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Wood Energy Planning and Policy Development Component

Working Document

Wood energy information in Africa

Review of TCDC Wood Energy country reports and comparison with the regional WETT study

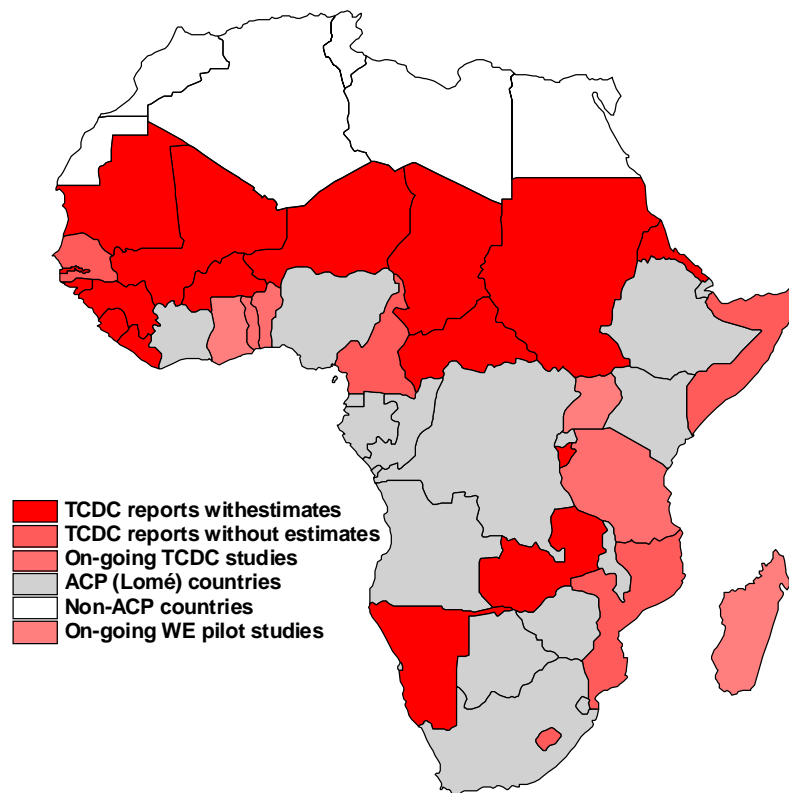


Figure 1 : Distribution of TCDC National Wood Energy Reports

*Written by Rudi Drigo
March 2001 - 23 completed country studies*

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Acronyms

EC	European Commission
ENDA	Energy Sector Management Assistance Programme (World Bank/UNDP joint programme)
ENDA/IEPE	Environment and Development Action (International NGO, Senegal) <i>and Institute d'Economie et de Politique de l'Energie</i> (Grenoble).
IEA	International Energy Agency
RPTES	World Bank's Regional Programme for the Traditional Energy Sector
TCDC	Technical Co-operation among Developing Countries (FAO Programme)
UNEP	United Nations Environment Programme
UWET	Unified Wood Energy Terminology
WE	Wood Energy
WEPP	Wood Energy Planning and Policy (project component)
WETT	Wood Energy Today for Tomorrow (publication series of FAO WE Programme) here always referring to the Regional Study "The Role of Wood Energy in Africa", FAO 1999.
WETT BE	Best Estimates produced by Samir Amous in the WETT Africa Study
WF	Wood Fuels

Introduction

This study is part of the Wood Energy Planning and Policy Development Component (WEPP) of the EC-FAO Partnership Programme “Sustainable Forest Management Programme in African ACP Countries”¹, and it is a follow-up to the activities of the previous leg of the Programme², during which several woodfuels data collection initiatives were initiated and carried out.

Relevant to this study are:

- The regional overview of total wood energy consumption, covering 55 African countries, based on information available in selected international organizations. Study carried out by Samir Amous “The role of wood energy in Africa” (Working Paper FOPW/99/3), published under the Forestry Department Publications series Wood Energy Today for Tomorrow (WETT).
- National Woodfuels studies carried out in selected ACP countries, under the TCDC Programme, to review and assess the national wood energy sector based on information available at national level and to compare these findings with the country statistics presented in the regional study above. The Terms of Reference on which the TCDC studies were carried out is reported in Annex 1.

To date, 23 studies have been submitted and 6 more are in progress, as listed in Table 1.

Table 1: List of completed and on-going country studies

Sub-region	Completed studies (report submitted)	On-going TCDC and other studies
IGAD Sub-region	Eritrea Somalia Sudan	Tanzania (TCDC) Uganda WE Pilot Study
Indian Ocean Countries ³	Comoros Seychelles	Madagascar WE Pilot Study
SADC Sub-region	Lesotho Mozambique Namibia Zambia	
Congo Basin Sub-region	Burundi Cameroon Central Africa Republic Chad	
ECOWAS Sub-region	Burkina Faso Gambia Guinea Guinea Bissau Liberia Mali Mauritania Niger Sierra Leone Senegal	Benin Togo Ghana- FAO assistance on woodfuels data analysis

¹ Project GCP/RAF/354/EC

² Project GCP/INT/679/EC “Data Collection and Analysis for Sustainable Forest Management in ACP Countries – Linking National and International Efforts”

³ Comoros and Seychelles are not shown in Figure 1

Scope of the review

The national reports so far received and available either in digital or printed format were reviewed with the following purposes:

- Compare wood fuel data availability at national level, provided in the country reports, with that available in international data bases and reported in the Regional WETT Study “The role of wood energy in Africa” FOPW/99/3.
- Review the overall consistency of the reports and preliminarily assess their contribution to the Africa Wood Energy database
- Identify gaps or missing elements or needed references, which the authors could provide, and that would maximize the contribution of the original information provided. Where needed, on the basis of such elements, feedback letters were sent to the authors with specific requests.
- Indicate follow-up action.

The conclusions from the review of this first set of country reports are summarized under Section 1.

The individual TCDC reports, country by country, are summarized in Annex 2, providing a synthetic comment on the report and author’s references, and some indication of additional information needed. These synthetic descriptions are followed by tabulations and graphs reporting the data sources compiled in the WETT study, WETT estimates, and the new estimates provided by the TCDC reports for both fuelwood and charcoal consumption

CONCLUSIONS OF THE REVIEW

General Conclusions

The first conclusion is that the development of small TCDC activities for the verification and collection of woodfuel data is definitely useful and should be expanded to other countries of the region for the following reasons:

- The material provided through the Country Reports although quite heterogeneous, is much richer and **informative** than simply filling a questionnaire. The descriptions provided of the national wood energy sectors provide an insight that tabulated parameters cannot, especially in situations, quite common in Africa, where reliable parameters are not available.
- Carried out more or less at the same time, the studies provide a **temporal baseline** where the current status of national wood energy sectors and their main issues are described and, in doing so, defining the current status of the available knowledge and planning capacities. Country references are more recent than those available at international databases, as shown in Figure 2.
- The Programme establishes important **personal/institutional links** which can develop, if properly pursued, into a regional network where information, capacities, solutions can be exchanged.

In view of the paramount importance of this sector in the region, detailed studies are needed for all remaining African countries. However, from a regional perspective, key priority countries not yet covered by such detailed studies for which an early action in this direction is recommended are:

Nigeria, Ethiopia, South Africa, Democratic Republic of Congo, Ivory Coast, Angola, Botswana.

These 7 countries are identified as priority in view of their size, ecological characters and the relevance of status and trend of their wood energy sectors in the regional context.

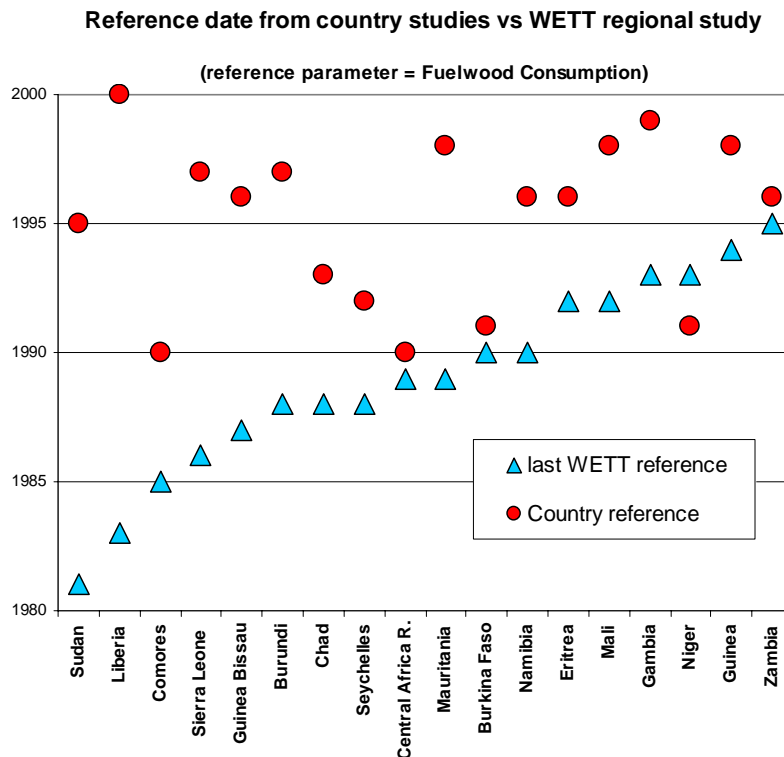
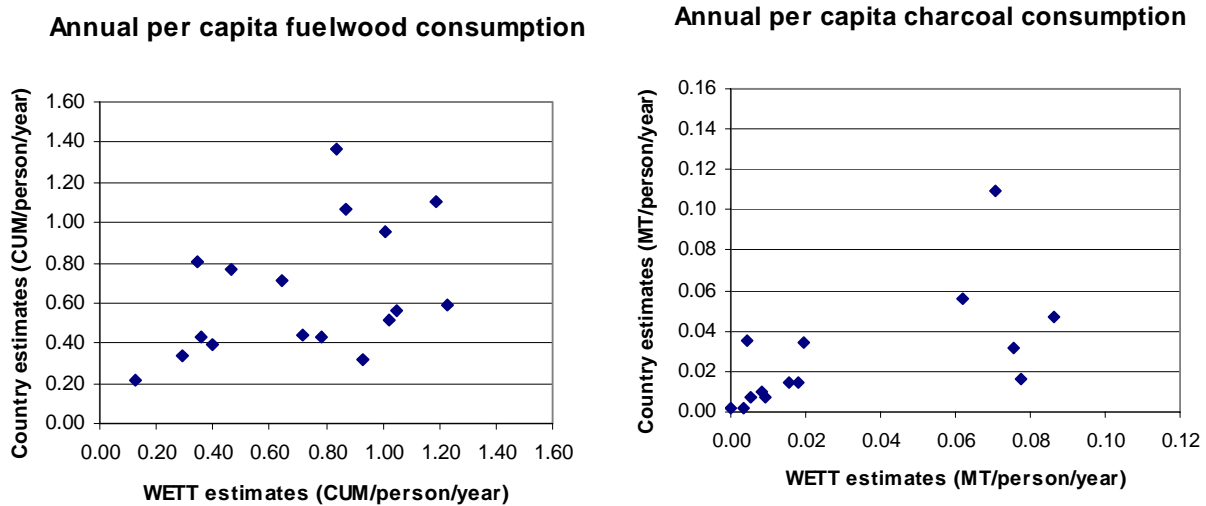


Figure 2: Dates of main reference sources

Information provided

The first conclusion to be highlighted is that all studies, except Seychelles, qualify **wood energy** by far the **primary form of energy** used in the countries. At the same time they all lament that **adequate surveys are rare** and the presence of teams specialized on this sector in national planning is poor or non-existent.



A general conclusion concerning the information provided is that discrepancies between the new country estimates and the values from WETT tend to be rather high, which indicates that there is **poor consistency among data sets**. The high variability among data sources is well represented in the graphs in Figure 3, where the per capita fuelwood and charcoal consumption estimates from the country studies are related to the corresponding “Best Estimates” produced in the WETT study. The poor correlation between the two sets of data should be considered as a clear evidence of the high degree of uncertainty associated to the estimates.

Figure 3: Correlation between WETT (Amous) and Country (TCDC) estimates of per capita fuelwood consumption (a) and charcoal consumption (b). Reference year 1996 (approx.)

This is further confirmed by the tables and graphs shown in Annex 2 where, for all countries covered by TCDC studies, fuelwood and charcoal consumption estimates from various sources are readily comparable. In addition to the WETT’s Best Estimates and TCDC estimates, the country graphs show also the values reported by various sources, such as FAO Forest Product’s Yearbook, IEA, ESMAP, ENDA/IEPE, etc..

The differences in survey methods, definitions, coverage, etc., among the various sources, strongly limit the comparability of the estimates and may result in biased time series. This variability can seriously affect analysis and planning, since different sources may indicate different scenarios, hence prompting for unrealistic policies. To solve this shortcoming **more emphasis should be given to data reliability** and, in order to allow that, all statistics should refer to the original sources and should report the survey methods applied to produce them (date of survey, approach, sampling intensity, stratification, coverage, etc.).

Moreover, there seems to be poor balance between the emphasis and efforts put on demand studies versus supply studies, with the latter being far less developed. Since the definition of sustainable wood energy policies and planning must be based on reliable demand/supply balance analysis, this disharmony could result in weak and shortsighted policy decisions. **More efforts should be put on surveying wood resources** and their sustainable production capacities. There is a widespread perception that in one way or another woodfuels will always be available, since people can plant woodlots to satisfy the demand and offset dwindling natural resources. Without objective evidence this perception could be seriously misleading. For instance, there are clear signs that this self-adjusting mechanism cannot offset the impact of the growing charcoal demand, which depends almost exclusively on natural resources, as discussed in the section on supply/demand balance. The production capacity must be safeguarded, which means that natural wood

resources must be managed in light of sustainability, especially so in fragile, dry ecosystems already threatened by processes of desertification. Adequate knowledge on the status and change of natural wood resources is therefore an essential pre-requisite for adequately plan the wood energy sector.

In general, it appears that the paramount importance of **demand/supply balance studies** for sustainable wood energy planning is not yet widely perceived and only **rarely implemented**.

The following summary table and comments are based on the 23 studies so far available and should be considered preliminary only. In many cases the authors have been contacted and requested to provide clarifications and/or further information on specific aspects, and several have not yet replied. It is therefore possible that some of the information gaps referred to below will be filled in.

Table 2 provides a synopsis of the woodfuels estimates provided in the country reports. It should be emphasized, however, that the informative contribution of these studies is not fully represented by the values reported. In most reports the original contribution consists of qualitative description of the sector and its mechanisms.

Table 2: Woodfuels estimates provided in the country studies alternative to those given in the WETT regional study.

Country	Fuelwood consumption data			Charcoal consumption data			Supply/demand balance	Remarks
	Total	By sector	By area	Total	By sector	By area		
Eritrea	Y	Y		Y	Y		Partial	
Somalia								No estimates available
Sudan	Y	Y	Y	Y			Partial	Limited to survey area
Comoros	Y			tentative			Y	
Seychelles	Y			Y				
Lesotho	Y	Y	Y				Y	No charcoal use in Lesotho
Mozambique								WETT estimates accepted
Namibia	Y	Y	Y	Y	Y	Y		
Zambia	Y			Y			Y	Breakdown not given but probably available
Burundi	Y	Y	Y	Y	Y	Y		
Cameroon								No estimates provided
Cent. Af. Rep.	Y			Y			Y	Tables not readable
Chad	Y		Y	Y		Y	Y	
Burkina Faso	Y		Y	Y		Y	Y	
Gambia	Y	Partial	Partial				Partial	Charcoal use is forbidden
Guinea	Y	Y	Y	Y	Y	Y	Y	
Guinea Bissau	Y	Y	Y	Y	Y	Y	Partial	No values of S/D balance
Liberia	Y	Y	Y	Y	Y	Y	Partial	
Mali	Y	Y	Y	Y	Y	Y	Partial	
Mauritania	Y			Y				
Niger	Y		Y				Y	No charcoal use in Niger
Sierra Leone	Y	Partial		Y				
Senegal								No estimates provided

Woodfuel consumption

Fuelwood and charcoal

- 18 studies provide estimates of woodfuels consumption (complete or incomplete) which are alternative to those published in the WETT Africa Study. Three of them show no, or insignificant, charcoal consumption (Lesotho, Gambia and Niger). These new estimates are based on more recent references than those used for the WETT Study, as shown in Figure 2, bringing the average reference date some six years ahead, from 1989 to 1995 .
- 4 studies do not provide alternative estimates due to lack of suitable national references (Somalia, Mozambique, Cameroon and Senegal).
- The discrepancies of the estimates tend to be rather high, as shown in the graphs in Figure 4, where the estimated fuelwood consumption values from WETT (Best Estimates) and from the country reports are compared. Used simply as an indicator in this very preliminary analysis, the comparison is based only on the estimated 1996 total fuelwood consumption. Considering the scale of the discrepancies displayed in Figure 5, in 7 out of 18 cases, the WETT estimates are more than 50 percent higher (Gambia, Eritrea, Burkina Faso, Namibia) or lower (Seychelles, Guinea Bissau) than the estimates given in the reports.

