1	6
Jacaleapa	307	291	5	1			10
Liure	80	75		1			4
Morocelí	264	255		1			8
Oropolí	166	159	1				6
Potrerillos	43	41					2
San Antonio F.	59	57	1				1
San Lucas	175	170	1				4

El Paraíso (cont.)

	<u>Total</u>	<u>Fuelwood</u>	<u>Kerosene</u>	<u>Butane</u>	<u>Charcoal</u>	<u>Electric</u>	<u>Not Cook</u>
Soledad	90	87					3
Texiguat	114	114					-
Vado Ancho	38	37					1

Francisco Morazán

Distrito Central	47,031	19,223	15,201	9,051	38	1,511	2,007
Lepaterique	169	158	4	2			5
Maraita	86	85	1				-
Marale	122	119					3
Nueva Armenia	144	138	5				1
Ojojona	193	174	4				15
San Antonio C.	36	33	1	2			-
San Buena Ventura	72	68	2	1			1
Santa Ana	108	103					5
Santa Lucía	128	123	2	3			-
Tatumbula	87	85					2
Valle de Angeles	222	203	6	3			10
Villa San Fco.	423	396	7	1			19

Source: National Housing Census: 1974

DOMESTIC CONSUMPTION OF KEROSENE (for cooking) Honduras

Year	Total Houses	Houses that use kerosene	Consumption of kerosene (barrils)	Consumption of kerosene T. Cals
1961	325,492	12,747	32,960.1	42.85
1970	415,505	32,448	83,901.3	109.10
1978	516,074	74,446	192,496.1	250.25

The percentage of houses using kerosene has increased from 4% in 1961 to 14% in 1980.

Consumption per house is calculated at 108.6 galons per annum.

Secretaría Técnica CONSUPLANE, Departament of Energy.

Domestic Consumption of Butane gas in Honduras

Year	Total Houses	Houses using Butane	Consumption Barrels Butane	Consumption Butane T. Cals
1961	325,492	1,840	4,153.6	3.95
1970	415,505	10,170	22,957.1	21.81
1978	516,074	46,466	104,889.2	99.64

The percentage of houses using butane gas has increased from 1% in 1961 to 9% in 1978. Annual consumption per household is 16.93 twenty five pound cylinders.

Source: Secretaría Técnica CONSUPLANE, Departament of Energy.

DOMESTIC CONSUMPTION OF FUELWOOD (Honduras)

Year	Total Houses	Houses Using Fuelwood	Fuelwood Consumption (tons)	Fuelwood Consumption T. Cals.
1961	325,492	298,009	2,036,236	7,730.45
1970	415,505	350,532	2,395,115	8,622.24
1978	516,074	404,923	2,766,758	9,960.33

Secretaría Técnica CONSUPLANE, Department of Energy

Domestic Energy Source (T Cals)

Year	Fuelwood	Kerosene	Butane	Electric	Total
1961	7,739.45	42.85	3.95		
1970	8,622.24	109.10	21.81	42.92	8,706.07
1978	9,960.33	250.24	99.64		
Percentabe					
in 1970	98.2	1.24	0.25	0.25	100

Secretaría Técnica CONSUPLANE, Department of Energy

ENERGY CONSUMPTION 1973 - 1979 (Honduras)(Percentage of total Calories)

Year	<u>Total Energy</u>			<u>Commercial Energy</u>			<u>Non-Commercial Energy</u>		
	Total	Imported	Local	Total	Oil	Hidro	Total	Fuelwood and Charcoal	Bagazo
1973	100	43.5	56.5	55.0	43.5	11.5	45.0	39.9	5.1
1974	100	41.9	58.1	55.0	41.9	13.1	45.0	40.0	5.0
1975	100	44.3	55.7	56.9	44.3	12.6	43.1	38.2	4.9
1976	100	45.4	54.6	57.8	45.4	12.4	42.2	37.2	5.0
1977	100	47.8	52.2	60.0	47.2	12.2	40.0	34.6	5.4
1978	100	46.8	53.2	62.2	46.8	15.4	37.8	32.4	5.4
1979	100	48.0	52.0	62.9	48.0	14.8	37.2	31.7	5.5

Secretaría Técnica CONSUPLANE, Department of Energy

Town or City	Total Houses	Percentage Fuelwood use		Percentage Non-Buyers
		CONSUPLANE	National Census	
Distrito Central	47,031	-	40.9	0
Choluloteca	4,681	77.5	78.0	0
Danlí	1,877	29.5	81.2	7.7
El Paraíso	1,096	59.1	88.9	7.7
Villa San Fco.	423	98.1	93.6	46.1
Yuscarán	286	90.4	90.2	6.9
Guinope	342	87.5	96.5	37.1
Jacaleapa	307	100.0	94.8	39.0
Morocelí	264	100.0	96.6	20.4
Valle de Angeles	222	70.0	91.4	10.7
Lepaterique	169	100.0	91.5	26.8
Orocuina	194	97.5	87.1	5.0%
Yusquare	191	-	97.9	-
Ojojona	193	95.2	90.2	10.0%
Marcovia	189	-	97.3	-
San Lucas	175	-	97.1	-
Oropolí	166	97.8	95.8	33.3
Morolica	176	-	96.0	-
El Corpus	167	95.0%	93.4	25.0
Namasigue	152	-	98.0	-
Taxíguat	114	100%	100.0	20.9
Apacilagua	126	95%	98.4	37.5
Nueva Armenia	144	-	95.8	-
Santa Lucía	128	100%	96.1	25.0
San Matías	120	-	98.3	-

