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PERMANENT INTERSTATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL

CILSS

CLUB DU SAHEL

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FUELWOOD: THE MAIN SOURCE OF ENERGY IN THE SAHEL AND FUELWOOD RESEARCH NEEDS

A Note by the Secretariat of the Club du Sahel

May 1983

SUMMARY OF SUGGESTIONS FOR FUELWOOD RESEARCH IN THE SAHEL

In the Sahel there exists a regional network linked to the international community. It is the CILSS/Club du Sahel framework, which has been working on fuelwood and related forestry programmes for several years. This network is worthy of support, since it plays an important role in the African network. Within the region, it helps to assure better coherence, sharing of information, evaluation, and strives to avoid the duplication of costly research.

Suggested themes for Fuelwood Research are:

I. Socio-Economics of Fuelwood & Fuelwood Economy

- the economics of fuelwood, transport, marketing, taxation, substitutes, labor costs, policy, etc.
- social aspects of forestry, land tenure, tree tenure, bush fire control, participation, private and community initiatives, livestock/forestry, education, etc.
- fuelwood economy, improved cookstoves, social acceptance of cookstoves and economic/policy options to reduce fuelwood consumption

II. Technical Aspects of Forestry and Fuelwood

- regeneration and improvement of the Sahelian forest (soil research)
- natural forestry management and improvement
- genetic improvement of tree species (local and exotic) and constitution of a tree species bank

Summary (continued)

- forestry on dunes
- wood technology (including reconstitution of wood in briquettes, transport vs. site transformation)
- Forestry on saline soils
- charcoal and improved production techniques
- irrigation of tree crops

III. Training

- Sahelian researchers must be trained.
- Status of researchers must be improved to retain the good ones in the region.

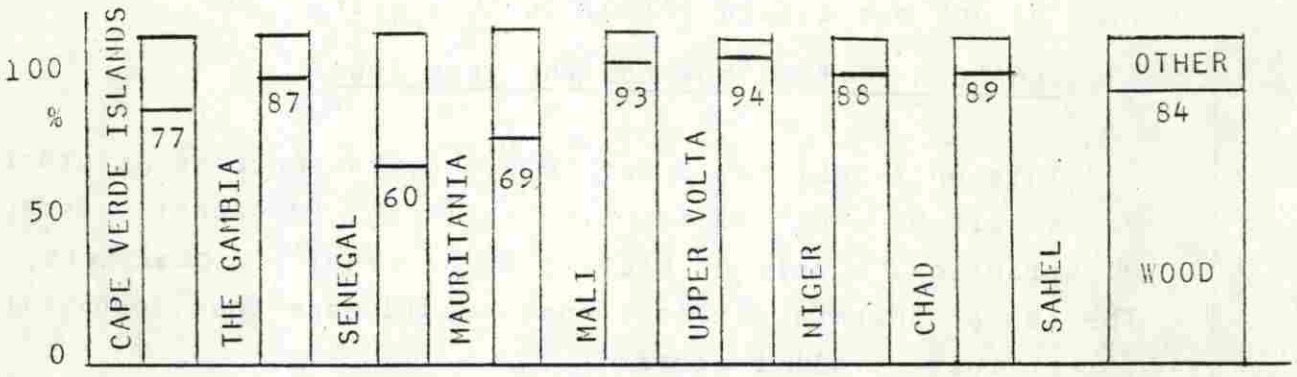
Introduction

Energy is an essential component of development. However, in the Sahel, energy does not mean only oil products and electricity: the primary source is fuelwood.

The CILSS (Permanent Interstate Committee for Drought Control in the Sahel) and the Club du Sahel (1) have thus emphasized the importance of ecological equilibrium and fuelwood in the development strategy for the region which is aimed at food self-sufficiency. Self-sufficiency in food has little meaning if there is no fuel to cook the food.

Wood is by far the main source of energy in the Sahel. It represents in total about 80 to 90 per cent of the region's energy supply. (See diagram)

Figure 1 - SHARE OF WOOD IN THE SAHEL'S ENERGY SUPPLY



Source: "Energy in the Development Strategy of the Sahel Position - Prospects - Recommendations" CILSS/Club du Sahel, October, 1978.

(1) The CILSS member countries are: Cape Verde Islands, the Gambia, Upper Volta, Mali, Mauritania, Niger, Senegal and Chad. The CILSS, whose headquarters are at Ouagadougou, Upper Volta, coordinates the actions undertaken within the drought control program in the Sahel. The Club du Sahel was created in 1976 by the CILSS and the International Community to support the development of Sahel countries. The Club du Sahel Secretariat is a special programme of the OECD in Paris, France.