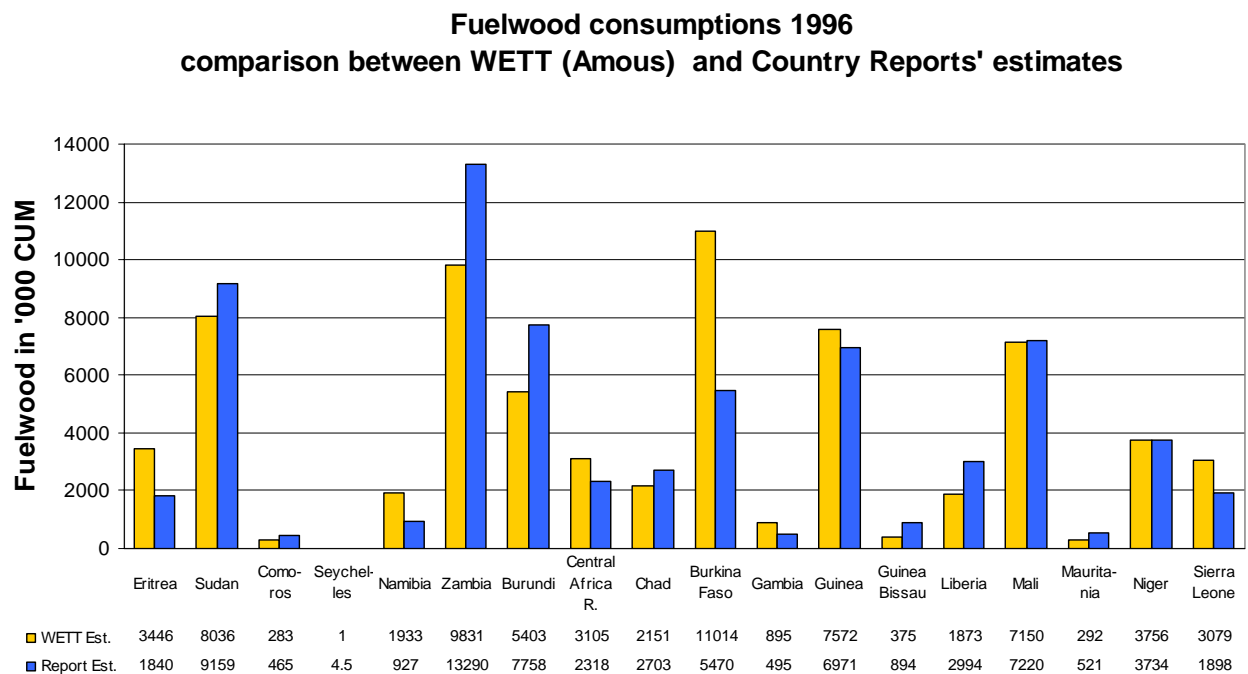


Figure 4: Comparison of WETT and Country Reports' estimates of fuelwood consumption

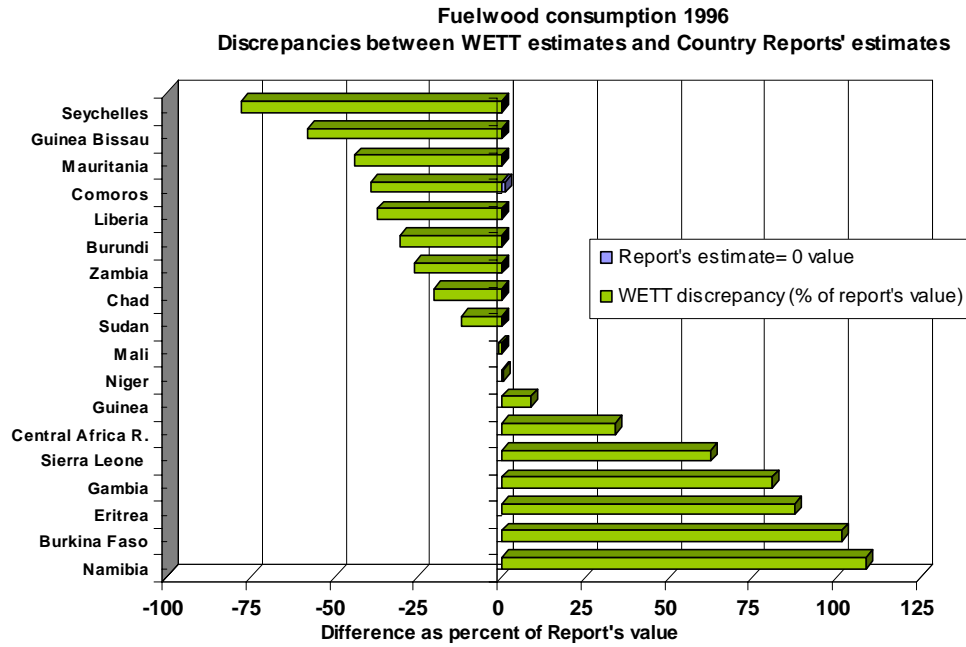


Figure 5: Discrepancies between WETT and Country Reports' estimates

Per capita fuelwood and charcoal consumption are shown, respectively, in Figures 6 and 7. The graphs show the rather wide range of values among the various countries as well as the discrepancies with the WETT estimates, although the overall weighted averages appear quite close in both cases. This is further represented by the low correlation between WETT and /TCDC reports' per capita consumption, shown in Figure 3 above.

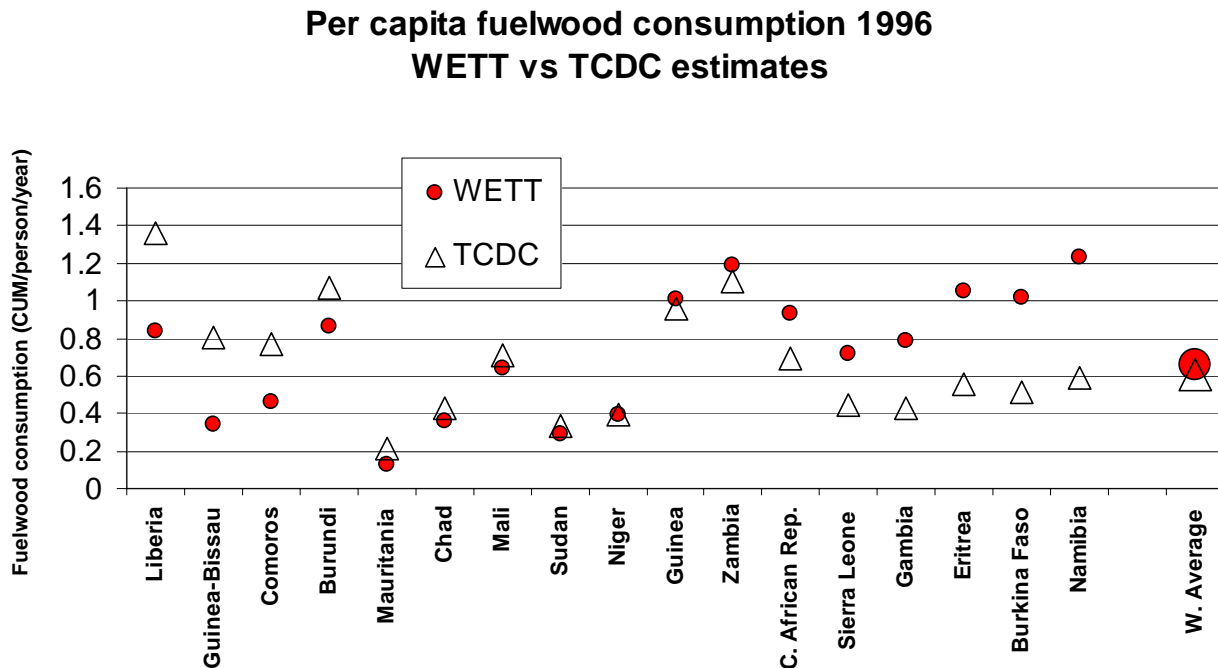


Figure 6: WETT and TCDC Country Reports' estimates of per capita fuelwood consumption

Per capita charcoal consumption 1996 WETT vs TCDC estimates

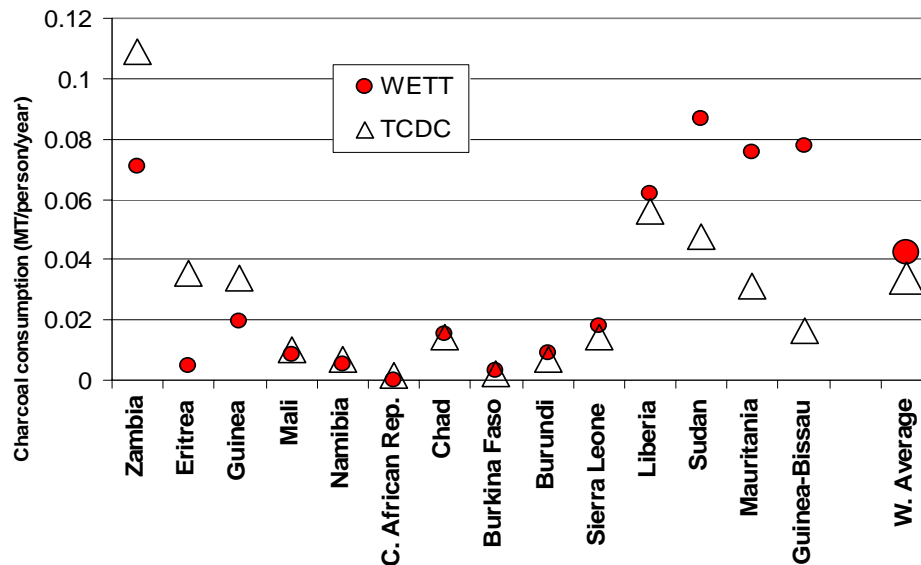


Figure 7: WETT and TCDC Country Reports' estimates of per capita charcoal consumption.

In the graphs in Figures 6 and 7 the countries are listed on the basis of the difference between WETT and TCDC estimates (sorting parameter = WETT – TCDC). Liberia (extreme left) shows the highest negative difference, while Namibia (extreme right) shows the higher positive difference. The central part of the graph groups the countries where WETT and TCDC estimates tend to agree. On this basis we can highlight the countries with higher discrepancy of estimates, and hence uncertainty. These are the cases that need further evaluation of the sources for the definition of the best references, or of further efforts needed to produce a reliable one.

The countries located at the two extremes of the graphs, presenting the higher discrepancies, are:

Liberia

Fuelwood. The source used to arrive at WETT's Best Estimates, ESMP 1983, is quite old and the projection based on this reference are probably weak. The estimates produced in the TCDC report on the contrary are very recent (collected by the author) although they were based on limited observation. Special argument in the TCDC report are that the decrease in consumption during the civil war was less than assumed in the WETT study, since this fuel replaced other ones no longer available, especially in urban areas, and that the demand is rapidly increasing. Until a new survey is carried out TCDC estimates should be used as main reference.

Guinea Bissau

Fuelwood and charcoal. WETT's sources were ESMAP 1983 and ENDA/IEPE 1987. In case of Guinea Bissau the TCDC report, which described in good detail the wood energy sector, was accompanied by tabulated estimates produced by Frans Pareyn who summarized the findings of the Letter of Agrarian Development Policy (LPDA) 1996, and of the FAO Project GCP/GBS/022/EC. Given the deep involvement of the FAO Project and other recent sources, the latter estimates should be considered as more reliable.

Comoros

Fuelwood and charcoal. It is difficult to identify the more reliable estimate between WETT, based on ENDA/IEPE 1985, and the one given in the TCDC report, citing World Bank sources but giving no further detail. The last study of the sector cited goes back to 1990 (*Etude de stratégie agricoles*). Considering that

wood energy is a serious issue in this country, in view of the limited resources available, it is recommended to fill the information gap with new data collection efforts.

Sierra Leone

Fuelwood. WETT's sources were ESMAP 1984 and 1986, while the estimates reported in the TCDC are based on surveys carried out by the author in 1997 and 1999, over part of the country (Western Area, interesting 16% of the entire population) and then projected to the entire country. The recent TCDC are probably more reliable and definitely more recent. However, in view of the large difference, a closer look would be recommended.

Gambia

Fuelwood. WETT estimates were based on ESMAP 1981 and RPTES 1993. The sources used in the TCDC report are from field survey carried out by the National Climate Committee in 1993 and 1999. The new estimates are probably more reliable than the previous one and should be used as main reference.

Eritrea

Fuelwood and charcoal. Lacking any direct reference for this new country, WETT estimates were derived from previous per capita consumption estimates for Ethiopia. The new TCDC values were based on the study carried out in 1996 jointly by the Ministry of Energy, Mines and Water Resources, the United Nations, and Lahmeyer International. The estimates given by the TCDC report are definitely the best available source.

Burkina Faso

Fuelwood. WETT estimates are based on values referring to 1980 and 1987 reported in RPTES documents. The TCDC estimates make reference to ESMAP 1991 and is consistent to ESMAP 1987 (4 128 000 CUM), which seems to be accepted also by ENDA/IEPE and other authors. For this reason the new TCDC consumption estimates seem to be more reliable. However the consumption rate and availability of woodfuels in this country are of such paramount importance that any doubt and approximation should be clarified by verifying the original data sources and by updating the knowledge on supply/demand balance trends.

Namibia

Fuelwood. The references used in the TCDC study are more recent (1992, 1996/97) and probably more field-based than the reference used in the WETT study (1990 Yearbook of the Southern Africa Development Committee). TCDC consumption estimates are lower than WETT's but show a steep increase for both fuelwood and charcoal. Considering this rapid growth of the demand, and considering that charcoal seems to be a booming export item, particular attention should be given to the environmental impact and sustainability of current and future supply.

Zambia

Charcoal. The TCDC report makes reference to a large number of recent surveys (1996/97). In view of this recent information the estimates provided in the TCDC report should be considered more reliable. In addition, WETT time series shows reduction charcoal consumption, while recent sources provide evidence of growing trend, for both fuelwood and charcoal.

Sudan

Charcoal. In recent years, Sudan surveyed its forest resources (1995-7) and also the consumption of forest products (1995), the latter being essentially woodfuels. These new sources, used as basis for the TCDC estimates, are definitely more up-to-date than those used by WETT. However, these new studies covered only part of the country, due civil war and others inaccessible areas. The effect is that national consumption estimates are still based on extrapolation. The two reports submitted (one after the Nakuru Workshop and one for the Nairobi Workshop) make reference to the same sources but provide slightly different estimates. In view of the regional relevance of the wood energy sector in Sudan, which is the largest tropical country in Africa, it is recommended to review the available sources to produce consolidated estimates.

Mauritania

Fuelwood and Charcoal. TCDC estimates for both fuelwood and charcoal were based on recent references (1996, 1998) which were not available for the WETT study. TCDC estimates should therefore be considered more up to date. The estimates cited in the report, referred to different sources (DEAR 1996, RPTES 1998

and PGRRF), differ slightly from one another. Concerning fuelwood consumption trends, DEAR assumed increasing values (period 1993-1996) while RPTES assumed reducing values. Concerning charcoal both main sources (DEAR and PGRRF) agree on the level as well as on the increasing consumption trend.

Consumption by urban/rural area

- 12 studies provide consumption estimates with urban/rural breakdown: Sudan, Lesotho, Namibia, Burundi, Chad, Burkina Faso, Gambia, Guinea, Guinea Bissau, Liberia, Mali, Niger.
- In 6 cases (Eritrea, Seychelles, Zambia, C.A.R., Mauritania, Sierra Leone) the authors will be contacted with the request to provide urban/rural breakdown for their consumption estimates. These are the cases where, in view of the references cited and knowledge expressed in the reports, such information is expected to be available.

Consumption by sector

- 9 studies provide consumption estimates by sector: Eritrea, Sudan, Namibia, Burundi, Guinea, Guinea Bissau, Liberia, Mali.
- In 6 cases (Seychelles, Zambia, C.A.R., Gambia, Mauritania, Sierra Leone) the authors will be contacted with the request to provide or complete the breakdown by sector for their consumption estimates. These are the cases where, in view of the references cited and knowledge expressed in the reports, such information is expected to be available.

Concerning supply and demand/supply balance

From the information available it appears that in several countries the situation demand/supply has reached or is heading towards critical points, with a scenarios where the poorest are deprived of even the most basic assets. In some countries the per capita consumption of wood energy is progressively reducing due to shorter supply or high pricing.

- In 7 studies the potential woodfuel supply and demand/supply balance is discussed with well supported evidence: Zambia, C.A.R., Chad, Burkina Faso, Guinea, Mauritania, Niger.
- In 7 studies the issue is addressed but either based on limited areas or mentioned only: Eritrea (not national coverage), Seychelles (fast reducing demand), Guinea Bissau (interesting discussion but no quantitative estimates), Lesotho, Gambia, Liberia and Mali (just mention).
- In 6 studies the supply and demand/supply balance is not mentioned at all.

In many reports the impact of charcoal making on the remaining resources is considered extremely serious, often being pointed out as a major cause of forest clearing in the countries, probably overtaking the practice of shifting cultivation in its impact on natural resources. Charcoal use is totally changing the relationship between household energy needs and wood resources in the region, transforming what was traditionally accepted as an all-time self-reliance practice (fuelwood gathering) into a vicious circle with potentially dramatic effects on natural forests and woodlands. The combination of many key aspects related to charcoal use indicates a situation in rapid evolution, with an uncommon speed for the so-called traditional energy systems. A short list of aspects that contribute to the rapid increment of charcoal use and to its stronger impact on the resources would include:

- rapid urbanization processes;
- shift to charcoal use by urban dwellers (no smoke, less handling, a definite status symbol);
- almost doubling the per-capita wood demand as result of low carbonization efficiency (needing up to twice the amount of wood for the same amount of end-use energy);
- strongly market oriented, charcoal-making opens up employment opportunities, promoting however the law of profit and rapid gain, to the detriment of resource sustainability;
- more wasteful than traditional fuelwood gathering, which privileges dead wood and marginal sources;
- charcoal making justifies clearing operations on a comparatively large scale, while fuelwood is more commonly a by-product of shifting cultivation practices;

- charcoal production is economically convenient even at long distance from the market, opening up to intense exploitation forests and wooded areas previously protected by the distance but less controlled;
- the best charcoal quality comes from drier wood formations, where the regenerative capacity is lower, potentially speeding up processes of desertification.

Unfortunately reliable estimates on the change in vegetation cover (forest and woodland) resulting from these practices are never available, leaving the issue simply as a vague threat or a subjective judgement. In the overall weakness of existing woodfuels supply information, the data gap on charcoal is probably the most serious one, whose filling would deserve the maximum efforts at local, national and international levels. The analysis of trends in charcoal demand must be accompanied by adequate surveys of associated land cover and biomass changes at local, sub-national and national levels.

Shortage of reliable and up-to-date information is a common constraint in Africa, and the wood energy sector, due to its multidisciplinary and inter-sectoral character, suffers the most. It is in fact extremely difficult to gather quality information in all the aspects that are involved in planning the wood energy sector. However, having said this, we must emphasise that a lot more could be achieved through **better integration of the information already available**.

Modern data analysis and planning systems and digital Geographic Information Systems offer efficient and user-friendly solutions for the handling of multiple data layers. The first step is in all cases the identification and thorough review of existing sources and databases, before deciding to undertake costly data collection activities.

Two regional FAO initiatives that should be looked at as promising, and much needed, sources of information on state and change of woody vegetation are the project AFRICOVER and the remote sensing component of the Forest Resources Assessment 1990 and 2000.