Town or City	Total Houses	Percentage Fuelwood use		Percentage Non-Buyers
		CONSUPLANE	National Census	
Santa Ana	108	100%	95.4	-
Maraita	122	-	98.8	-
Liure	80	-	93.7	-
Soledad	90	-	96.7	-
Tatumbra	87	-	97.7	-
Alauca	61	-	98.4	-
San Antonio	36	97.5	96.6	-
San Buena Ventura	73	-	94.4	-
Potrerillos	43	-	95.3	-
Vado Ancho	38	-	97.4	-

FUELWOOD PRICES IN TOWNS AND CITIES (June 1979)

Tegucigalpa	L. 5.00/per carga (40 logs)*	
Choluteca	3.50	L. 20.00/carretada
Danlí	2.50	
El Paraíso	3.00	
Villa San Francisco	2.50	
Yuscarán	2.00	
Morocelí	2.00	L. 12.00/carretada
Valle de Angeles	3.50	
Lepaterique	1.50	L. 12.00/carretada
Orocuina	1.25	L. 12.00/carretada
Ojojona	1.50	
El Corpus	2.50	
Apacilagua	1.00	L. 8.00/carretada
Nueva Armenia	1.50	
Santa Ana	2.00	

Source: **CONSUPLANE**, Department of Energy

* In Tegucigalpa the standard carga consists of 60 logs and costs L.7.50/carga.

MONTHLY PRODUCTION OF FUELWOOD BY COOPERATIVES IN THE
FRANCISCO MORAZAN FORESTRY DISTRICT (cargas)

<u>Month</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
January	8,971	9,079	9,234
February	6,302	4,882	6,816
March	5,449	5,188	8,882
April	1,764	5,189	7,137
May	4,133	6,782	8,158
June	6,087	5,633	7,685
July	5,918	8,857	5,481
August	6,349	7,851	8,553
September	5,786	7,576	4,545
October	5,372	7,798	9,131
November	5,631	9,880	10,789
December	<u>7,475</u>	<u>6,884</u>	<u>8,002</u>
TOTAL	69,057	86,229	94,413

Source: Distrito Forestal Francisco Morazán, COHDEFOR

FUELWOOD PRODUCTION BY COOPERATIVES IN THE FRANCISCO MORAZAN

FORESTRY DISTRICT: 1979 (cargas)

Month	D.C.	Lepaterique	Maraita	Ojojona	San Buena Ventura	Reitoca	TOTAL
January	0	0	473	7,971	790	0	9,234
February	0	0	597	6,219	0	0	6,816
March	0	0	519	6,303	2,060	0	8,882
April	0	0	80	5,917	1,140	0	7,137
May	0	0	402	6,111	1,040	605	8,158
June	0	0	999	5,561	1,125	0	7,685
July	0	0	462	3,904	1,065	50	5,481
August	0	0	618	7,935	0	0	8,553
September	0	395	293	3,032	825	0	4,545
October	0	827	748	5,954	1,602	0	9,131
November	0	400	737	8,012	1,640	0	10,789
December	558	602	526	4,551	1,764	0	8,002
T O T A L	558	2,225	6,454	71,470	13,051	655	94,413
%	0.6	2.4	6.8	75.7	13.8	0.7	100%

Source: Distrito Forestal Francisco Morazán: COHDEFOR

PERMITS FOR FUELWOOD: CENTRAL DISTRICT 1979 (cargas)

<u>A r e a</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>	<u>TOTAL</u>
Cantarranas	0	0	0	0	210	0	0	0	0	0	0	0	210
Distrito Central	5,050	3,630	2,925	2,300	3,190	0	1,500	2,650	4,865	1,400	2,620	2,100	32,320
Guinope	0	0	0	1,000	0	0	0	100	0	0	500	0	1,600
Lepaterique	2,500	0	0	300	40	0	0	200	300	500	3,160	0	7,000
Maraita	0	0	0	0	0	100	0	0	100	72	500	0	772
Sabanagrande	50	0	1,050	0	0	0	0	0	0	0	500	150	1,750
San Antonio O.	250	325	200	300	0	200	600	400	0	300	200	0	2,775
San Buena Vent.	1,000	0	0	1,000	0	0	0	1,000	0	0	0	0	3,000
Santa Ana	0	900	0	0	900	300	500	1,100	0	500	0	0	4,200
Santa Lucia	0	100	0	0	0	0	0	1,000	525	0	200	0	1,825
Tatumbla	1,000	350	0	200	80	0	0	0	200	0	0	0	2,030
Valle de Angeles	900	850	1,700	200	200	100	950	1,500	750	1,300	500	100	9,050
T O T A L	10,750	6,155	5,875	5,300	4,620	700	3,550	7,950	6,740	4,072	8,180	2,350	66,442