WOOD - AN IRREPLACEABLE FUEL

- Estimated fuelwood consumption in the Sahel is at least 16 million m3 per year (or 12 million tons per year), corresponding to 0.6 m3 per person per year.

- If oil were substituted for wood, annual imports would be 2.5 million tons per year (assuming that its efficiency ratio is twice as high as that of fuelwood), i.e. almost three times the present oil consumption of the region. At to-day's prices, these imports would cost over 60 billion CFA francs a year in foreign exchange.(1)

- Towards the turn of the century, with a population of 50 million and world oil prices twice as high as at present these imports would require a foreign currency outlay of almost 240 billion CFA francs/year. This is out of the question.

- It is also possible to think in terms of cost "per person": the import costs of substitute fuel would amount to :

. 2000 CFA F per person per year (or $9) in 1978, i.e. 7.5% of GNP per capita ($120) in that year.

. 4000 CFA F ($18) towards the year 2000.

This unit cost could not be borne, the more so as other costs must be added to it, i.e. refining, transport, storage, distribution, supply of heaters to households , canisters, etc. The sum of these additional costs would more than double the direct cost of oil imports.

Wood is almost irreplaceable on a large scale by oil products; the countries' economies could simply not bear the burden of substitution.

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(1) On the basis of 24000 CFA Francs per ton of crude delivered at the Dakar refinery

Source: Energy in the development strategy of the Sahel - Position - Prospects - Recommendations, CILSS/Club du Sahel, October 1978

Moreover, except for the fortunate few who can afford gas stoves, wood and charcoal remain in most instances, the only source of energy for cooking food. This is a social problem too, for the Sahel countries are among the poorest in the world. The substitution of oil imports for wood is economically unthinkable (see inset p.2). The programme to combat desertification in CILSS member countries, thus empasize the need to meet the population's requirements for fuelwood.

The Problem

Knowledge of the two main parameters, supply and demand (production and needs) remains insufficient. Most of the investigations carried out in the Sahel on fuelwood consumption indicate an average per capita figure of between 0.5 and 2.5 m3 per year (see Table 1). The CILSS/Club du Sahel Energy Report uses 0.6 m3. Obviously, conditions change markedly from one region to the next. In addition, these figures are calculated after many conversions of units of volume, weight, form and state of wood. Great care must thus be taken in interpreting the figures, which explains why the trend of consumption is uncertain. According to some surveys, technological and social progress result in increased use of wood. The Sahel is moving towards a fuelwood consumption increase both by reason of population growth (the population will increase from the present figure of 30 million to 50 million by the year 2000) and increased consumption due to technological progress.

The rate of urbanization is another factor. All Sahel countries are becoming more urban and their towns are growing faster than in other countries at the same leve level of development. In addition, despite slow economic growth, the population is concentrated in the largest town of each country.

COUNTRY (population in millions)	WOOD - ENERGY							Furniture etc. Wood (thousand tons per year)	Industrial wood (in thousand tons per year)	Total consumption (in thousand tons per year)
	Kg/per person/daily			Thousand tons/per year						
	Urban Sector	Semi-Urban Sector	Rural Sector	Urban Sector	Semi-Urban Sector	Rural Sector	Total			
CAPE VERDE (0.4)	0,08	0,14	0,36	3	1	25	29	2	10	41
THE BAMBIA (0.6)	2,50		3,64	137		591	728	55	7	790
UPPER VOLTA (6.1)	1,42	1,38	1,69	266	91	3.454	3.811	202	28	4.041
MALI (7.0)	0,66(1) 1,90(2)		1,00(1) 2,00(2)	600(1) 820(2)		2.150(1) 4.300(2)	2.750(1) 5.120(2)	280(1) 510(2)	29 29	3.059(1) 5.659(2)
MAURITANIA (1.5)	1,50		1,25	193		498	691	35	10	736
NIGER (5.3)	1,00		1,00	250		1.830	2.080	104	(3)	2.184
SENEGAL (5.7)	1,42		1,86	1.000		2.800	3.800	640	208(4)	3.746
CHAD (4.5)										
	(Programme/overview still to be written)									
TOTALS FOR CILSS COUNTRIES				2.449(1) 2.669(2)	92	11.348(1) 13.498(2)	13.889(1) 16.259(2)	1.318(1) 1.548(2)	292	15.499(1) 18.099(2)

(1) Low estimate for Mali
(2) High estimate for Mali
(3) Not available
(4) Of which 144 for paper and boxes

Source: Prepared from information in the Programme/ Overviews of the CILSS/Club du Sahel, presented to the Regional Ecology and Forestry Team - Banjul meeting, 13th-22nd October, 1982, in "Quantification of Wood needs in the Sahel countries: an analysis of the Bilans-Programmes (not available in English).