AFRICOVER has the objective of providing each participating country with a detailed and harmonised Multi-Purpose Database for Environmental Resources (MADE), containing detailed land cover and environmental information that could be used as basis for resources assessment and potential supply estimations. The countries involved in the project, at varying stages of progress, are Burundi, Democratic Republic of Congo, Egypt, Eritrea, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda. The comparatively large scale of mapping (1:100 000 to 200 000) and the flexibility of the new Land Cover Classification System (LCCS) offer good possibilities for the use of this data in the assessment of the density and distribution of woody biomass.

The remote sensing component of FRA 1990 and 2000 developed and implemented a robust land cover monitoring method, which produced consistent data on the processes of change that took place in the tropics over the periods 1980-1990 and 1990-2000. Current results for Africa, which are based on a statistical sample covering some 10 percent of its tropical belt, can only be used for a sub-regional or ecological overview but not for country estimates. However, the areas actually studied and the method developed could find useful application at national/sub-national level, to study land use trends and to identify priority areas for action.

ANNEX 1

TERMS OF REFERENCE

FOR WOODFUELS REVIEW AND ASSESSMENT

EC-FAO PARTNERSHIP PROGRAMME (1998-2000)
Funded in part by the Tropical Forestry Budget line B7-6201
Project GCP/INT/679/EC

Under the general supervision of the Chief, Forestry Planning and Statistics Branch, Forestry Policy and Planning Division and the direct supervision of the Senior Technical Forestry Officer (Woodfuels) and in close collaboration with the EC-FAO Partnership Programme on "*Data Collection and Analysis for Sustainable Forest Management in ACP Countries - linking National and International Efforts*", the incumbent will:

- Present a review of the existing data related to woodfuels (mainly fuelwood and charcoal) available in his country over the last five years, at national and/or sub-national level; the review and compilation should cover woodfuel production, consumption and trade (figures have to be reported with source references);
- Compare and assess this collected information with the woodfuel data-sets provided by FAO (see attachment); comment on the results and complete existing data gaps of the FAO data-sets as much as possible (providing again the source references);
- Analyse the past, present and foreseeable trends of woodfuels, its supply, demand, consumption and trade in the context of local, sub-national and national level.

To support and guide this assignment the following documents are provided herewith:

1. Definitions of Woodfuel Terminology;
2. Report: "Wood Energy in Africa: Analysis of its Role and the Data" (by Mr Amir Samous, FAO Consultant); and
3. National FAO woodfuel data set.

Expected Output: A report (one hard copy sent through the mailing system of FAO + the electronic version on disk or by E-mail attachment) on the points requested above, including a detailed bibliographic review. It is also recommend to provide a copy of the most important source documents.

Contract proposed: TCDC (Technical Cooperation amongst Developing Countries)

ANNEX 2

Review of TCDC Wood Energy reports and comparison with other sources

To date, 23 TCDC studies have been submitted and 3 are in progress. In addition, wood energy studies are in progress in 3 more countries:

Sub-region	Completed studies (WETT Country number)	On-going TCDC and other studies	
IGAD Sub-region	(11) Eritrea (14) Somalia (15) Sudan	(40) Tanzania (TCDC) Uganda WE Pilot Study	<p>In the following section the TCDC Wood Energy reports completed to date are synthetically analyzed in respect of estimates provided and sources used. In order to relate the new estimates to previous ones and other data sources, fuelwood and charcoal consumption estimates have been inserted, as an extra reference, to the tables of historical data reported in Appendices 4.2 and 4.3 of the WETT study.</p> <p>The graphs derived from these tables are useful to visualize the range of the estimated values and the agreement, or disagreement, among the various sources.</p> <p>In addition to the estimates provided by the country studies (TCDC Rep.), the references reported in the tables are:</p> <p>WETT (S. Amous' BE) = Best Estimates of the WETT study based on available sources (all other reported sources except TCDC Re.)</p> <p>FAO = FAO Forest Products Yearbook database</p> <p>IEA = International Energy Agency. Regional data base derived from various sources.</p> <p>ESMAP = Energy Sector Management Assistance Programme (World Bank / UNDP joint programme). Data from country projects and expert missions. Mainly national or sub-national data, not aggregated as regional data base.</p> <p>ENDA/IEPE = Environment and Development Action (International NGO, Senegal) and Institute d'Economie et de Politique de l'Energie (Grenoble). Synoptic study compiling existing data for francophone countries.</p> <p>Other data = Various sources. National, regional and international documents, mainly from FAO Library, IEA Library, S. Amous' library, etc.</p>
Indian Ocean Countries	(43) Comoros (47) Seychelles	Madagascar WE Pilot Study	
SADC Sub-region	(53) Lesotho (37) Mozambique (38) Namibia (41) Zambia		
Congo Basin Sub-region	(24) Burundi (25) Cameroon (26) Central Africa Rep. (03) Chad		
ECOWAS Sub-region	(01) Burkina Faso (04) Gambia (19) Guinea (05) Guinea Bissau (20) Liberia (06) Mali (07) Mauritania (08) Niger (09) Senegal (22) Sierra Leone	(16) Benin (23) Togo Ghana- FAO assistance on woodfuels data analysis	

(01) Burkina Faso**Report by**

Mr. BADO Adrien; Ingenieur Du Developpement Rural Option " Eaux Et Forets"; Adresse Postale: 01 BP. 6682, Ouagadougou 01; Tél: 226-34 38 63

New national references cited and report overview:

ESMAP 1991: Burkina Faso. Stratégie pour l'énergie ménagère, 185 pages

The values of consumption provided are considerably lower, almost half, than those estimated in WETT, although the estimated growth rate is much higher. Mr. Bado disagrees on equaling consumption and production and indicates that the differences are losses due to wild fires and clearing techniques that, according to him, should be accounted under production. Although it is not possible to operate a choice between the sources available (those used in WETT and the latest ESMAP here reported) without comparing the assessment techniques applied in each case, it is probably preferable to use the recent data set as main reference for the revision of FAO statistics. Fuelwood consumption estimates are provided by rural and urban areas. No sector breakdown is provided

As per supply, the report provides supply estimates and demand/supply balance from two different sources (ESMAP and CONAGESE'98) which agree that the balance is still positive but disagree on the values. It appears that the disagreement is not so much on the balance, i.e. 1.36 vs 1.53 if converted in MT, but rather on supply and consumption estimates: for 1998, ESMAP estimates 4.2 MT consumption and 5.7 MT supply while CONAGESE estimates 5.7 and 7.2 MT, respectively. However, in the report ESMAP estimates and projections are privileged. According to ESMAP the balance will remain positive but will reduce by half in the 5 years 2000 – 2004.

Additional information needed:

- Woodfuels consumption by sector;
- measurement units and conversion factors;
- missing annexes;
- survey description;
- copy of main references

Burkina Faso - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	5,203	5,450	5,709	5,980	6,264	6,562	6,874	7,200	7,542	7,901	8,276	8,680	9,106	9,551	10,017	10,504	11,014				
FAO	6,293	6,455	6,624	6,801	6,986	7,179	7,381	7,592	7,811	8,038	8,272	8,514	8,761	9,016	9,278	9,545	9,649				
IEA																					
ESMAP				5,462				4,128													
ENDA/IEPE								4,138													
Other data TCDC Rep.	5,203		5,257					4,128			8,276				5,152	5,308	5,470	5,635	5,805	5,979	
1975 : 2,683 kt (FAOL13)	FAOL35							FAOL35 OD22			IEA2										

TCDC Report's main reference ESMAP 1991 (Original source, probably 1987, not available). Report Table 6 reporting extrapolated fuelwood demand (here as consumption). [Values in Table 7 (Consommation) are higher (1996 CUM 7,901,888) but probably refer to total production/exploitation (not clear)].

Burkina Faso - Historical Data for Charcoal (1000 T)

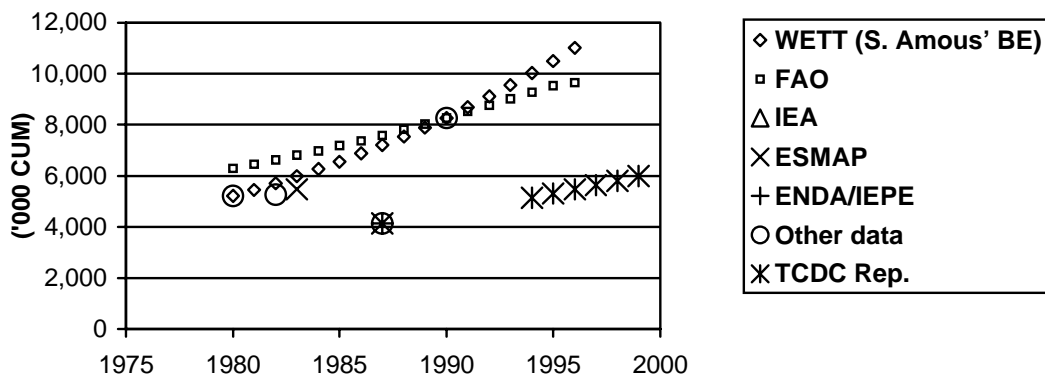
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	7	8	8	9	10	11	13	14	15	17	19	21	23	26	28	31	35				
FAO	20	21	21	22	23	23	24	25	25	26	27	28	28	29	30	31	31				
IEA																					
ESMAP				10				14													
ENDA/IEPE								45													
Other data	7							14													
TCDC Rep.															17	18	20	22	23	25	
Sources of data adopted as BE	FAOL35							FAOL35													
Other sources of data								11,000 T (OD15)													

TCDC Report's main reference: ESMAP 1991 (Original source, probably 1987, not available). TCDC Report's Table 10 reporting fuelwood demand (here as consumption). Values refer to the demand of 4 cities only: Ouagadougou, Bobo-Dioulasso, Koudougou, Ouahigouya.

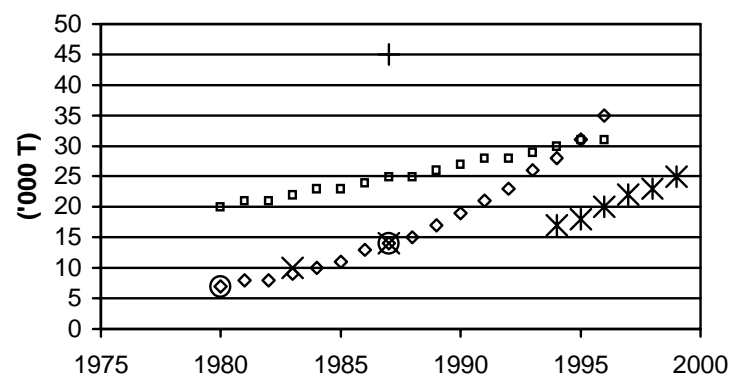
Note:

Report estimates are the result of long extrapolations (original source value at original survey date ('87?) not given). Extrapolations are based on '87 population projections which are out of date. 1996 census data should be used instead.

Burkina Faso - Sources of Fuelwood Consumption



Burkina Faso - Sources of Charcoal Consumption



(03) Chad**Report by**

Mr. Taga HAMID, DFPE, BP 447 N'djamena , Tel: 235-52 31 28

New national references cited and report overview:

- *ESMAP 1993, Elément de stratégie pour l'énergie domestique urbaine : le cas de N'Djaména, Report No. 160/94, 87p.*
- *Rép du Tchad, Comité Directeur de Suivi de la stratégie pour l'énergie domestique, plan d'action détaillé, mai 1994, 40p.*

The report of Mr. Taga Hamid is very rich of references (most data reported is derived from ESMAP 1991, 1993, 1996 and other national documents) and well describes the various aspects of the wood energy sector in Chad. Consumption estimates are reported in several units (TOE, CUM, Tonne, fuelwood/charcoal ratio) with conversion factors different from those of FAO. However, WETT and TCDC national estimates are in the same order of magnitude, with national estimates of fuelwood consumption some 12% higher than WETT and estimates of charcoal almost equal.

Consumption breakdown is reported by urban/rural areas but not by sector. In the sections covering Chad's potential wood energy supply, Mr. Hamid describes thoroughly and with evident competence the information available from various sources (CTFT/CIRAD, ESMAP, FAO) on the resource base. Although the various potential supply estimates vary considerably, highlighting the need for a proper survey, the annual national supply seems to be well above the current demand. The situation appears more critical in urban areas, where the rapidly raising population combined with the raising demand for charcoal are causing an annual increase in wood exploitation around 10 %.

Additional information needed:

- Woodfuels consumption by sector (household/industrial)
- survey description;

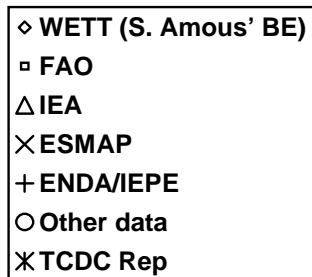
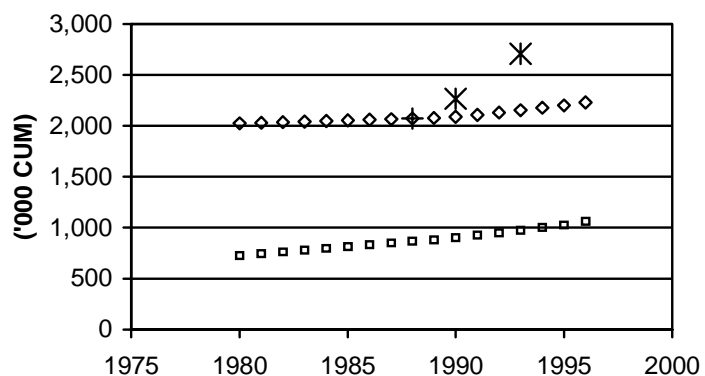
Chad - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,026	2,032	2,037	2,042	2,047	2,053	2,058	2,064	2,069	2,078	2,091	2,107	2,128	2,151	2,176	2,202	2,229				
FAO	725	742	759	777	795	813	829	845	862	879	899	921	945	971	998	1,026	1,059				
IEA																					
ESMAP																					
ENDA/IEPE									2,069												
Other data																					
TCDC Rep											2,262			2,703							
1975 : 1,450 kt (FAOL13)																					

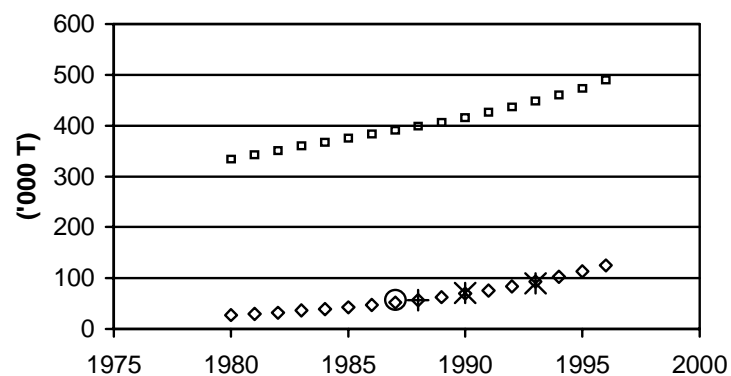
Chad - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	27	29	32	36	39	43	47	52	57	63	69	76	84	93	102	113	125				
FAO	334	342	350	359	367	375	383	390	398	406	415	425	436	448	460	473	489				
IEA																					
ESMAP																					
ENDA/IEPE									57												
Other data								57													
TCDC Rep											71			90							
Sources of data adopted as BE								OD22													

Chad - Sources of Fuelwood Consumption



Chad - Sources of Charcoal Consumption



(04) Gambia**Report by**

Mr. Yorro M.A. SALLAH; Former Acting Assistant Director; Forestry Department, State Department of the Presidency and Natural Resources; 5, Marina Parade, Banjul, Gambia

New national references cited and report overview:

1993 Fuelwood Survey and 1999 Energy Survey, both conducted by the National Climate Committee (NCC)

The consumption estimates reported are based on the 1993 Fuelwood Survey and on the 1999 Energy Survey. None of these sources were use for the WETT study. Compared to these new references, Amous' estimates appear high by a factor of 1.8. The new references should be used to update Gambia's country tables.

Concerning supply and supply/demand balance, the report at p. 13 says "Annual fuelwood consumption surpasses wood production by more than 100,000 CUM." with no quantitative details or scenarios, as information was not available.

As answer to a feedback note on the report, the author provided further information on sector and area consumption breakdown, as well as on the critical status of the demand/supply balance.

Additional information needed:

- demand/supply balance for the period 1994-2004
- description of the reference surveys;
- copy of the main references used.

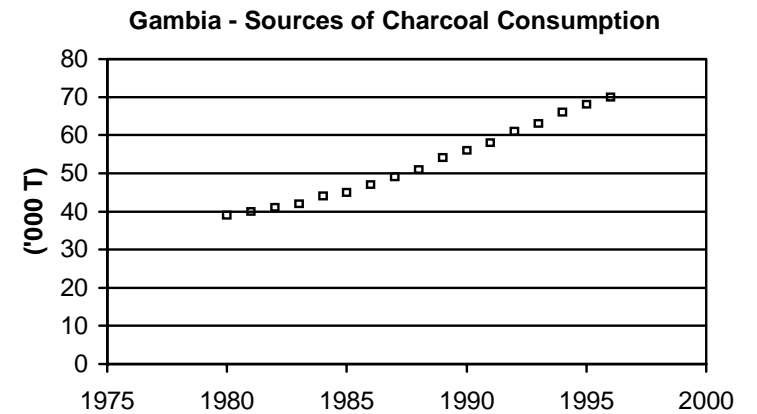
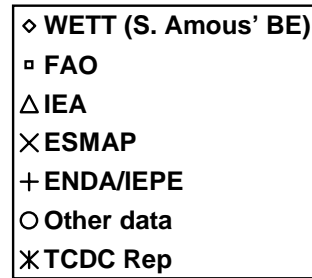
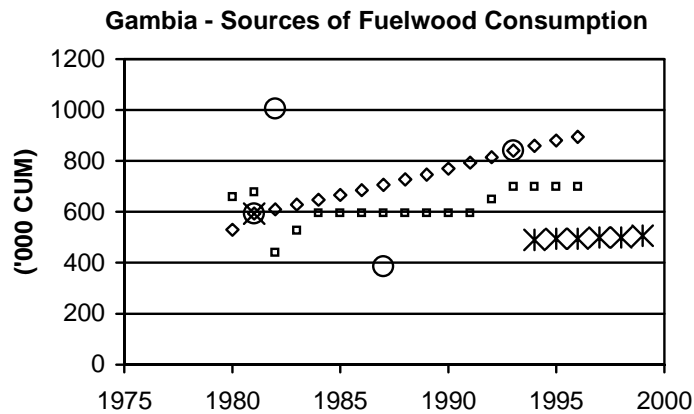
Gambia - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	530	593	610	628	647	666	685	705	726	747	769	792	815	839	860	880	895				
FAO	660	678	440	528	595	595	595	595	595	595	595	595	650	700	700	700	700				
IEA																					
ESMAP		593																			
ENDA/IEPE																					
Other data		593	1,004					386						839							
TCDC Rep															490	495	495	500	500	505	
1973 : 500 kt (FAOL34) 1975 : 218 kt (FAOL13)								OD22						FAOL34							

Gambia - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)																						
FAO	39	40	41	42	44	45	47	49	51	54	56	58	61	63	66	68	70					
IEA																						
ESMAP																						
ENDA/IEPE																						
Other data																						
TCDC Rep.																						
Sources, notes, Comments, etc.																						