Source: COHDEFOR, Forest District Francisco Morazán

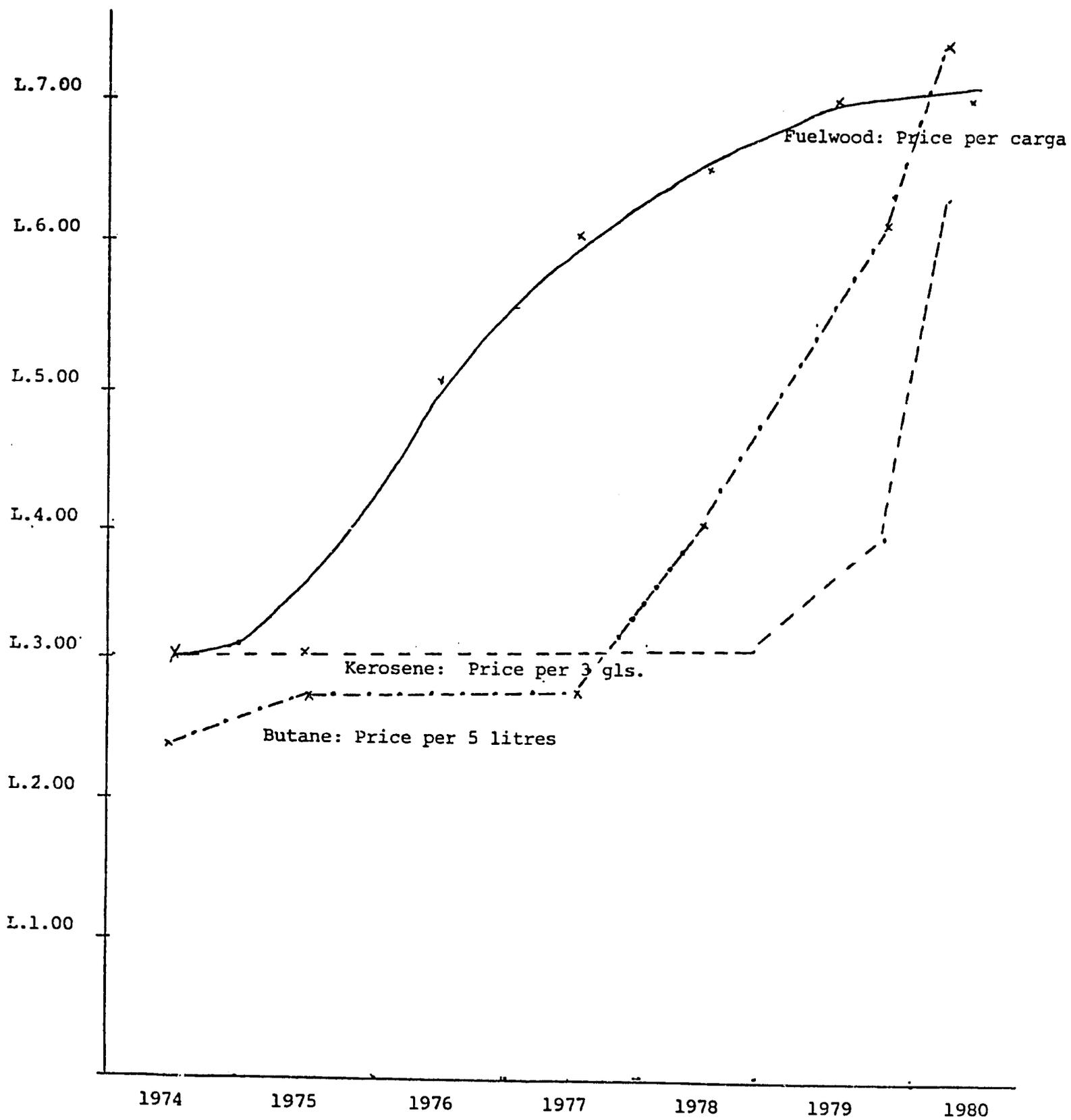
FUEL PRICES FOR COOKING 1974 - 1980

Tegucigalpa-Honduras

<u>Year</u>	<u>Fuelwood Lps. per carga</u>	<u>Kerosene Lps. per gallon</u>	<u>Butane Lps. per liter</u>
1974	3.00	0.96	0.475
1975	3.00	0.99	0.550
1976	5.00	0.99	0.5550
1977	6.00	0.99	0.5550
1978	6.50	1.01	0.7770
1979	7.00	1.30	1.2270
1980	7.00	2.08	1.4770

Sources: Kerosene and butane: Ministry of Economics

Fuelwood prices: Interviews in Tegucigalpa



COOKING FUEL PRICES IN TEGUCIGALPA: 1974 - 1980