TABLE 2

FORECASTS OF URBAN GORWTH

Country	Population in 1980	Urban Population in 1980 %	Rate of Urban Growth 1970 - 1980	Urban population in 1980	Projected total population in 2000	Continuity in the rate 70 - 80		Estimated rate of growth of GDP/per capita					
								1%		3%		5%	
						Urban in 2000	Urban pop in 2000	Urban as a %	Urban pop in 2000	Urban as a %	Urban pop in 2000	Urban as a %	Urban pop in 2000
MALI	7.0	20	5.6	1.4	13	33.9	4.4	23.8	3.1	31.3	4.1	38.6	5.0
UPPER VOLTA	6.1	10	5.9	0.6	10	22.3	2.2	13.8	1.4	21.3	2.1	28.6	2.9
NIGER	5.3	13	6.8	0.7	10	27.7	2.8	16.8	1.7	24.3	2.4	31.6	3.2
MAURITANIA	1.5	23	8.4	0.3	3	64.4	1.9	26.6	0.8	34.3	1.0	41.6	1.2
SENEGAL	5.7	25	3.5	1.4	10	28.9	2.9	28.8	2.9	36.3	3.6	43.6	4.4

Source: World Bank and PADCO.

Table 3 summarizes these trends in five Sahel countries for which figures are available. Unless habits change radically fuelwood consumption is forecast as follows :

Table 3

TREND IN FUELWOOD CONSUMPTION - 1975 - 2000

Country	Million m3/year					
	1975			2000		
	Urban	Rural	Total	Urban	Rural	Total
Chad	470	1 600	2 000	1 700	3 600	5 300
Niger	340	2 500	2 800	1 200	4 600	5 800
Upper Volta	400	3 300	3 700	1 400	5 800	7 200
Mali	610	2 900	3 500	1 900	5 200	7 100
Mauritania	120	700	800	600	1 100	1 700
Senegal	1 000	1 900	2 900	2 900	3 000	5 900
The Gambia	50	250	300	120	430	550
Cape Verde	5	25	30	24	80	104
TOTAL	3 005	13 025	16 030	9 824	23 780	33 604

Sources: "Energy in the development strategy of the Sahel- Position - Prospects - Recommendations" - CILSS/ Club du Sahel, October 1978, and "Analysis of the Forestry Sector and Proposals - Cape Verde Islands" CILSS/Club du Sahel, D(82)179, October, 1982.

Although it is true that concentrating population in a town opens opportunities to promote energy savings and substitution programs, the shortage of fuel in an urban environment creates tragic social situations, and the degradation of the surroundings of towns in the Sahel is taking on disquieting proportions. Even now, long distances must be travelled to bring wood to cities: Niamey : 60 to 90 km; Ouagadougou : 80 to 100 km; Ndjamena : 50 to 60 km. Natural regeneration is almost impossible within a 15 to 20 km radius of capitals because of population growth and because land is still worked even though the soil is nearly exhausted. Beyond that radius, the rural population allows nature to take over for a few years before re-growing. At each clearing the volume of wood cut decreases, and within a 50 km radius of capitals degradation is serious.

The energy problem of fuelwood supply thus creates an ecological problem of the first order as well as an economic and social problem. It is estimated that only 6% of the population has an adequate fuelwood supply. The remaining 94% suffers more or less from some degree of shortage.

It should be noted that fuelwood is not the only problem relating to wood in the Sahel. In itself wood is a major factor in the CILSS countries' economies. Trees protect from erosion and maintain soil fertility (especially the acacia albida); wood is used as a construction material (poles), for utensils, fodder, nutrients (fruit, flour, leaves, etc.), medicines and fencing, to mention only these uses.

It should also be observed that fuelwood and charcoal are not used solely for domestic needs such as cooking food, producing hot water or space heating. They also have agricultural uses, in processing crops, smoking fish and processing Karite; crafts; and brewing Dolo (millet beer). They are also basic for blacksmiths, potters, food roasters, launderers, jewelers, small restaurant owners and in factories producing matches, baked bricks and lime.