NB. The use of the charcoal is forbidden since many years



(05) Guinea Bissau**Report by**

Monsieur Alexandre Cabral, Ingénieur en Technologie Chimique des Substances Combustibles et des Hydrocarbur, Chercheur au INITA/MAPRN

New national references cited and report overview:

Bertrand A. (Cirad/Foret) 1986 and 1992 ; EnquetesESMAP in PAFT, 1992 ;1983 Energy Balance of Guinea Bissau (DGE); Letter of Agrarian Development Policy (LPDA) 1996 (cited by F. Pareyn)

The report of Alexandre Cabral is very informative and well describes the wood energy sector of Guinea Bissau. The main source is the work of A. Bertrand (Cirad/Foret) 1986 and 1992. The report doesn't contain comprehensive national estimates on wood fuels nor an evaluation of Amous' estimates. National estimated consumption time series are provided by Frans Pareyn on separate paper. These estimates seem to be well documented and exhaustive. Pareyn tables provide consumption estimates by rural and urban area as well as by sector. Supply/demand balance is discussed qualitatively by Cabral but no quantitative estimates are provided. The report says that in spite of the relatively large wooded area of the country, the booming practice of charcoal production is currently threatening the resource base more than agricultural expansion or any other cause (p.13) with serious impact on sustainability.

Additional information needed:

To verify if the State Department for Energy (DGE) has released a revised national energy balance. The energy balance reported refers to the year 1983.

Guinea Bissau - Historical Data for Fuelwood (1000 CUM)

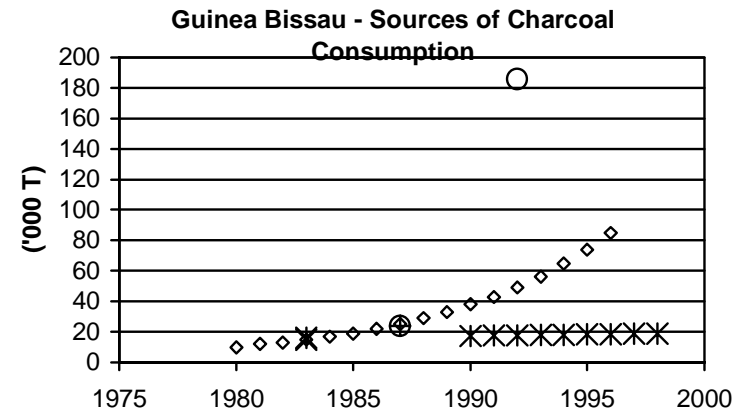
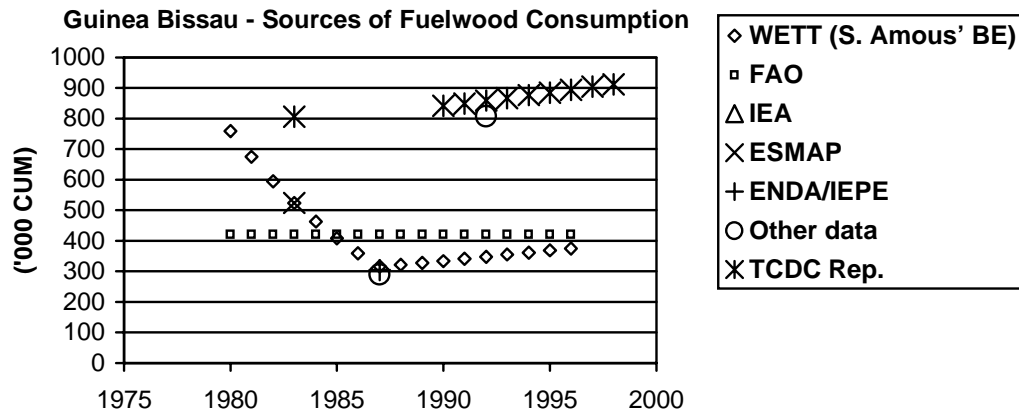
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	759	675	595	524	462	407	358	316	322	328	334	341	348	354	361	368	375				
FAO	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422	422				
IEA																					
ESMAP				524																	
ENDA/IEPE								303													
Other data								290					807								
TCDC Rep.				805							842	849	858	867	876	885	894	903	912		
Sources, notes, etc.								OD22													

Reporter's (Frans Pareyn) references: 1983 Energy Balance of Guinea Bissau (DGE); 1996 Letter of Agrarian Development Policy (LPDA). Pareyn considered most probable the estimates based on population (per capita consumption and growth rates).

Guinea Bissau - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	10	12	13	15	17	19	22	25	29	33	38	43	49	56	65	74	85				
FAO																					
IEA																					
ESMAP				15																	
ENDA/IEPE								24													
Other data								24					186								
TCDC Rep				16.3							17.4	17.6	17.8	18.0	18.1	18.3	18.5	18.7	18.9		
Sources of data adopted as BE								OD22													
Other data sources													20,700 T for urban pop. in 1992 (FAOL7)								

Reporter's (Frans Pareyn) references: 1983 Energy Balance of Guinea Bissau (DGE); 1996 Letter of Agrarian Development Policy (LPDA). Pareyn considered most probable the estimates based on population (per capita consumption and growth rates).



(06) Mali**Report by**

Mr Ismael Toure, Direction Energie, tel: (223) 23.26.29 or 77.54.53, fax: (223) 234830, touresed@afribone.net.ml

New national references cited and report overview:

Note technique sur l'évolution de la demande de bois énergie au Mali: 1998 SED/CCL - H. KONANDJI

The report by Mr. Ismael Toure provides a very clear and synthetic description of the wood energy sector in Mali. Consumption estimates for fuelwood and charcoal are provided for the period 1990 – 1998 by sector and by supplying system (auto-consumption, commercialized). The latter was defined as rural auto-consumption and urban commercialization. However, whether this definition can be considered equivalent to a rural/urban area breakdown should be confirmed by the author. The wood fuel consumption estimates provided are very close to those produced by Amous. The only significant discrepancy is a higher charcoal consumption growth (+11% for 1996).

From the estimated national wood resources and annual productivity cited in page 2, it seems that there is a wide supply surplus. The annual estimated potential productivity is some 28 million m³ (0.86m³/ha/year over 33 million ha), while total 1998 consumption is estimated at some 8.6 million m³, and projected to some 11.1 million by 2005. However, supply/demand balance, which should estimate actual sustainable productivity considering accessibility limitations and production losses, was not discussed in detail.

Consumption trends are discussed in detail and projections 1995 – 2000 – 2005 are provided (Table 5, p.17). The report provides a good description of current policies and legislation regulating the wood energy sector.

Additional information needed:

- Clarification on rural/urban consumption (Table 2 of the report).
- Concerning the demand/supply estimates, assess the amount of actual sustainable woodfuels supply.
- Provide the missing Annex 1.
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Mali - Historical Data for Fuelwood (1000 CUM)

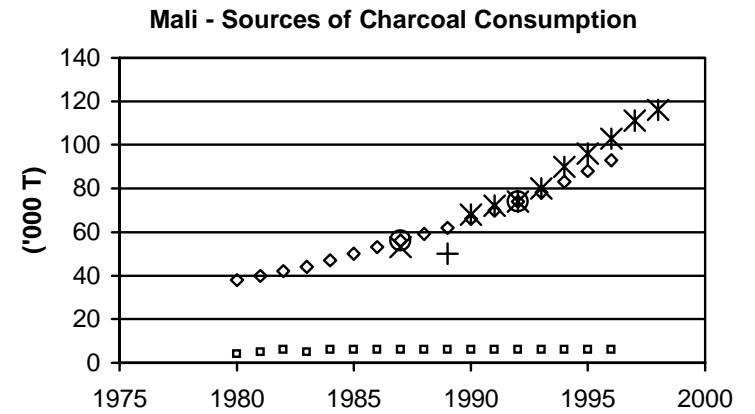
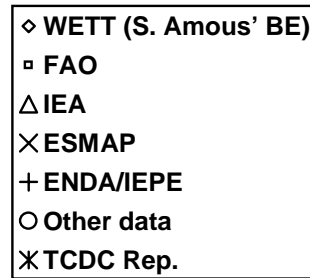
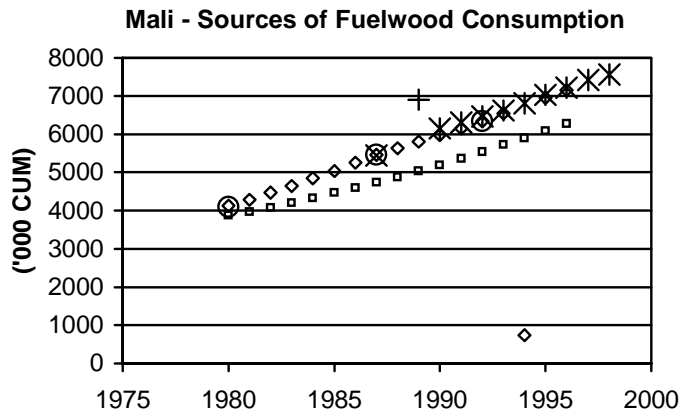
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)	4118	4288	4465	4649	4841	5041	5249	5466	5630	5800	5974	6154	6340	6537	738	6943	7150					
FAO	3872	3974	4086	4207	4334	4466	4601	4741	4886	5038	5198	5365	5539	5719	5903	6091	6282					
IEA																						
ESMAP								5439														
ENDA/IEPE										6897												
Other data	4101							5466					6340									
TCDC Rep.											6152	6303	6467	6615	6811	7026	7221	7413	7566			
1975 : 2,538 kt (FAOL13)								Average FAOL36 OD22					FAOL36									

BE : 1 T charcoal = 7 T wood. Other Data : 1 T charcoal = 7 T wood.

Mali - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	38	40	42	44	47	50	53	56	59	62	66	70	74	78	83	88	93				
FAO	4	5	6	5	6	6	6	6	6	6	6	6	6	6	6	6	6				
IEA																					
ESMAP								53													
ENDA/IEPE									50												
Other data								56					74								
TCDC Rep											68	72	74	80	90	96	103	111	116		
								FAOL36					FAOL36								
Other sources of data								11,000 T in 1987 (OD22)													

BE : 1 T charcoal = 7 T wood. Other Data : 1 T charcoal = 7 T wood.



(07) Mauritania**Report by**

Monsieur Touré Mohamed Lehib, Consultant Forestier, Président de l'Association pour la Sauvegarde des Espèces Animales et Végétales en Voie de disparition en Mauritanie (ASEAV). Adresse : BP 1125 - Nouakchott

New national references cited and report overview:

Direction de l'Environnement et de l'Amenagement Rural (DEAR), 1996

Rapport National portant sur le Secteur des Energies domestiques en Mauritanie dans le cadre du Programme RPTES/ Dieng Mika Yéro et Cheikhna M'baré, Juin 1998.

Projet Gestion Rationnelle des Ressources Forestières (PGRRF) 1997

The report provides a comprehensive overview of the various aspects of the energy sector, including detailed description of non-wood energy sources, their consumption and trends. It highlights the huge gap between the estimated wood supply (560,000 CUM/year) and the estimated woodfuels consumption in 1996 (1,410,546 CUM!).

Concerning the consumption, three main sources are reported, DEAR 1996 (fuelwood and charcoal), RPTES 1998 (fuelwood), and PGRRF (charcoal). The values are comparable but the trends for fuelwood consumption are opposite, with DEAR estimating increasing consumption linked to growing population, while RPTES estimates a reduced consumption as a result of the widespread use of butane and kerosene. Which one is more reliable?

The distinction between rural and urban consumption, although discussed, is not quantified at national level. Nor is the use by sector, i.e. household and industrial. WETT estimates are not discussed.

Supply and supply/demand balance is discussed for Houakchott

Additional information needed:

- Review/verify some conversion factors applied and some values.
- Rural/Urban and household/industrial breakdown, if possible.

Mauritania - Historical Data for Fuelwood (1000 CUM)

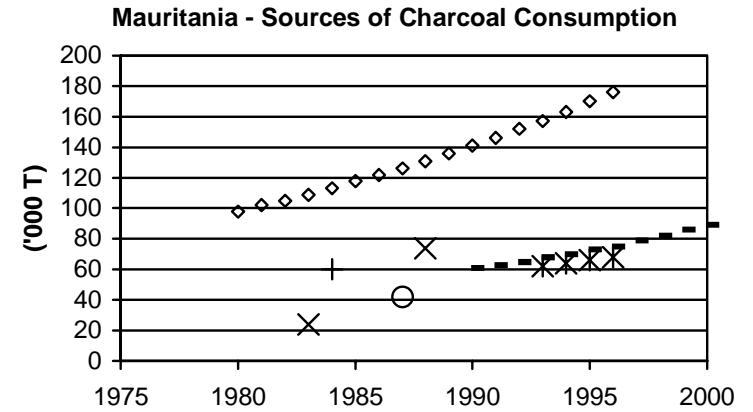
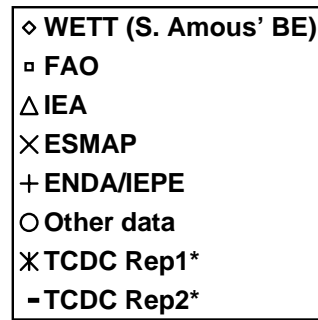
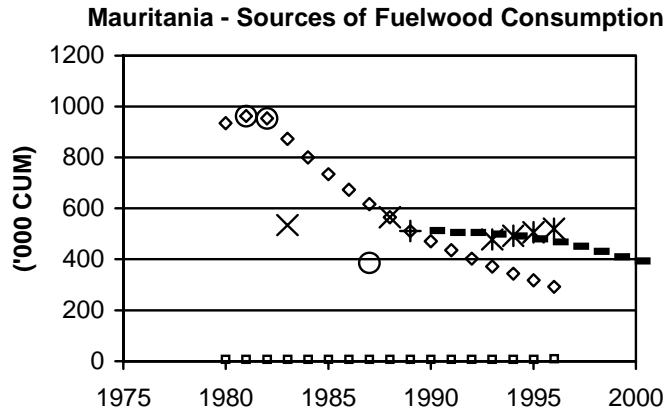
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	933	963	953	873	800	733	672	616	564	510	471	435	402	371	343	317	292				
FAO	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9				
IEA																					
ESMAP				535					564												
ENDA/IEPE										510											
Other data		963	953					386													
TCDC Rep1*														477	492	506	521				
TCDC Rep2*											513	507	505	499	492	481	469	451	430	409	392
1975 : 580 kt (FAOL13)							OD22														

* TCDC Rep. 1 = DEAR 1996; TCDC Rep 2 = RPTES 1998

Mauritania - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	98	102	105	109	113	118	122	126	131	136	141	146	152	157	163	170	176				
FAO																					
IEA																					
ESMAP				24					74												
ENDA/IEPE					60																
Other data								42													
TCDC Rep1*													62	64	66	68					
TCDC Rep2*											61	63	65	68	70	73	75	79	82	86	89
Sources, notes, etc.								OD22													

* TCDC Rep. 1 = DEAR 1996; TCDC Rep 2 = PGRRF 1997



(08) Niger**Report by**

Monsieur Elhadji Mahamane Lawali, Ingénieur Agronome des Eaux et Forests

Responsable de suivi des Dossiers de la Conférences des Nations Unies sur l'Environnement et Développement (CNUED) à Direction de l'Environnement

New national references cited and report overview:

Cellule Technique de Coordination Foyers Améliorés (CTFED), 1989, summarized per capita consumption estimates produced by many studies (GTZ, FED, Projet Energie, etc.). Plan National de Lutte contre la Desertification, 1991.

The report by Mr. Elhadji Mahamane Lawali describes in great detail the critical situation of Niger concerning wood energy supply. The sector analysis is supported by many references/studies that were carried out on this subject in Niger. The estimates of fuelwood consumption, based on past surveys and other estimation methods are very much in line with WETT's Best Estimates; although there is no direct comparison, these are practically confirmed for 1996. Concerning trend, WETT estimates show a higher consumption increment rate than that proposed in the report.

Consumption estimates are subdivided by rural and urban area but not by sector.

Fuelwood supply and supply/demand balance is discussed at length, describing a situation off-balance since many years, and worsening year after year.