The fuelwood problem, however great, cannot be solved without taking into account the importance of trees in the Sahel's economy and ecology, as well as the various uses of fuelwood. Accordingly, the CILSS and the Club du Sahel adopted an overall integrated approach to the ecological problem, within which fuelwood plays a major role as the main source of energy supply in the region. This approach was formulated in the "Programme for the Struggle against Desertification in CILSS Member Countries", adopted by the CILSS, the Club du SAHEL and the UNSO in November 1979.

Fuelwood and Charcoal Supply

Rural inhabitants cut their own fuelwood. This task is usually performed by women. It is hard work and time comsuming, since in some areas, the wood must be collected from as far as ten kilometers away.

In villages and towns, fuelwood has become an important commercial good, and the population obtains supplies through various marketing systems.

Several means of transport are used for supplying urban and semi-urban centres: carts, donkeys, bicycles, trucks. Each locality has a different system which changes with time, oil prices, and State policies. For instance, in 1970, apart from limited quantities brought in by bicycle, Ouagadougou was mostly supplied by trucks, delivering to large customers, such as restaurant proprietors, dolo breweries, or fixed points of sale in town markets. After 1970, with the appearance of carts, the truck-owners lost their quasi-monopoly on the marketing of wood. This transformation took three years, from 1969 to 1971, and comparative figures show the massive increase in the number of carts over that period.

TABLE 4

WOOD CONSIGNMENTS OBSERVED BETWEEN 1979 and 1971 IN OUAGADOUGOU - UPPER VOLTA

(figures provided by the Forestry Inspection of the Centre)

Year	Large Trucks 10 steres/load	Vans 6 steres/load	Carts 1 stere/load
1969	1 903	125	0
1971	1 590	94	61 887

Source: "The problem of wood in Sahel countries" - Jean-Marc Bellot - CILSS/Club du Sahel - December 1982.

Carts have taken the lion's share since 1973. They appear to be more profitable : the small quantity of wood transported is easily marketed, whereas a truck-owner may have difficulties in selling his full load other than to a wood merchant. The advantages of carts over trucks are easy maintenance and cheap labour; trucks are difficult to maintain, and fuel and repairs are expensive. Cart drivers can stand in the street or carry wood to the door, and sometimes deliver on a subscription basis.

Fixed-location wholesale and retail traders have created large wood-trading markets, or wood merchants' yards, often affiliated with trucking firms which provide a wholesale delivery service.

In the wood markets, housewives who cannot afford to buy a full cart- or truck-load can buy their wood in small quantities. Large logs are broken into smaller pieces. Bark and twigs are lower grade wood, sold separately or used as "linga", i.e. as a

gift to the buyer. In trational districts, the smaller wood merchants speculate on micro-retailing. Wood purchased by the cartload or the bundle on the wood market is split and piled up in small heaps. Here, housewives with irregular or very low incomes purchase their wood; they cannot afford to buy larger quantities. For these socially deprived housewives, fuelwood costs are relatively high, as the micro-retailed wood is twice or three times as expensive as at wholesale. It is therefore a heavy charge on the income of the poorest town dwellers.

Competition between traditional and modern trade is a feature of the fuelwood supply and marketing system in Niamey (Niger).

The traditional wood trade is undertaken by donkey and camel drivers.

In general, the camel drivers are usually sedentary farmers from Filingué, who undertake this activity in the dry season.

By contrast, donkey-drivers are mostly from the Haoussa ethnic group, originating from Tahoua country.

Trucks and vans carry the "modern" supply. There are fewer truck-drivers than camel or donkey-drivers, but competition between them is fierce.

As the surroundings of Niamey have been exploited, a truck driver may have to make an 80 to 100 kilometer return journey. Camel and donkey drivers cannot venture that far for their supplies.

On delivery, wood is marketed by merchants. Some specialize in this trade, in particular, male retailers installed at the entrance to a town. Women retailers are generally scattered throughout the town, apart from the administrative districts, but they have a quasi-monopoly in the traditional districts of Niamey.

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Women retailers will, for instance, purchase a small van-load and call for wood splitters, who reduce logs to small bundles so that customers can consume the product directly. Civil servants tend to get their supplies from truck-drivers.

The wood supplied to Niamey ends up not only in households but also in public establishments (hospitals, boarding schools, prisons, etc.). These establishments usually have an operating budget and avail themselves of a truck driver's services.

The systems existing in Ouagadougou and Niamey are also found in Bamako. However, in this latter town, the railway carries approximately 5 % of the town's wood and charcoal supply, with a further 3% on the river by pirogue.

The situation is somewhat different in Dakar for several reasons. First, charcoal is virtually the only fuel used for preparing meals.

This charcoal comes from the river region and Eastern Senegal.

Second, supplies are conveyed by large trucks, a continuous and lucrative activity.

Inhabitants of the Gambia are allowed to use forestry products for their own purposes without prior authorization. It should nevertheless be mentioned that the production of charcoal has been forbidden since January 1st, 1980.

Fuelwood marketing in Cape Verde is still rudimentary, as the wood delivered to markets originates mostly from illegal fellings. This is tolerated as, despite the absence of regulations governing wood cutting and marketing, it is nevetheless

necessary to satisfy a real need of the population. Women convey most of the fuelwood sold. The bundles they carry weigh between 10 and 25 kg. and are subdivided into smaller bundles or heaps sold at a price determined by the weight, shape and size of the pieces of wood.

In Mauritania, the population in the Senegal River region consumes wood, whereas in Nouakchott, wood cookers are replaced by charcoal braziers. Several hundred entrepreneurs make and market charcoal. They are intermediaries who employ labour for felling trees, making charcoal and filling it into bags. These entrepreneurs obtain permits from the regional departments for the protection of nature, to cover the activity of their teams of cutters. The cutters sell their produce to the entrepreneurs at a pre-set price, and he then deals with the packaging and conveyance of the charcoal to urban centres where he usually owns storage facilities from which he sells to retailers. The absence of on-site control of these entrepreneurs' activities means that the local departments do not know the actual volume of charcoal produced; this can only be estimated on the basis of the transport permit.

Most charcoal transits via Rosso, where boats bring charcoal from both banks of the Senegal. It is assumed that a large share originates from Senegal today, whereas it is believed that some ten years ago, Mauritania was exporting charcoal to Senegal. However, charcoal production has been subject to a twenty-fold increase in ten years, despite the fact that Rosso remains, in practice, the largest producing region.

This brief description of systems shows that the supply of towns is a large-scale, complex and diversified business, whose

features vary according to the country and the town. However, difficulties are arising in the supply of towns in all of the Sahel countries and this is reflected in price fluctuations governed by the season, the distances covered and the modes of transport used. Sale prices are between 10 and 25 CFA Francs per kg., which corresponds to from 10% to over 25% of the family budget. At certain times, or in certain towns, some families have only a single hot meal a day. Interruptions in supply are increasingly frequent, especially during the rainy season, by reason of transport difficulties.

The prices and costs of fuelwood and charcoal vary according to the nature of the product (wood or charcoal). Legislation also has an effect on prices in the form of taxes which provide part of the revenue of the different governments.

The table on the next page shows several salient features. First, apart from Mauritania, the merchants' profit margin is always more than one-third of the sales price, which substantiates the assumption that merchants owing modern means of transport earn substantial net incomes.

Second, transport costs are very high by reason of the high costs involved in the maintenance and depreciation of the transport firms' fleets of vehicles. It must also be said that the drivers are often forced to drive on unpaved roads.

Third, the wood trade creates employment. The labour force may be permanent (drivers, merchants and sellers), occasional (truck loading, apprentices and workers splitting wood), or seasonal (producer farmers). At all events, the wood trade provides a money income for the rural environment, where the poorest people live, furthermore, mainly during the most difficult period, i.e. the dry season. A non-negligible share of the rural population can stay in the village because of the wood trade, instead of joining the seasonally unemployed, who stream to the towns in search of jobs that do not exist.

TABLE 5

STRUCTURE OF WOOD PRICES

(hypothesis : one ten ton truck)

ITEMS	COUNTRY	MALI	NIGER	UPPER VOLTA	MAURITANIA
	Sale price of 1 stere (1)	4340/5720 MF 2170/2860 CFAF	3125 CFAF	10000 CFA F	630 MU 3150 CFA F
Producer price		22 %	30 %	12,5 %	42,8 %
Tax levied by the State		2,2%	1,3%	3,3 %	14,2 %
Cost of labour		7 %	10 %	4,2 %	4,7 %
Transport (2)		18,8%	19 %	45,8 %	29,5 %
Retail profit margin (3)		50 %	39,7%	34,2 %	8,8 %

(1) One stere = approximately 250 kg (this weight can vary).

(2) the write-off of vehicles (life : 5 years) is included in transport costs.

(3) Including wage-component corresponding to the merchant's work.

N.B. the information to establish a complete table for all CILSS countries is not available.

Source : "The Problem of Wood in Sahel Countries, Jean-Marc Bellot, CILSS/Club du Sahel, December, 1982.