Additional information needed:

- Estimated woodfuels consumption by sector (urban/rural already provided)
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Niger - Historical Data for Fuelwood (1000 CUM)

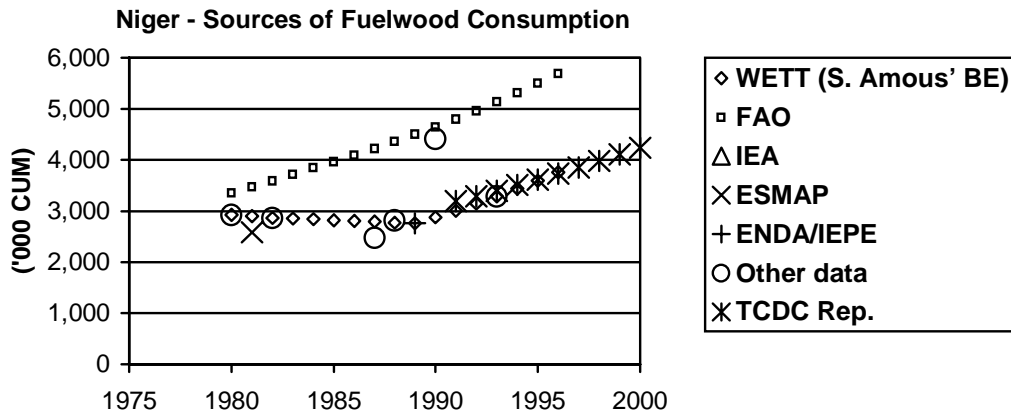
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,926	2,897	2,869	2,853	2,837	2,821	2,805	2,790	2,774	2,759	2,882	3,011	3,146	3,287	3,437	3,593	3,756				
FAO	3,359	3,474	3,595	3,719	3,846	3,974	4,103	4,232	4,364	4,503	4,650	4,806	4,970	5,142	5,321	5,504	5,693				
IEA																					
ESMAP		2,579																			
ENDA/IEPE										2,759											
Other data TCDC rep.	2,926		2,869					2,483	2,817		4,414			3,287							
1975 : 2,030 kt (FAOL13) 1977 : 218 kt (FAOL37)	S44 FAOL17							OD22 FAOL37		IEA2			FAOL37								
											3190	3292	3397	3506	3618	3734	3854	3977	4104	4236	

Reporter's main reference: Plan National de Lutte contre la Desertification, 1991

Niger - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)																						
FAO																						
IEA																						
ESMAP																						
ENDA/IEPE																						
Other data																						
TCDC Rep.																						
Sources of data adopted as BE																						
Other data sources																						

No charcoal data. This might mean that this energy is not consumed at all or, more probably that the consumption is not significant and was as a result not reported in any reference.



(09) Senegal**Report by**

Mr Amsatou Niang Chef de la Division Suivi/Evaluation/Formation, Direction des Eaux et Forêts, Louga, SÉNÉGAL

New national references cited and report overview:

Atelier sur «Triangle de planification du sous-secteur des combustibles domestiques au Sénégal», PSACD⁴, Dakar, Décembre 1999, 53p.

Schéma d'Approvisionnement Energétique Régional (SAER) pour la ville de Kaolack, plan de déroulement; PSACD, Dakar, Décembre 1998, 61p.

The report well describes the inadequacy of the Forest Department to assess woodfuels consumption and supply. The quota system in use does not include at all fuelwood and even for the charcoal it seems to catch only a small portion of the actual trade and consumption. In 1999 the PSACD (*Projet Sénégal-Allemand Combustibles domestiques*) launched the study of the current domestic energy system in the country. Preliminary urban household consumption estimates indicate the annual per capita consumption of 52 Kg of fuelwood and 58 Kg of charcoal. No estimates are provided for rural areas and industrial uses. New estimates will be produced in 2001 by the RPTES PROGEDE initiative (Projet de Gestion Durable des Energies Traditionnelles et de Substitution).

Additional information needed:

Author's comments on WETT Best Estimates on Senegal and on the sources used to produce them (ESMAP '81, ENDA/IEPE '88 to '94, Senegal Ministry of Energy Mines and Industry, etc.)

Senegal - Historical Data for Fuelwood (1000 CUM)

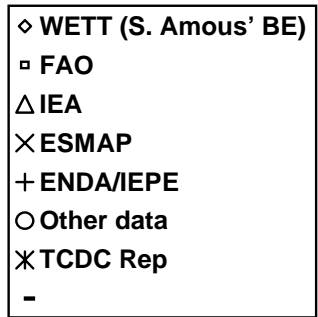
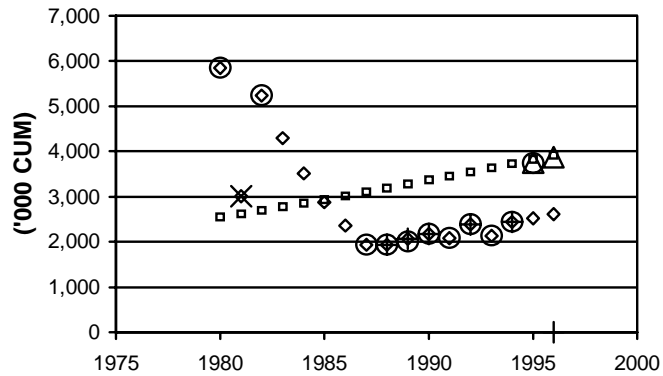
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	5,851	3,006	5,241	4,293	3,515	2,879	2,358	1,931	1,939	2,069	2,179	2,076	2,388	2,138	2,443	2,525	2,611				
FAO	2,543	2,615	2,690	2,767	2,845	2,927	3,011	3,098	3,186	3,275	3,364	3,452	3,539	3,628	3,720	3,816	3,917				
IEA																3,755	3,865				
ESMAP		3,006																			
ENDA/IEPE									1,939	2,069	2,179		2,388		2,443		0				
Other data	5,851		5,241					1,931	1,939	2,000	2,179	2,076	2,388	2,138	2,443	3,738					
TCDC Rep																					
	1975 : 2,103 kt (FAOL13)							OD22	OD25	FAOL33	OD25	FAOL33	OD25		OD25						

⁴ PSACD : Projet Sénégal-allemand Combustibles Domestiques ; projet logé à la Direction de l'Energie et dont l'objectif principal est de mettre au point une forme d'exploitation intégrée des énergies domestiques qui soit compatible avec une gestion durable des forêts.

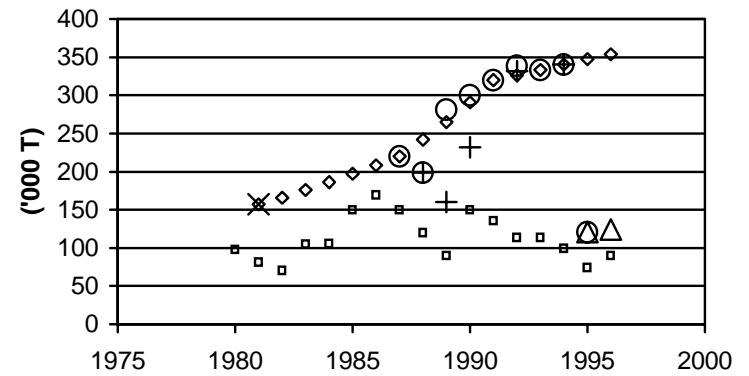
Senegal - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)		157	166	176	186	197	208	220	242	265	291	320	326	333	340	347	354					
FAO	98	82	71	105	106	150	170	150	120	90	150	136	114	114	100	75	90					
IEA																121	124					
ESMAP		157																				
ENDA/IEPE									199	160	232		332		340							
Other data								220	199	281	300	320	339	333	340	121						
TCDC rep																						
								OD22 FAOL33		FAOL33	FAOL34	FAOL35	FAOL36									
									262,000 T (FAOL33)													
									213,000 T (OD25- IEA20)		249,000 T (OD25- IEA20)		356,000 T (OD25- IEA20)		364,000 T (OD25- IEA20)							

Senegal - Sources of Fuelwood Consumption



Senegal - Sources of Charcoal Consumption



(11) Eritrea**Report by**

Mr. Estifanos Bein Manna and Mr. Eleas Araya, Forestry Section, Forestry and Wildlife Division, Department of Land Resources and Crop Production, Ministry of Agriculture, Asmara - Eritrea

New national references cited and report overview:

Interim Report, 1996: Strengthening The Department Of Energy, Comprehensive Energy Sector Studies, Eritrea (UNOPS Project ERI94/001); Ministry Of Energy, Mines and Water Resources, United Nations, Lahmeyer International.

The report well describes the status of wood energy information in Eritrea. For the present purpose of developing national statistics it seems that the results of the 1996 Lahmeyer International study best fit the requirements. Table 4 at p. 8 summarizes the household energy consumption by fuel type. The values reported, however, were estimated using conversion factors different from FAO standards (16.6 MJ/Kg for fuelwood and 29MJ/Kg for charcoal). In spite of this, the values reported are much lower than those provided by FAO for fuelwood (21 PJ against FAO's 34) and higher for charcoal (3.3 PJ against FAO's 0.0).

Consumption estimates are provided by sector (household, social, commercial) but not by area. From the reference described it should be possible to summarize also by area.

The paper provides additional interesting information/references on consumption, actual/potential supply and biomass stocking for Western Lowlands. Biomass stocking data was derived from an FAO-TCP project, which carried out a survey of the entire range of natural vegetation types, as well as agricultural lands, through physiognomic stratification and field sampling. On the basis of the biomass survey findings, the report discusses with much clarity the widening demand/supply gap on wood fuel and un-sustainability of the current situation. The study described could be very useful for spatial/ecological analyses of supply patterns.

Additional information needed:

- Provide results by original units of measurement and describe conversion factors
- Provide estimates of consumption by rural/urban areas
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Eritrea - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)														2,939	3,081	3,249	3,446				
FAO														2,411	2,464	2,534	2,621				
IEA																					
ESMAP																					
ENDA/IEPE																					
Other data																					
TCDC Rep.																	1840				
Sources, notes, etc.																					

WETT data related to Fuelwood was simulated using the similar Per Capita consumption as Ethiopia.

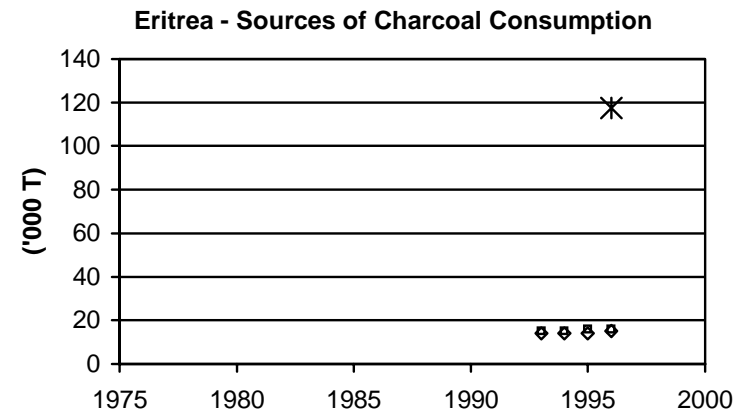
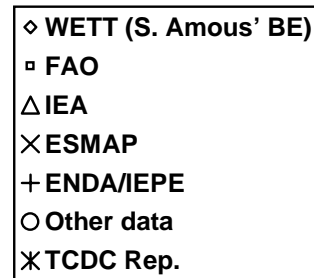
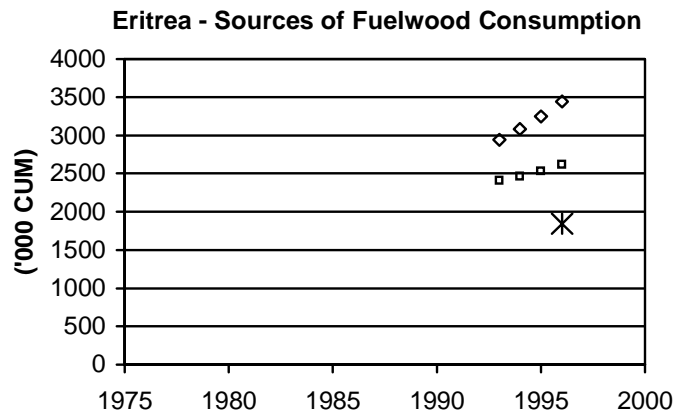
TCDC report's main reference: 1996: Strengthening The Department Of Energy, Comprehensive Energy Sector Studies, Eritrea (UNOPS Project ERI94/001)

Eritrea - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)														14	14	14	15					
FAO														15	15	16	16					
IEA																						
ESMAP																						
ENDA/IEPE																						
Other data																						
TCDC Rep.																	117.4					
Sources, notes, etc.																						
Other data sources																						

WETT data related to charcoal was simulated using the similar Per Capita consumption as Ethiopia.

TCDC report's main reference: 1996: Strengthening The Department Of Energy, Comprehensive Energy Sector Studies, Eritrea (UNOPS Project ERI94/001)



(14) Somalia**Report by**

Mr Yusuf Mohamed Hussein, Mogdishu Forestry Association, c/o FAO Office, Mogadishu

New national references cited and report overview:

No references.

The report of Mr. Yussuf Mohamed Hussein describes the dramatic situation that Somalia is currently living. Reliable information is clearly not available and the values provided appear as tentative rough estimates only. Table at page 2 on fuelwood seems to be limited to non-conifers species, and the values give are not clear. The charcoal production/consumption estimates shown at p. 5 are lower but somehow comparable to the FAO values. It is difficult to assess their reliability.

No breakdown is provided by rural/urban areas nor by sector. No supply data.

No reference to the FAO statistics.

Additional information needed:

- Clarify fuelwood consumption estimates 1994-1999 in table at Page 2, (total consumption, or only broadleaved species?)
- Review FAO Country Tables, provide comments and/or insert alternative estimates.
- Description of the surveys which originated the reported data (date of survey, approach, coverage, stratification, sampling intensity, etc.).

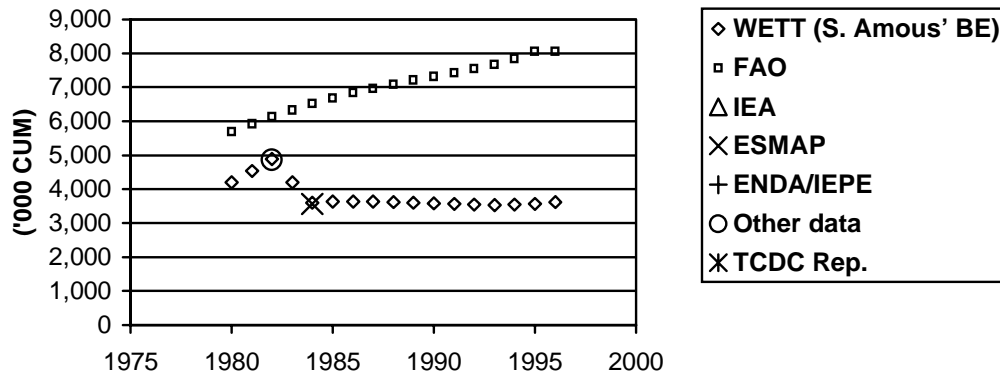
Somalia - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	4,206	4,537	4,894	4,201	3,608	3,627	3,636	3,633	3,622	3,606	3,589	3,569	3,550	3,537	3,542	3,568	3,617				
FAO	5,704	5,921	6,133	6,336	6,523	6,692	6,843	6,977	7,099	7,213	7,327	7,438	7,549	7,677	7,845	8,065	8,059				
IEA																					
ESMAP					3,563																
ENDA/IEPE																					
Other data			4,862																		
TCDC Rep.																					
1975 : 2,064 kt (ESMAP)			FAOL19																		

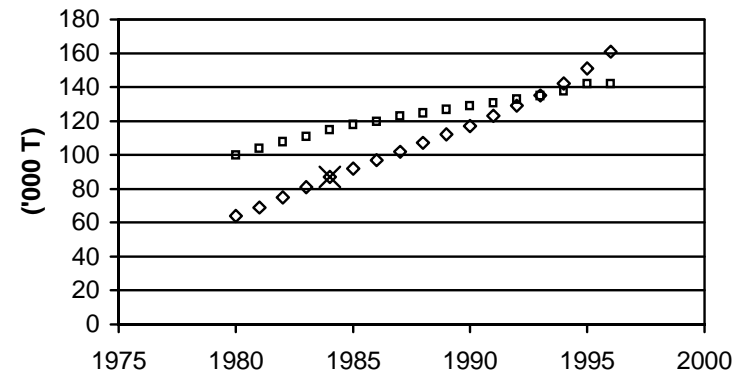
Somalia - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	64	69	75	81	87	92	97	102	107	112	117	123	129	135	142	151	161				
FAO	100	104	108	111	115	118	120	123	125	127	129	131	133	135	138	142	142				
IEA																					
ESMAP					87																
ENDA/IEPE																					
Other data																					
TCDC Rep.																					
Sources of data adopted as BE																					
Other data sources																					

Somalia - Sources of Fuelwood Consumption



Somalia - Sources of Charcoal Consumption



(15) Sudan**Reports by**

Report 1: Mr. Mohamed Ezeldeen Hussein, Coordinator, National Forest Inventory Unit, and Mr. Abdel Rahim Osman , Head of Afforestation Administration, Forest National Corporation (FNC) P.O. Box 658 Khartoum - Sudan

Report 2 (presented at Nairobi Workshop): Mr. Mohamed Ezeldeen Hussein, Coordinator, National Forest Inventory Unit.

New national references cited and report overview:

Various reports by Forest National Corporation, such as: “Forest Products Consumption Survey in the Sudan 1995”.

The first report is very concise (5 pages only) but also rich of important technical details. The report makes continuous reference to recent surveys (“Forest Products Consumption Survey in the Sudan 1995” et al.). The report contains one table on total woodfuel consumption (all sectors) 1994 – 1998 which provides essential fuelwood/charcoal estimates. While the consumption of fuelwood (firewood) is similar to WETT, that of charcoal is considerably lower. Information on urban/rural and sector breakdown is available within the text.

The second report makes reference to the same sources but provide slightly different estimates. In view of the regional relevance of the wood energy sector in Sudan, which is the largest tropical country in Africa, it is recommended to review the available sources to produce consolidated estimates.

It appears that all surveys excluded the southern provinces of Sudan, due to the persistence of the civil war, and other inaccessible areas. The 1995-97 National Forest Inventory (NFI) covered 24.9 % of the country. How are the estimates of consumption and supply for the unsurveyed areas being done? Forest resources were estimates on World Bank 1986 or on the parts covered by the NFI. Wood fuel demand/supply balance was discussed in the second report for the inventory areas, where it results that the estimated wood consumption (16.5 million CUM) exceeds the annual allowable cut (11.7 million CUM) by 4.8 million CUM.