Fourth, it is not true that the forest is a cost, and makes no contribution to state revenues. Table 6 below makes the point:

TABLE 6

ESTIMATED BUDGETARY REVENUES OF FOUR SAHEL STATES FROM FORESTRY IN 1980

Country	Ascertained Production (in steres)	Retail price per stere	Taxes (in %)	Amount of taxes received by the State
MALI	6.040.000	4.340/5.720 MF (2170/2860 CFA)	2.2	57.669.920 to 76.007.360 MF
MAURITANIA	2.764.000	630 MU (3.150 CFA)	14,2	24.726.744.000 MU
UPPER VOLTA	9.375.000	10.000 CFA	3.3	3.093.750.000 CFA
NIGER	6.552.000	3.125 CFA	1.3	266.175.000 CFA

Source: "The Problem of Wood in the Sahel Countries", Jean-Marc Bellot - CILSS/Club du Sahel - December 1982.

No Sahel State invested as much in the forestry sector in 1980, excluding international aid, as is indicated in the right hand column under "Amount of taxes received by the State."

The figures above should be interpreted with care. Their apparent coverage masks some basic gaps. For instance, what percentage of ascertained production is not subject to tax? The ratio of ascertained production to actual production is unknown, and impossible to calculate since on the one hand, the fraudulent quantities passing through the parallel market are unknown, nor is, on the other hand, the very scattered rural consumption.

Finally, it would be useful to know the value of a tree and the direct and indirect effects of marketing wood on the economy of the

different Sahel countries. These studies have yet to be done, but it is probable that even the comparatively high cost of wood in towns does not reflect the real value of a tree in the Sahel, and that from this standpoint, wood may be under-priced.

Charcoal

Charcoal is used in all the Sahel countries, but especially in Senegal and Mauritania. The conversion of wood to charcoal wastes precious energy and several studies have proved that it is not desirable to seek generalization of its use.

Charcoal is very much appreciated because it is practical and easy to use, especially in towns; however, its high cost makes it almost a luxury item.

The traditional method of making charcoal uses 8 to 10 kg of wood for each kg of charcoal which finally returns only 20% of the original calorific value of the wood. Thus, for an equivalent calorific value, wood is not necessarily more expensive in terms of transport costs than charcoal.

In most instances, the charcoalmaker is a farmer working on his own account. However, town-dwellers in the charcoal business often hire wage-earning charcoalmakers. Adolescents and young rural dwellers seeking a job during the dry season are sent to a wooded site with a cutting permit purchased from the Forestry Inspectorate. This form of operation will probably expand in line with rising urban demand.

None of the traditional methods used to produce charcoal are very efficient. It is possible to halve the wood intake for the same quantity of charcoal by using modern techniques, i.e. 3.5 or 4 kg of wood per kg of charcoal instead of 5 to 10 kg. This underlines the great interest of informing charcoal producers of new production techniques (brick furnaces, metallic furnaces and retort furnaces) which yield substantial savings of wood.

How to solve the fuelwood problem

On the assumption that average annual consumption per Sahelian is 0.6 m3 and that a non-irrigated,planted forest on average soils produces 3 to 6 m3 per annually, a one-hectare stand can supply the needs of 5 to 10 persons.

The accessible natural forests are barely enough to cover the population's present needs. On the basis of the above hypothesis, to supply 30 million Sahelians in the year 2000 out of a total population of roughly 50 million, it will be necessary to plant 3 to 6 million hectares, i.e. 150 000 to 300 000 hectares each year up to 2000. Unfortunately, at most 15,000 to 20,000 hecares annually are planted at present. The magnitude of the effort to be undertaken for reforestation is incommensurate with the rate of new plantations.

Three directions of action can be envisaged, and all three should be followed simultaneously:

- reduce consumption;
- increase production and supply of wood and charcoal;
- introduce substitute energy sources.

The CILSS and the Club du Sahel have launched and sustained many initiatives on these three points. First, they have started programmes for the development of improved cookstoves in CILSS states to reduce consumption. It has been observed that, despite their poverty and the scarcity of wood, Sahelians today consume 3 to 5 times more energy per person for cooking than in rich countries. This is due to the very low energy efficiency of open hearths (the three stone system). Improved hearths or cookstoves can reduce wood consumption if their introduction is supported by appropriate training programmes and extension services. Thousands of improved cookstoves have been built as part of the CILSS -

Club du Sahel programme. Like any new programme at its beginnings, there is uncertainty and problems remain to be solved. Also, the introduction of improved cookstoves involves a major change in cooking habits. It is not always easy to find the type of stove suitable for a given village, or which will be accepted by the population. Notwithstanding, the programme is continuing and there is reason to hope that it will reduce wood consumption.