Additional information needed:

- Description of sources (survey date, method, intensity, etc.)
- Copy of main references, (originally attached to the report, but now missing)

Sudan - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	12,105	11,858	11,478	11,111	10,755	10,412	10,079	9,758	9,447	9,146	8,855	8,573	8,301	8,038	7,783	7,537	8,036				
FAO	4,856	5,002	5,148	5,294	5,438	5,580	5,718	5,855	5,989	6,122	6,255	6,389	6,522	6,659	6,799	6,944	7,502				
IEA																7,536	8,036				
ESMAP		11,858																			
ENDA/IEPE																					
Other data	40,124		35,409												7,388						
TCDC Rep.															9,439	9,008	9,159	9,482	9,729		
Sources, notes, etc.			FAOL19												FAOL26						

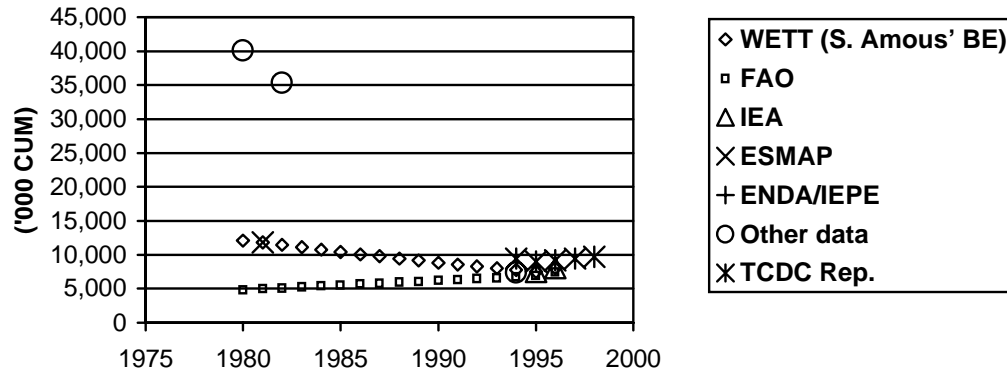
TCDC report's main references: Forest Production Consumption in Sudan , Forest National Corporation , 1995

Sudan - Historical Data for Charcoal (1000 T)

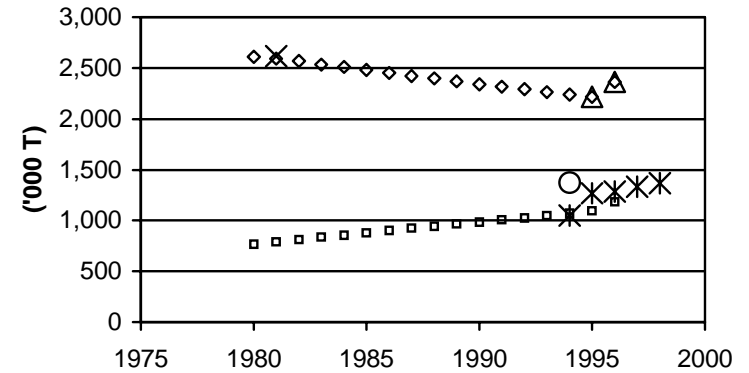
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,612	2,596	2,567	2,537	2,508	2,480	2,451	2,424	2,396	2,369	2,342	2,316	2,290	2,264	2,239	2,215	2,362				
FAO	765	788	811	834	857	879	901	923	944	965	986	1,007	1,028	1,050	1,072	1,094	1,183				
IEA																2,216	2,363				
ESMAP		2,615																			
ENDA/IEPE																					
Other data															1,375						
TCDC Rep.															1050	1265	1286	1332	1366		
Other data sources															FAOL26						

TCDC Report's main references: Forest Production Consumption in Sudan , Forest National Corporation , 1995

Sudan - Sources of Fuelwood Consumption



Sudan - Sources of Charcoal Consumption



(19) Guinea**Report by**

Mr. Nabi Issa Camara, Chef Section Énergies Domestiques, Direction Nationale de l'Énergie, Ministère de l'Hydraulique et de l'Énergie, B.P. 1217 Conakry

New national references cited and report overview:

RPTES 1998: LE SECTEUR DES ÉNERGIES TRADITIONNELLES EN GUINÉE

The report is based essentially on the report RPTES 1998 that provides up-to-date estimates of wood fuel consumption and production. The values reported in Annex to the report seem to be usable right away. They would therefore replace WETT Best Estimates' values which are slightly higher. There are some puzzles about the WETT value cited in Section II page 6 (7,009,885) whose origin is not clear.

Consumption estimates are provided by rural and urban areas, as well as by sector (household and commercial). Concerning supply and demand/supply Guinea presents a positive situation, with a positive balance (with some 13 MT accessible supply and a consumption of some 7 MT at 1996), which is likely to remain positive at least for the next decade.

Additional information needed:

- Clarifications on Table 2 (measurement units and reference dates) and on Section II (p.6)
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Guinea - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	7,751	7,483	7,228	6,986	6,754	6,993	7,241	7,497	7,762	8,037	7,849	7,669	7,496	7,331	7,172	7,417	7,572				
FAO	2,676	2,728	2,788	2,853	2,922	2,992	3,061	3,131	3,211	3,316	3,453	3,630	3,838	4,057	4,255	4,409	4,141				
IEA																					
ESMAP																					
ENDA/IEPE										6,897											
Other data					6,754										7,172						
TCDC Rep															6550	6756	6971	7201	7443		
Sources, notes, etc.					OD27										OD14						
Other data :					5,578 kt (FAOL31)																

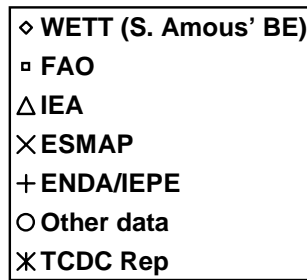
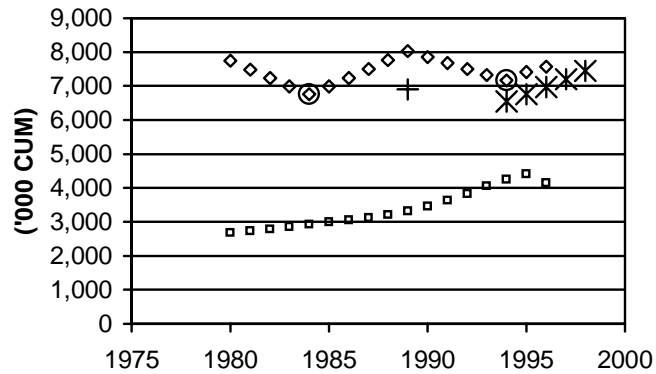
TCDC report's main references: *RPTES 1998: LE SECTEUR DES ÉNERGIES TRADITIONNELLES EN GUINÉE*

Guinea - Historical Data for Charcoal (1000 T)

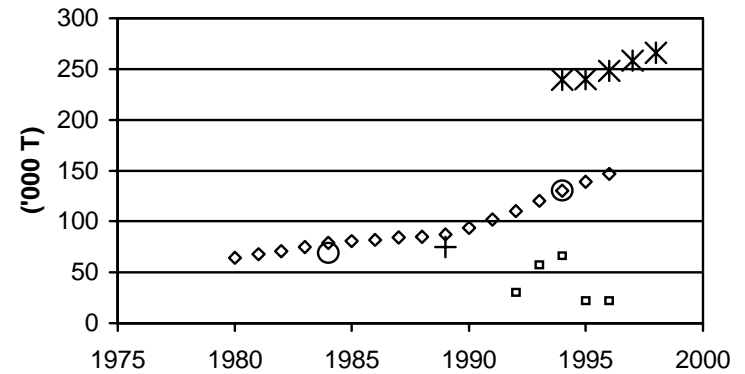
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	64	68	71	75	79	81	82	84	85	87	94	102	110	120	130	139	147				
FAO													30	57	66	22	22				
IEA																					
ESMAP																					
ENDA/IEPE										75											
Other data					69										130						
TCDC Rep															239	240	248	258	266		
Sources, notes, Comments, etc.					FAOL31										OD14						
Other data :					88,000 T (OD34)																

TCDC report's main references: *RPTES 1998: LE SECTEUR DES ÉNERGIES TRADITIONNELLES EN GUINÉE*

Guinea - Sources of Fuelwood Consumption



Guinea - Sources of Charcoal Consumption



(20) Liberia**Report by**

Lawrence N. Satia, Forestry Development Authority, Box 10-3010, 1000 Monrovia-10, Liberia

New national references cited and report overview:

Only report cited: Rep. 5279, LBR/UNDP/WB Energy Sector, 1984.

Most estimates are based on new research carried out by the author.

The report of Mr. Lawrence N. Satia provides a clear overview of recent sector developments and their dramatic social and economic settings, which is a considerable achievement, considering the total absence of recent surveys (the last reference available being based on 1983 ESMAP data).

The report well describes the essential role of wood energy in the present delicate moment of social and economic reconstruction after the bitter years of civil war.

Missing recent references, and considering the tremendous social and economic changes that occurred since the last studies, the situation description and the estimates reported in tables 1 to 8 are based on direct author's investigations, interviews and sampling.

Discrepancies with WETT estimates are significant and are discussed in the report. According to the author, the civil war provoked an increase of fuelwood consumption (and not a decrease as reported in WETT) as a substitute of electricity and gas whose supply are interrupted since the beginning of the war, and of charcoal which was in shorter supply. Charcoal production diminished during the war but has rapidly increased; the reported charcoal consumption for year 1996 (123,000MT) is quite close to WETT estimate (139,000 MT).

Estimated wood fuel consumption is subdivided by sector (household and industrial) as well as by urban/rural areas and reported for the 1994 –1998 period following the standard FAO reporting format.

The supply/demand balance is not specifically discussed but the report clearly states that wood resources in the country guarantee potential supplies largely exceeding the demand (although it seems that the country's forest cover is overestimated).

Additional information needed:

- Description of the method of expansion of survey data to the entire country

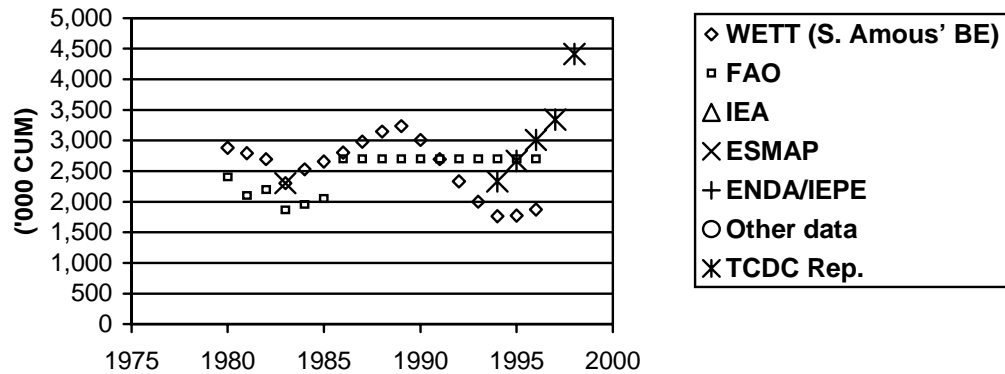
Liberia - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,879	2,793	2,700	2,308	2,525	2,652	2,807	2,985	3,146	3,237	3,011	2,694	2,331	2,001	1,768	1,771	1,873				
FAO	2,400	2,100	2,200	1,860	1,950	2,050	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700	2,700				
IEA																					
ESMAP				2,308																	
ENDA/IEPE																					
Other data																					
TCDC Rep.															2,332	2,666	3,006	3,346	4,413		
Sources, notes, Comments, etc.																					

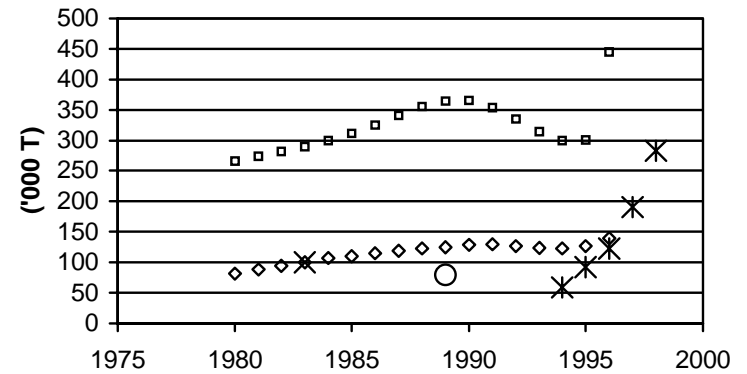
Liberia - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	82	88	94	100	107	110	115	119	123	125	129	130	127	124	123	127	139				
FAO	266	274	282	290	300	311	325	341	356	364	365	354	335	314	300	301	445				
IEA																					
ESMAP				100																	
ENDA/IEPE																					
Other data										80											
TCDC Rep															59	92	123	191	283		
Sources, notes, Comments, etc.										FAOL11											
Other data :					88,000 T (OD34)					65,000 T (FAOL9)											

Liberia - Sources of Fuelwood Consumption



Liberia - Sources of Charcoal Consumption



(22) Sierra Leone**Report by**

Mr. Abdul-Abib Frederick Conteh, Conservator of Forests, Acting Head of Forestry Planning Unit, Ministry of Agriculture Forestry and Marine Resources, Youyi Building, Freetown, Sierra Leone.

New national references cited and report overview:

Conteh A.A.F. 1997. Woodfuel demand and strategy for supply in the Western Area of Sierra Leone. MSc Thesis, University of Stellenbosch, RSA.

Conteh A.A.F. 1999. A survey of charcoal producers in rural and urban Western Area of Sierra Leone, Freetown (unpublished)

The report offers recent and quite different estimates, compared to WETT, on the basis of a survey carried out by the author (Conteh 1997) in the Western Area of the country. The survey, which is not described in detail, interested approximately 16 % of the population of the country. The author expanded the per capita fuelwood and charcoal consumption estimated through the survey to the entire country, on the basis of population projections.

The estimated consumption is much lower than WETT values. Almost half for fuelwood and some 20 % less for charcoal. Conteh estimates are much more recent (1997 vs ESMAP 1984/86) and probably more reliable. No consistent national breakdown by sector is provided (estimates are given for Western Area only). No urban/rural breakdown is provided. Supply and supply/demand balance is mentioned only and quantitative estimates are not provided.

Additional information needed:

- Comments on the estimates produced in the WETT study, which are based on ESMAP '84 and '86 estimates.
- Could the national consumption by household/industrial sector as well as by urban/rural areas be derived from Western Area survey results?
- Copy of main references

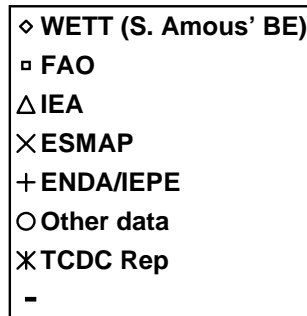
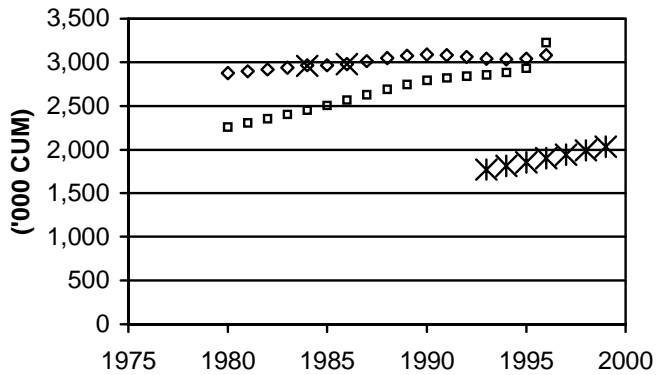
Sierra Leone - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,873	2,895	2,916	2,938	2,963	2,965	2,977	3,013	3,049	3,074	3,085	3,080	3,062	3,041	3,031	3,043	3,079				
FAO	2,260	2,306	2,353	2,400	2,450	2,504	2,564	2,628	2,692	2,747	2,792	2,822	2,840	2,856	2,883	2,931	3,225				
IEA																					
ESMAP					2,956		2,977														
ENDA/IEPE																					
Other data																					
TCDC Rep														1,773	1,813	1,855	1,898	1,942	1,987	2,033	

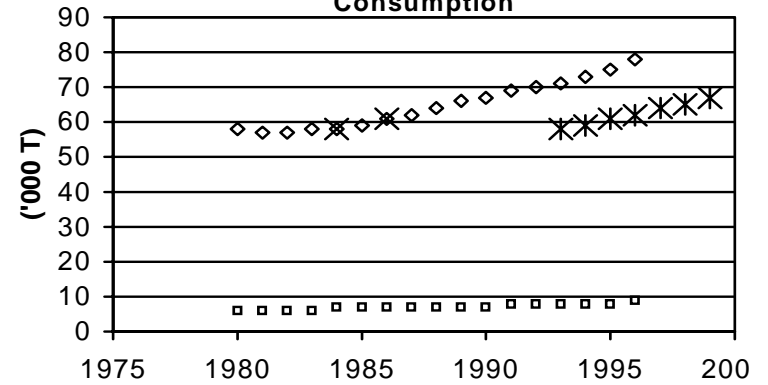
Sierra Leone - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	58	57	57	58	58	59	61	62	64	66	67	69	70	71	73	75	78				
FAO	6	6	6	6	7	7	7	7	7	7	7	8	8	8	8	8	9				
IEA																					
ESMAP					58		61														
ENDA/IEPE																					
Other data																					
TCDC rep														58	59	61	62	64	65	67	

Sierra Leone - Sources of Fuelwood Consumption



Sierra Leone - Sources of Fuelwood Consumption



(24) Burundi**Report by**

Prof. François NKURUNZIZA, Université de Burundi, BP 5142, Bujumbura, Tel: 257-22 62 21/22 52 28 Fax: 257-21 64 66

New national references cited and report overview:

Département de l'Energie, Direction Générale de l'Eau et de l'Energie, Ministère de l'Energie et des Mines, Annuaire statistique sur la biomasse, l'électricité, la tourbe et les produits pétroliers pour 1997, 24 p

The report summarizes the estimates provided in the 1997 Statistical Annuary of the *Département de l'Énergie, Ministère de l'Energie et des Mines*, which were derived from information provided by the Forest Department. There is no description on how these estimates were produced.

The estimated fuelwood consumption is much higher than WETT estimates (7.7 M CUM vs. 5.4 for 1996). The method of calculation is not given. The report also estimates the daily per capita fuelwood consumption to 2.4 Kg in 1989 raised to 2.9 in 1994 (as per inquiries carried out in the respective years). The difference between the two figures is probably due to survey methods. 1994 survey was well described by the author on subsequent correspondence and appears rather solid, with 4221 rural households and 953 urban households interviewed. The report states that in view of a rapidly declining resource base, fuelwood is becoming more and more rare.

Consumption estimates are reported by urban/rural areas and by sector as per standard format (T.1-4)

No reference was made to demand/supply and supply sustainability.

Additional information needed:

- Description of data sources and relevant survey methods applied in the 1989 survey (1994 survey is well described).
- Comments on supply/demand balance and supply sustainability.

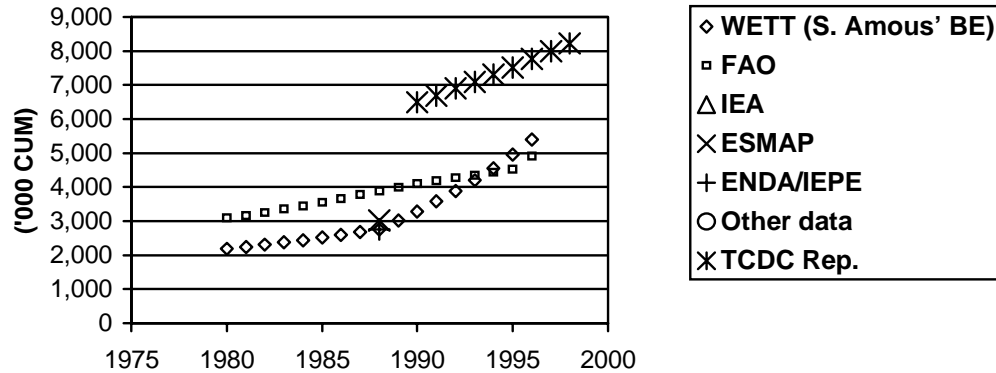
Burundi - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,190	2,249	2,311	2,376	2,444	2,517	2,595	2,677	2,759	3,018	3,291	3,576	3,877	4,198	4,552	4,951	5,403				
FAO	3,083	3,167	3,253	3,345	3,441	3,544	3,653	3,768	3,884	3,994	4,096	4,184	4,264	4,342	4,426	4,526	4,910				
IEA																					
ESMAP									3,013												
ENDA/IEPE									2,759												
Other data																					
TCDC Rep.											6,501	6,694	6,893	7,100	7,300	7,526	7,758	7,991	8231		
Sources, notes, etc.																					

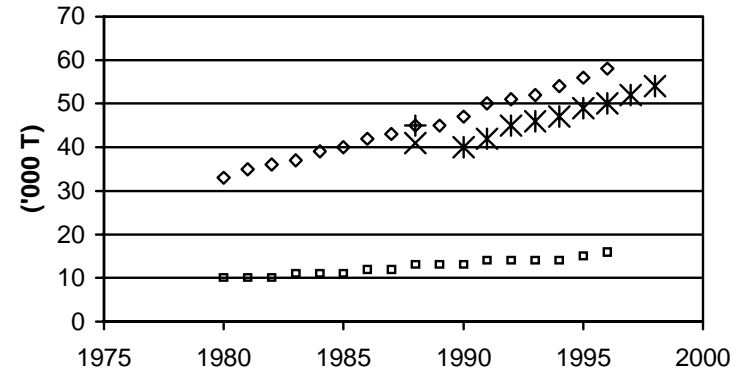
Burundi - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	33	35	36	37	39	40	42	43	45	45	47	50	51	52	54	56	58				
FAO	10	10	10	11	11	11	12	12	13	13	13	14	14	14	14	15	16				
IEA																					
ESMAP									41												
ENDA/IEPE									45												
Other data																					
TCDC Rep											40	42	45	46	47	49	50	52	54		
Sources, notes, etc.																					

Burundi - Sources of Fuelwood Consumption



Burundi - Sources of Charcoal Consumption



(25) Cameroon**Report by**

Dr. POUNA Emmuel, Directeur de la promotion, et de la transformation du Bois , Ministère de l'Environnement et des Forêts du Cameroun

New national references cited and report overview:

None considered relevant by the author.

The report says that there is no reliable information in Cameroon concerning the national wood energy sector and that the few studies available on the issue are very limited in coverage and scope. Various per capita consumption rates, estimated before 1991, are cited without indicating best references. Hence, FAO estimates are not confirmed nor revised.

No breakdown by urban/rural areas nor by sector.

No reference was made to demand/supply and supply sustainability.

Additional information needed:

- Attempt to estimate woodfuels consumption on the basis of the *Projet Energétique National- phase I (PEN-I)*.
- Description of data sources and relevant survey methods applied.
- Copy of main references

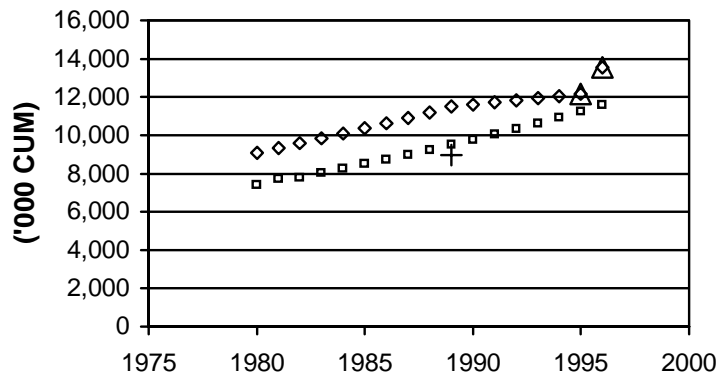
Cameroon - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	9,094	9,335	9,582	9,837	10,097	10,365	10,638	10,916	11,203	11,496	11,605	11,716	11,828	11,941	12,055	12,170	13,557				
FAO	7,433	7,724	7,807	8,033	8,265	8,503	8,747	8,997	9,254	9,517	9,787	10,060	10,350	10,640	10,940	11,240	11,600				
IEA																12,170	13,558				
ESMAP																					
ENDA/IEPE										8,966											
Other data																					
TCDC Rep.																					
Sources, notes, etc.																					

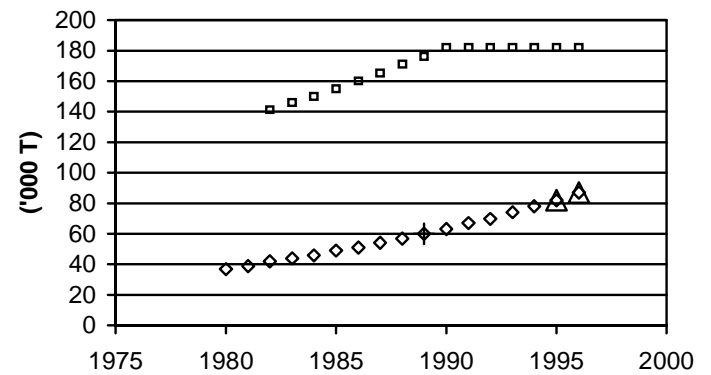
Cameroon - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	37	39	42	44	46	49	51	54	57	60	63	67	70	74	78	82	87				
FAO			141	146	150	155	160	165	171	176	182	182	182	182	182	182	182				
IEA																82	87				
ESMAP																					
ENDA/IEPE										60											
Other data																					
TCDC Rep																					
Other data sources																					

Cameroon - Sources of Fuelwood Consumption



Cameroon - Sources of Charcoal Consumption



(26) Central Africa Republic

Report by

Mr Philemon SELEBANGUE, Ancien Directeur Technique de l'OAB; actuellement Fonctionnaire au Ministère de l'Environnement des Eaux Forêts Chasses et Pêches, BP 830 Bangui,

New national references cited and report overview:

- République Centrafricaine : problèmes et choix énergétiques. Mission d'évaluation ; B. CASSAGNE, Michel MALTY et Michel PATOU ; Programme ESMAP, PNUD, Banque Mondiale, Commission des Communautés Européennes, février 1991, 25 pages et annexes
- PARN documentation, 1994-95.

The report of Mr. Philemon Selebangue provides interesting references that were not used in the WETT study. These are ESMAP 1991/2 and the survey conducted under the *Projet d'Amenagement des Ressources Naturelles (Parn)* 1995. According to these sources the consumption of wood fuel in CAR is lower than WETT estimates (1,590 MT of fuelwood against WETT 2,017 MT).

Unfortunately good part of the report and almost all tables and graphs are unreadable, probably as a result of low resolution scanning of the original source documents. Breakdown by rural/urban areas and by sector is probably available from the reference used, but at present not readable.

Concerning the demand/supply issue, the report indicates that the wood fuel resource, from natural forest growth and from forest clearing for agricultural expansion, is well above the current annual consumption, although the distance between the resource and the user communities is increasing considerably.

Additional information needed:

- Re-send tables and graphs as the ones in the report are not readable.
- Provide consumption estimates by area and sector.
 - Description of data sources and relevant survey methods applied.
- Copy of main references.

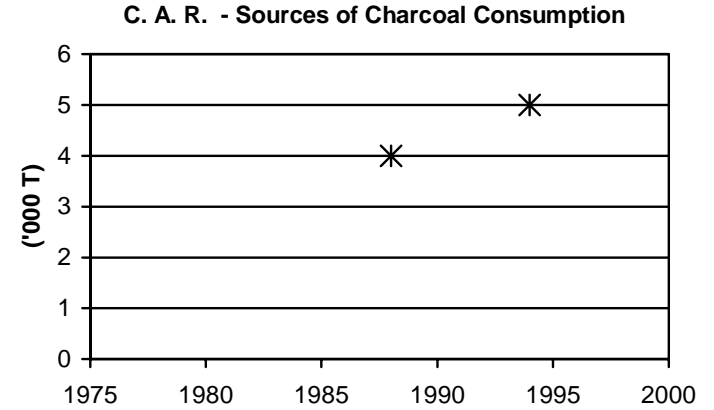
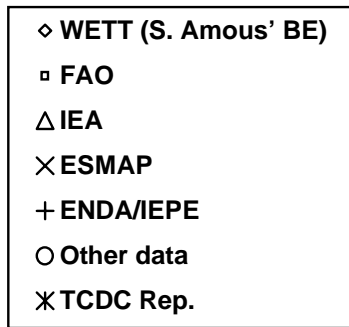
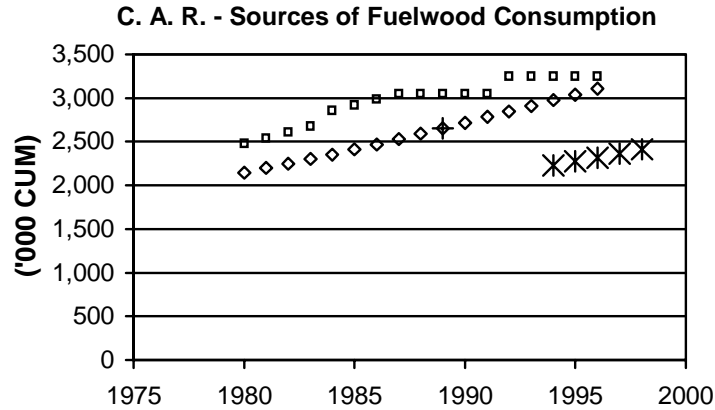
Central Africa Republic - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	2,147	2,198	2,249	2,301	2,355	2,411	2,469	2,531	2,592	2,655	2,719	2,782	2,845	2,910	2,974	3,039	3,105				
FAO	2,485	2,547	2,613	2,680	2,860	2,925	2,990	3,055	3,055	3,055	3,055	3,055	3,250	3,250	3,250	3,250	3,250				
IEA																					
ESMAP																					
ENDA/IEPE										2,655											
Other data																					
TCDC Rep.															2,228	2,273	2,318	2,365	2,412		
Sources, notes, Comments, etc.																					

Central Africa Republic - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)																						
FAO																						
IEA																						
ESMAP																						
ENDA/IEPE																						
Other data																						
TCDC Rep									4						5							
Sources, notes, Comments, etc.																						

WETT gave no charcoal data. This might mean that this energy was not consumed at all or, more probably that the consumption was not significant and was as a result not reported in any reference.



(37) Mozambique**Report by**

Mr. Pedro Duarte Mangué, and Mr. Mandrate Oreste Nakala, Forestry Research Center, Maputo, Mozambique

New national references cited and report overview:

- Fernandes, Y.; Brito, L.; Machado, J.; Manso, O. & Williams, A. 1997. Country Energy Report – Mozambique. Prepared for the GTZ/EU Regional Biomass Energy Conservation Programme.
- Mangué, P. 1998. Fuelwood estimation in savanna ecosystems in Mozambique. MSc. Thesis. University of Witwatersrand. Johannesburg. RSA

The report by Pedro Duarte Mangué (TCDC Contractor) and Mandrate Oreste Nakala appears as a complete compendium of the knowledge base available in Mozambique on wood energy issues highlighting, however, the lack of any consistent national survey able to provide national statistics. The conclusion being that missing any national reference, WETT estimates are probably the best available for Mozambique and therefore they are accepted as they are. No reference was made to demand/supply and/or supply sustainability.

Additional information needed:

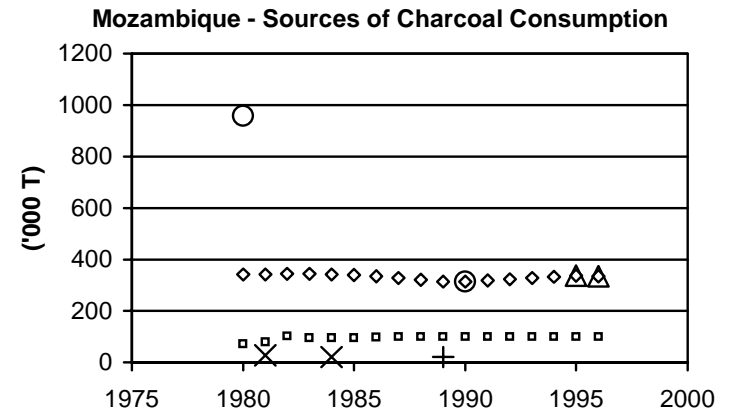
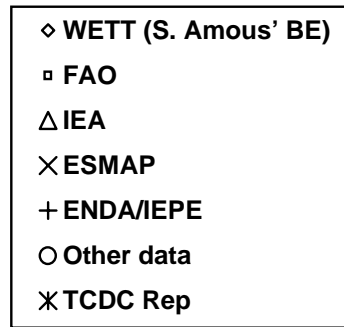
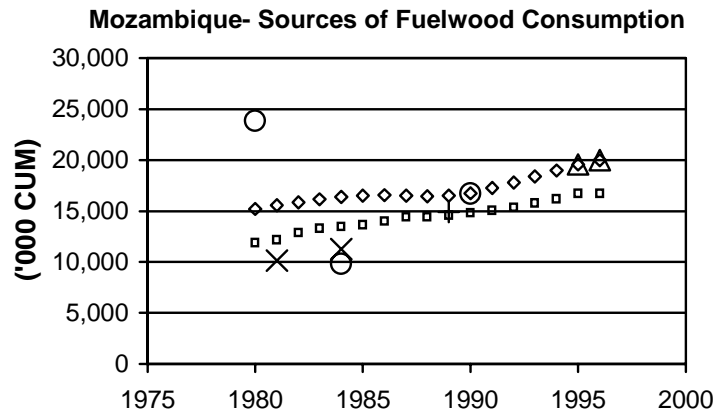
- Comments on demand/supply balance and supply sustainability.
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references

Mozambique - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	15,234	15,551	15,866	16,151	16,371	16,509	16,542	16,498	16,450	16,506	16,735	17,266	17,814	18,379	18,961	19,563	19,988				
FAO	11,880	12,200	12,900	13,300	13,500	13,700	14,055	14,422	14,422	14,641	14,825	15,079	15,398	15,782	16,226	16,724	16,724				
IEA																19,563	19,987				
ESMAP		10,117			11,233																
ENDA/IEPE									14,897												
Other data	23,888				9,823						16,735										
TCDC Rep																					
Sources, Comments, etc.	IAE12				IAE26						IAE46										
Other data :											5,756 kcum (IAE58)										

Mozambique - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	342	343	344	344	342	339	334	327	320	315	314	319	323	328	333	338	334				
FAO	71	78	102	95	95	95	98	100	100	100	100	100	100	100	100	100	100				
IEA																338	334				
ESMAP		29			21																
ENDA/IEPE									20												
Other data	957										314										
TCDC Rep																					
Other data adopted as BE											(IEA46)										
Other sources of data :	449,000 T (IEA12)				49,000 T (IEA26)						353,000 T (IEA58)										



(38) Namibia**Report by**

Dr. Harrison Ocheing Kojwang, Director of Forestry, Ministry of Environment and Tourism, P.M.B 13346, Windhoek, Namibia, Tel: +264-61-248211 Fax: +264-61-222830, kojwang@forestry.met.gov.na

New national references cited and report overview:

- NISER (The Namibia Institute for Social and Economic Research) 1992. Namibia Household Energy Assessment. University of Namibia.
- Government of Namibia 1997. Various surveys of woody resources. Directorate of Forestry.
- Wamukonya L 1997. Energy Consumption Patterns of Rural and Peri-Urban Households in Namibia. Ministry of Mines and Energy Namibia, UNDP, GTZ.

The report of Dr. Harrison Ocheing Kojwang shows that there is only limited information available on wood energy in Namibia. However, the studies carried out recently (1996) in urban and rural areas bring the estimated daily fuelwood consumption per capita at around 1.1 Kg, for a total national annual value of some 672 000 Tons (927 000 CUM). This estimate seems to be somehow more realistic than WETT, that, with 1 933 000 Tons (1996), implies a daily per capita consumption of 2.4 Kg.

The report describes the increasing charcoal production in Namibia (some 12 000 T in 1996, with prediction up to 40 000 T by 2006), mainly for export to Europe and South Africa, and marginally, for local consumption. Breakdown by rural/urban area and by sector (commercial, subsistence) is provided.

Demand/supply balance and supply sustainability was not discussed.