To increase wood and charcoal production and supply, the CILSS and the Club du Sahel and their partners have launched many programmes relating to the haulage of wood from remote regions and its conditioning, loading and carriage.

As seen above, the transformation of coal into charcoal wastes precious energy and it is important to reduce its use to the minimum (for instance, it is illegal to produce charcoal in the Gambia) and to improve the techniques for its production.

As regards production as such, many programmes are under way for large-scale reforestation, planting around villages, and the plantation of trees along roads, in fields and around houses. Reforestation is also included in projects for agro-sylvo-pastoral development, irrigated reforestation. Most important, programmes to improve the management of natural forest resources are being implemented.

The financial situation for ecology/forestry-type projects is evolving. The Secretariat of the CILSS and the Club du Sahel have helped to mobilise increased financial assistance

for the ecology and forestry sector, which had been seriously neglected before the existence of the two organisations. For instance, in 1975, of the $817 million in aid commitments to the CILSS Member countries, some only $2.9 million was allocated to ecology and forestry projects. But, the Sahelians and donors have now begun to pay greater attention to this sector : the funds allocated to ecology and forestry projects have increased markedly from year to year since 1976 both in absolute value and as a share of total commitments, reaching $45 million in 1980 and 1981.

The annual average rate of increase of total ODA in the Sahel was approximately 14% from 1975 to 1981 The budget for the ecology and forestry sector increased five times more rapidly. This performance is to the credit of the CILSS' Ecology/Forestry team. Its work in drawing up projects, analysing the sector and circulating information was determinant in securing this level of financing.

The donors who have provided the most financing to the ecology/forestry sector are in order : the World Bank, the United States, France, West Germany, the Netherlands, the United Nations and Switzerland. The total amount of funding for ecology and forestry projects between 1975 and 1981 was $150 million.

Setting aside the reforestation programmes proper, more rational use of forests around towns is also possible through the implementation of tariff and fiscal policies offsetting the handicap of having to exploit more distant forests. To balance the annual differences in transport costs between merchants who find their supplies near towns and those who work on remote perimeters financial equalisation systems can be envisaged, such as : cheaper cutting permits away from towns; tax exemptions for long distance operations; degressive taxes related to distance, and transport subsidies. The CILSS is discussing these problems, which warrant further study.

Substitute fuel

There is no universal approach to the replacement of fuelwood by other fuels. The use of oil products could be envisaged in some cases, e.g. in Chad. Niger is studying the possibility of using its coal. An attempt has been made to introduce the use of butane (Senegal) or oil for lighting (Mauritania) in coastal countries as substitutes for fuelwood. The main drawback remains their high cost. There is a possibility of using imported coal, and a survey of peat deposits in Senegal is under way. Agricultural wastes are an asset which must be developed in the best possible way (fertilizers, cattle feed), but this approach cannot be envisaged on a large scale until agro-food installations can make larger quantities available. Major programmes for new energy sources are under way. However, in the near future, these sources (solar cooking, solar drying, photovoltaic solar pump, windpower, etc.)can only have a very limited effect on rural living standards or national energy balances. The CILSS, in collaboration with the CEAO, has launched a programme of research into solar energy (CRES programme, headquarters in Bamako, Mali) to pave the way for the progressive introduction of these new energy sources, especially solar energy. Beyond 1990 and 2000, they will make a significant contribution. However, the search for new energy sources must not serve as an alibi for avoiding basic work on the energy problem in the Sahel, and this relates in the main to the fuelwood problem in all its aspects.

Research on Fuelwood

Based on the foregoing discussion of the role of fuelwood in the Sahel, it is clear that much greater attention must be given to the problem of research on forestry, and in particular, fuelwood. The CILSS/Club du Sahel have carried out a study entitled "Situation de la Recherche Forestiere dans le Pays du Sahel Membres du CILSS", SAHEL D(82)182 (October 1982), prepared by M. Rene Catinot, the former Director of the CTFT. This study not only reviews the situation on research in the Sahel, but also analyses the needs and makes proposals.