Additional information needed:

- Comments on demand/supply balance and supply sustainability.
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Namibia - Historical Data for Fuelwood (1000 CUM)

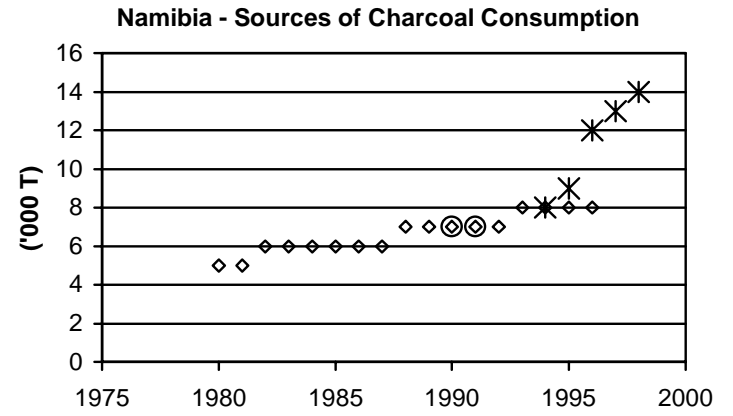
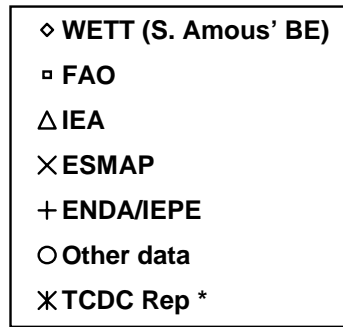
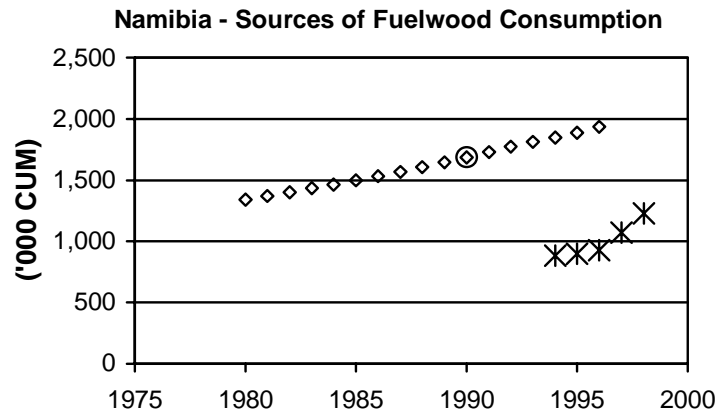
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	1,341	1,371	1,402	1,432	1,465	1,499	1,533	1,567	1,604	1,644	1,684	1,730	1,771	1,811	1,847	1,887	1,933				
FAO																					
IEA																					
ESMAP																					
ENDA/IEPE																					
Other data											1,684										
TCDC Rep *															884	898	929	1,069	1,228		
Sources, notes, etc.											IAE46										

* TCDC Rep. Data tabulated by Dr. Kojwang , Values including internal consumption and export.

Namibia - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	5	5	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8				
FAO																					
IEA																					
ESMAP																					
ENDA/IEPE																					
Other data											7	7									
TCDC Rep *															8	9	12	13	14		
Sources, notes, etc.																					

* TCDC Rep. Data tabulated by Dr. Kojwang , Values including consumption and export.



(41) Zambia**Report by**

John MULOMBWA, Principal Extension Officer, Forest Department, P O Box 410017 Kasama – Zambia, Tel: 260-4-221222 (Office), 260-4-222212 (Home)
E-mail: Forestry@zamnet.zm

New national references cited and report overview:

ZFAP 1997. Draft Forest Policy. Ministry of environment and Natural Resources. ..and many other references.

The report from John Mulombwa “Woodfuel Review and Assessment in Zambia” is rich and informative, and it makes a very interesting reading. The analysis of the wood energy issue in the country and in its provinces is well described and quite authoritative. Reference is made to the large number of reports produced around 1996-7 in the framework of the National and Provincial Forestry Action Programs.

Its contribution to the filling of the standard country table is, however, rather poor, since the data provided do not present the suitable breakdown, terminology, etc..

The author can certainly summarize his knowledge in the format required for the National Report Data Tables, reporting also urban/rural and breakdown by sector.

As per supply issues, the report describes several scenarios (T. 3.1/2/3, pp. 20-21), where a negative demand /supply balance will be reached by year 2004-2006 (current trends). For selected provinces, the paper discusses in detail consumption patterns highlighting the considerable areas deforested for charcoal production (Luapula Province, T.3.5, p.28).

Additional information needed:

- Compare report’s estimates with the FAO Woodfuel Data-set (WETT)
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Zambia - Historical Data for Fuelwood (1000 CUM)

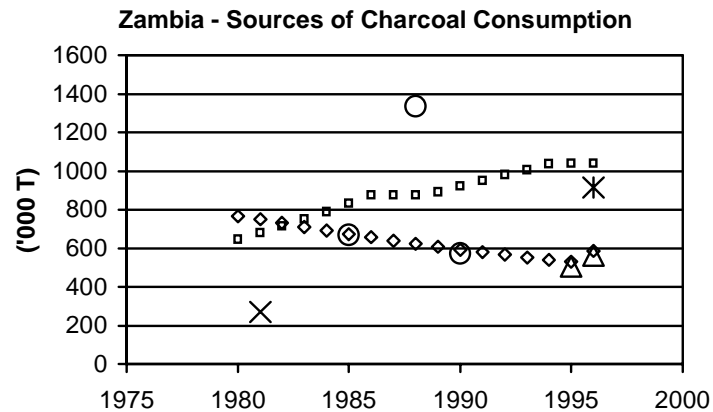
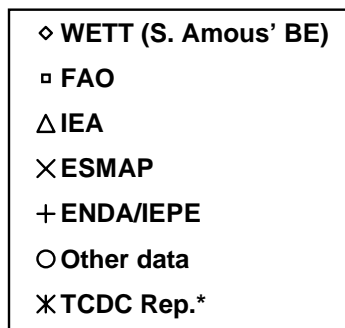
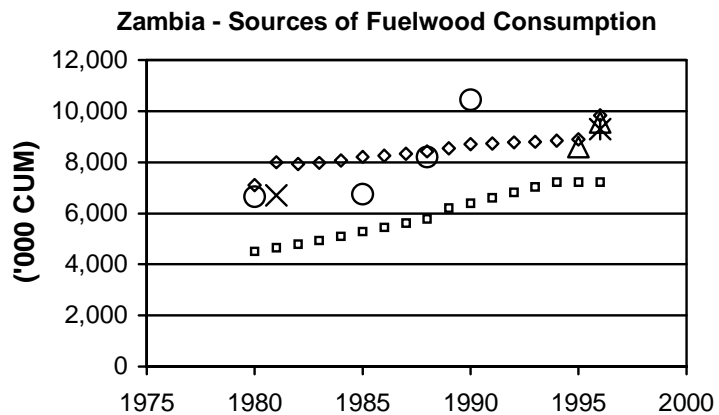
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	7,098	7,993	7,929	7,970	8,066	8,193	8,249	8,317	8,406	8,527	8,701	8,734	8,768	8,804	8,842	8,882	9,831				
FAO	4,510	4,645	4,785	4,935	5,095	5,275	5,440	5,610	5,775	6,192	6,398	6,604	6,809	7,015	7,219	7,219	7,219				
IEA																8,579	9,537				
ESMAP		6,699																			
ENDA/IEPE																					
Other data	6,652					6,752			8,210		10,448										
TCDC Rep.*																	9,279				
Sources, notes, etc.	IAE12					FAOL18			IAE59		IAE33										

* TCDC Rep. Estimate based on rural/urban population (p 5) and quoted per capita consumption rates (p. 22, 23)

Zambia - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	767	750	731	711	692	674	657	640	624	608	593	579	566	553	541	529	586				
FAO	649	682	715	753	790	835	878	878	878	894	924	953	982	1,008	1,039	1,041	1,041				
IEA																505	562				
ESMAP		270																			
ENDA/IEPE																					
Other data						671			1,337		575										
TCDC Rep *																	915				
Sources, notes, Comments, etc.						FAOL18			IEA32		IEA46										
Other sources of data :	497,000 T (IEA12)								1,913,000 T (IEA59)		651,000 T (IEA33) & 684,000 T (IEA59bis)										

* TCDC Rep. Estimate based on rural/urban population (p 5) and quoted per capita consumption rates (p. 22, 23)



(43) Comoros**Report by**

Mr. Abdourahaman Ben Houssen, Directeur du département forestier

New national references cited and report overview:

Etude de stratégie agricoles – document provisoire, Juillet 1990

The report brings forward interesting thesis and conclusions. Table 1 provides figures on potential annual production, industrial use, woodfuel available for household consumption citing the reference given above. Consumption values given at page 4, (ref. World Bank sources) provides values which are almost double than that used by S. Amous for WETT estimates (ENDA/IEPE '85). Similarly for charcoal, the estimates provided (approx. 1000 T) are very different from the ESMAP '85 source used in the WETT study (49,000 T '85 , 68,000 T '95). A good part of the report is dedicated to the potential fuelwood production from forest plantation and to the estimation of the plantation area needed to satisfy wood energy requirements.

Additional information needed:

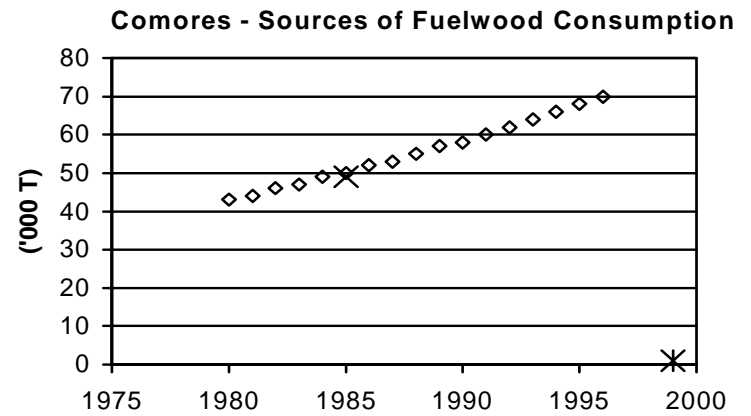
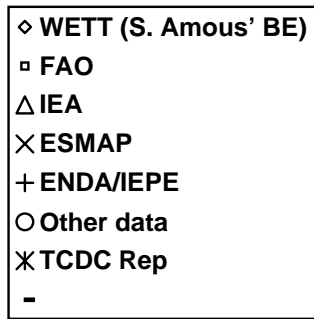
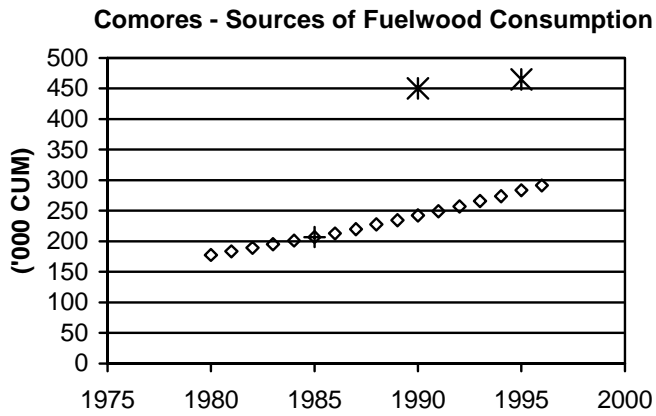
- Comparison of report's estimates of fuelwood and charcoal consumption with the data sources used for the WETT estimates
- Clarification on the formulae used to estimate fuelwood productivity from forest plantations.
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Comoros - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	177	183	189	195	201	207	213	220	227	234	242	249	257	266	274	283	291				
FAO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
IEA																					
ESMAP																					
ENDA/IEPE						207															
Other data																					
TCDC Rep											450					465					

Comoros - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	43	44	46	47	49	50	52	53	55	57	58	60	62	64	66	68	70				
FAO																					
IEA																					
ESMAP						49															
ENDA/IEPE																					
Other data																					
TCDC rep																					1



(47) Seychelles**Report by**

Mrs Helda Antoine , Project Officer, Forestry Section , Division of Environment, Ministry of Environment & Transport , St Louis, Mahe- Seychelles, *Email:* forestry@seychelles.net *alternate e-mail:* natpark@seychelles.net

New national references cited and report overview:

Seychelles Forest Management Plan/Sector Study. INDUFOR ,1993
Management of Information Systems Division (MISD), 1992 Census Report

The report “Woodfuel Review and Assessment” by Mrs Helda Antoine clearly describes the declining role of wood fuels in meeting the national energy requirements. The rapid diffusion of LPG and electricity has reduced households’ dependency from wood fuels from 45% in 1977 to the current estimated 8%. The data reported present some slight contradiction, for which some further clarification is required. The overall trend, however , is very clear, which justify the marginal attention that the sector is currently receiving.

Relevant appears the discrepancy between the situation described in the report and the estimates produced in WETT, based on IEA/AFREPREN Questionnaire of Biomass Energy Statistics, Data for Seychelles, 1988. WETT estimates described a dominance of growing charcoal consumption (12,529 MT in 1992 and 13,056 in 1996) and a marginal reducing amount of fuelwood (1,929 CUM in 1992 and 1,077 in 1996). On the contrary, the report describes a situation dominated by fuelwood (approximately 10 to 1) and an overall rapid consumption reduction.

Report’s estimates are based on the 1992/1993 references cited above.

Additional information needed:

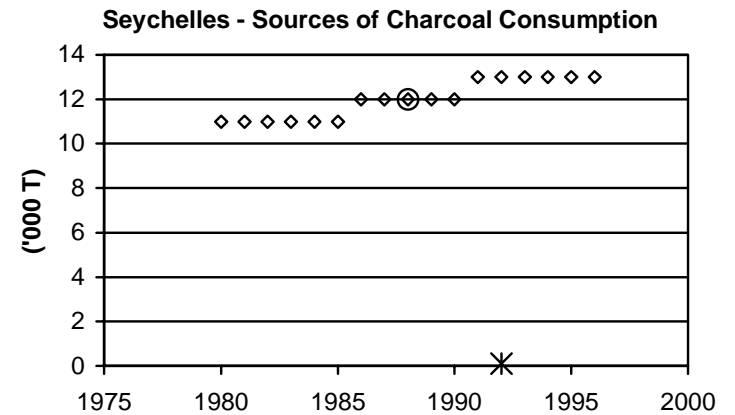
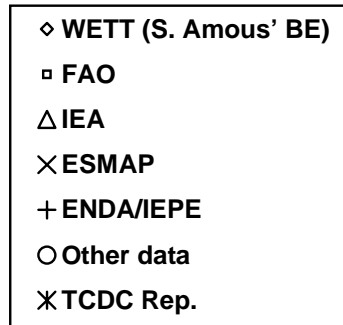
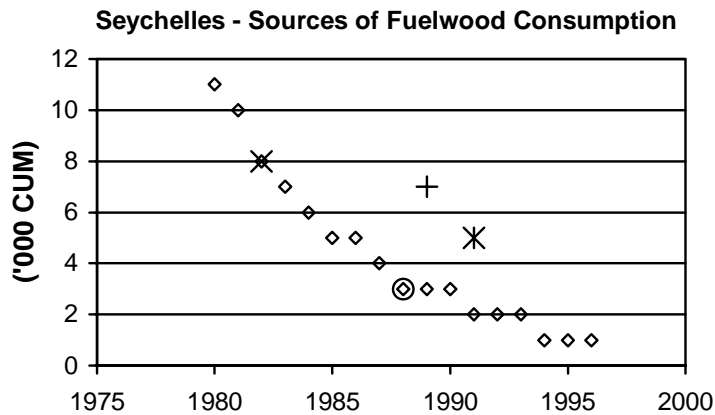
- Provide estimates following standard format (National Report Data Tables)
- Clarification on Table 1.3
- Clarification on Seychelles forest cover estimate
- Description of sources (survey date, method, intensity, etc.)
- Copy of main references (specifically the one listed above)

Seychelles - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	11	10	8	7	6	5	5	4	3	3	3	2	2	2	1	1	1				
FAO																					
IEA																					
ESMAP			8																		
ENDA/IEPE										7											
Other data									3												
TCDC Rep.												5									
Sources, Comments, etc.									IAE47												

Seychelles - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	11	11	11	11	11	11	12	12	12	12	12	13	13	13	13	13	13				
FAO																					
IEA																					
ESMAP																					
ENDA/IEPE																					
Other data									12												
TCDC Rep													0.1								
Sources, notes, etc.									IEA47												



(53) Lesotho**Report by**

Mrs. N. L. Masilo, Representative of the Forestry Division on the SADC Woodfuel/NRSE Sub-Committee, Forestry Division, Ministry of Agriculture, P. O. Box 774, Maseru 100. Lesotho

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New national references cited and report overview:

Lesotho Energy Master Plan 1986 reporting results of the GoL/GTZ National Energy Survey: Rural Sector Energy Consumption 1986, Urban Sector Energy Consumption 1987.

The report of Mrs. N. L. Masilo basically refers the results of the study carried out for the Lesotho Energy Master Plan (LEMP) 1988. Usable figures refer to rural households where the fuelwood consumption reported for 1986 is some 784,907 Tons (1,082,630 CUM). However, in the table of Lesotho Energy Balance, at p.12 of the LEMP 1988 (copy provided) it results that total fuelwood consumption for 1984 was 1,131,661 CUM (1,082,676 rural households, 48,327 urban households and 658 industrial/commercial). Both values are comparable to WETT' estimate for total fuelwood for the same years.

Concerning demand/supply, the report briefly describes the resource base of the country (T.2, p.8) and mention about the widening fuelwood gap (LEMP) from 175,000 T in 1984 to 680,000 by year 2010 (p. 10). According to the 1991 revision of LEMP, some 6,000 ha of plantations should be established every year up to year 2010 to fill the fuelwood gap.

Additional information needed:

- Recent consumption estimates in rural and urban areas.
- Description of data sources (survey date, method, intensity, etc.)

Lesotho - Historical Data for Fuelwood (1000 CUM)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WETT (S. Amous' BE)	985	1,013	1,041	1,070	1,099	1,130	1,161	1,193	1,226	1,260	1,295	1,330	1,366	1,402	1,440	1,478	1,517				
FAO	472	486	539	556	559	573	588	603	618	634	649	634	649	666	684	701	728				
IEA																					
ESMAP		39																			
ENDA/IEPE																					
Other data	969										1,295			707							
TCDC Rep.*					1132		(1083)														
Sources, Comments, etc.	IAE11										IAE46			IAE49							

* TCDC Rep. The value reported for 1986 is limited to rural household consumption. The 1984 value should represent total consumption.

Lesotho - Historical Data for Charcoal (1000 T)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
WETT (S. Amous' BE)																						
FAO																						
IEA																						
ESMAP																						
ENDA/IEPE																						
Other data																						
Sources of data adopted as BE																						
Other data sources																						
TCDC Rep.																						

No charcoal data. This might mean that this energy is not consumed at all or, more probably that the consumption is not significant and was as a result not reported in any reference.