One of the first things that may be noted about fuelwood research in the Sahel is that a mechanism currently exists in the region for sharing information, dialogue, joint study and initiating programmes. It is the CILSS/Club du Sahel network. Research is costly and individual countries in the Sahel cannot afford to go it alone in this field. The need for cooperation and sharing of information is all the more necessary because the Sahel countries have ecological zones which cut across national boundaries. Therefore, research applicable in the various ecological zones of the Sahel can, and must, be shared by the individual countries. Thus, it is important that support be given to this regional structure, the CILSS/Club du Sahel network (including the CILSS Executive Secretariat, Sahel Institute and Agrymet, Sahel national countries and donors from the international community) which has been working together on this and related problems since the creation of the Club du Sahel in 1976. This regional

cooperation framework helps to assure that programmes are as coherent as possible, that they are mutually reinforced and coordinated, and that results will be circulated and shared. The mechanism also evaluates progress and makes correctives.

Based on the work of M. Catinot and other studies made by the CILSS/Club du Sahel, one can isolate the following themes for research in fuelwood in the Sahel.

I. Socio-Economics of Fuelwood

1. The Economics of Fuelwood.

The CILSS/Club du Sahel have done some analysis of this question in national sector studies and have recently commissioned a synthesis study in cooperation with FAO. This study should be ready in October 1983 and will provide recommendations for future work. Clearly, the problem of fuelwood economics must be explored more fully. The situation is complex in the Sahel. Fuelwood costs in cities are high enough to provoke social problems for the urban poor who must rely on fuelwood. Yet, fuelwood costs generally are too low to reflect the true value of a tree in the Sahel environment, given a tree's environmental, ecological, agronomic, micro-climatic and nutritional utility. The study of economics of fuelwood should include the relationship between transport costs, marketing, taxes, substitutes, and labor opportunities in rural areas. Such analyses should lead to marketing policy options that governments might implement to ease the fuelwood problem.

2. Social and legal aspects of forestry.

This is a vast arena for research that will be crucial to the success of any fuelwood programme. Research must be

done on the public's perception of trees, land tenure, tree tenure, motivations for maintaining trees, bush fires and their control, participation in tree planting schemes, sharing of benefits, private initiatives in forestry, livestock vs. forestry, village forestry, education and sensitisation, etc.

3. Fuelwood economy.

Closely related to the above two sub-themes is the question of fuelwood economy. So far this has been approached from the standpoint of fuel economy through improved cookstoves. This line of research should be pursued, both from the technical aspect (better models) and the social aspects (acceptance). However, it should also be studied from the economic standpoint. What economic motivations could help reduce fuelwood consumption?

II. Technical Aspects of Forestry and Fuelwood

This theme is mainly concerned with increasing production through better forestry programmes. This is discussed in greater detail in M. Catinot's paper cited above.
The main priorities noted are:

1. Regeneration and improvement of the Sahel forest (soil research included)
2. Natural Forestry Management and Improvement
3. Genetic improvement of tree species (both local and exotic)
4. Forestry on Dunes
5. Wood Technology (to include study of the reconstitution of wood in briquettes, transport vs. transformation on site, etc.)
6. Constitution of tree species bank

7. Study of the extent of natural forests
8. Forestry on saline soils (Mangroves)
9. Irrigated tree crops
10. Charcoal and improved techniques for making it.

III. Training

Outside technicians can help in the above research, but it is essential that progressively, Sahelians assume this work themselves. As M. Catinot pointed out in his paper, Forestry as a sector was a poor cousin for many years. Forest research was even more neglected than tree planting. Training of forestry researchers was relegated to an even lower level of priority. Thus, the picture is quite dismal. The Sahel lacks international-quality researchers capable of meeting the challenge of the above research demands. It is not realistic to think that outside researchers will be either available or able to fill the gap. Training of Sahelian researchers should therefore be stepped up in priority. Furthermore, the status of researchers must be improved if there is to be any hope of retaining them in national/regional Sahel programmes once they are trained.

Conclusion

The Sahel is presently confronted with a major energy problem. Fuelwood, the fuel used by most Sahelians, is at the heart of the problem, which is also an ecological problem of the first degree, since deforestation and deterioration of the environment are direct consequences. Population growth (tripling of town population and doubling of total population by the year 2000) will accelerate deforestation. Fuelwood is vital for the Sahel countries and its large-scale replacement by imported fuel is not economically feasible. The Sahel countries should therefore reduce their fuelwood consumption through savings (improved cookstoves), increase the supply of wood by implementing massive reforestation programmes, with the participation of the population, and pave the way for the introduction of substitute energy sources. They must also put more emphasis on research for solution to the fuelwood problem.

The CILSS/Club du Sahel have played a leading role in launching these programmes and are following them up with analysis, dialogue and study to help the Sahel countries to deal with their critical situation.