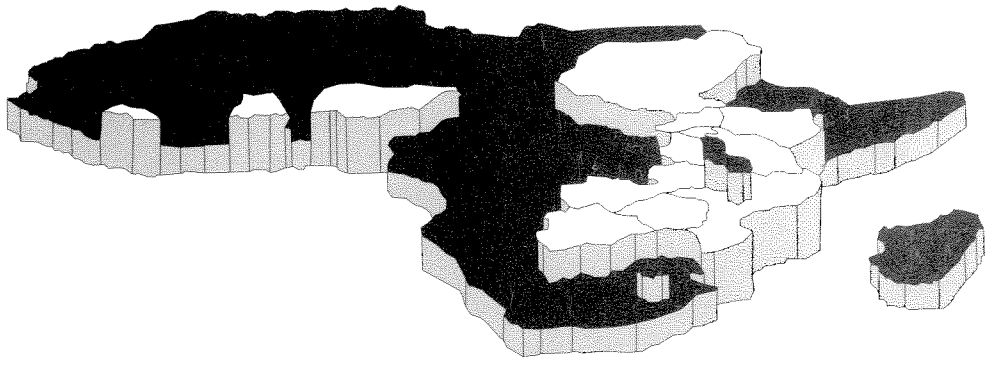
REPORT

Blantyre,
Malawi,
12-25
November
1989

Seminar on forestry statistics in Africa

Food and Agriculture Organization
of the United Nations

Report of the seminar on forestry statistics in Africa



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by Min. Stanford Demba,
Minister of Forestry and
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Mr. G.K. Mburathi,
FAO Representative to Malawi
(on speaker's left)

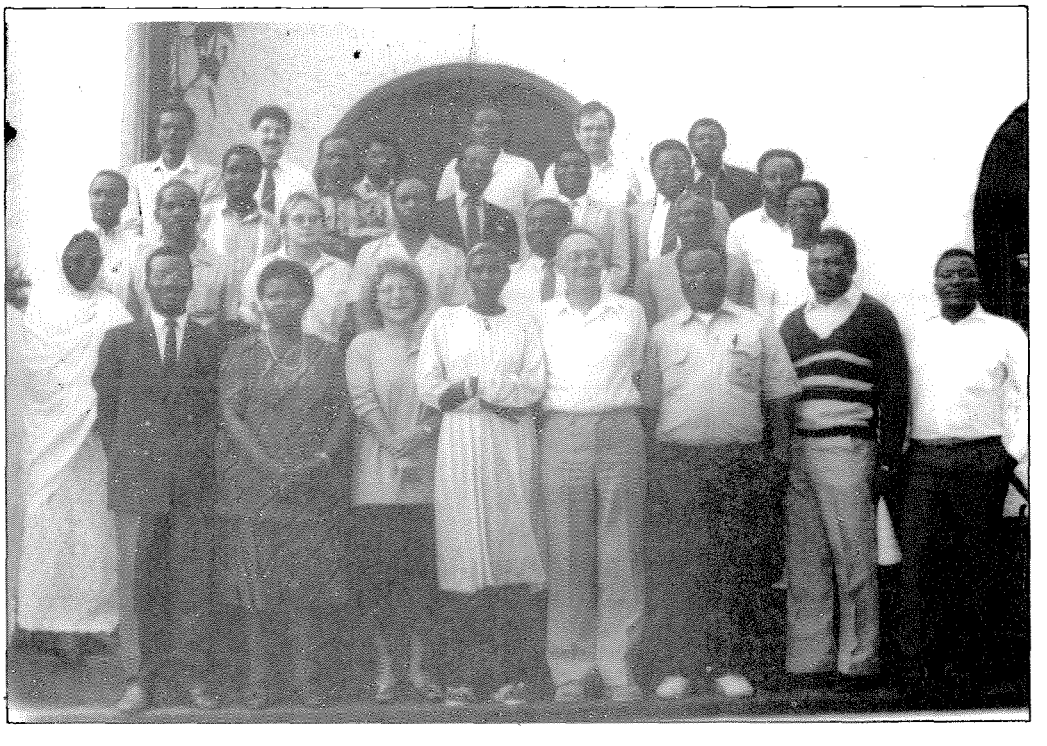
Participants

Back row
Hisham Mohy El Din, J. Allen,
O. Elungat, C. Kahuki,
R. Sayinzoga, P. Wardle,
A. Sesane

Middle rows
S. M. dos Santos, J. Doe,
H. Andrua, Ms. P. Vehomaki,
R. Aruofor, W. Belo, A. Sbanya,
R. Nkaonja, R. Nyirendas,
G. H. Mtsendero, G. Kowero,
R. Yaya

Front row
Ms. Amira Awad, B. Misomali,
Ms. N. Moshoeshoe,
Ms. S. Storti-Lopez,
Ms. S. Mathias, K. Openshaw,
F. Alidi, L. Mjojo, D. Mabvurira

Not present
D. Gzaita Magumba, W.M. Phiri



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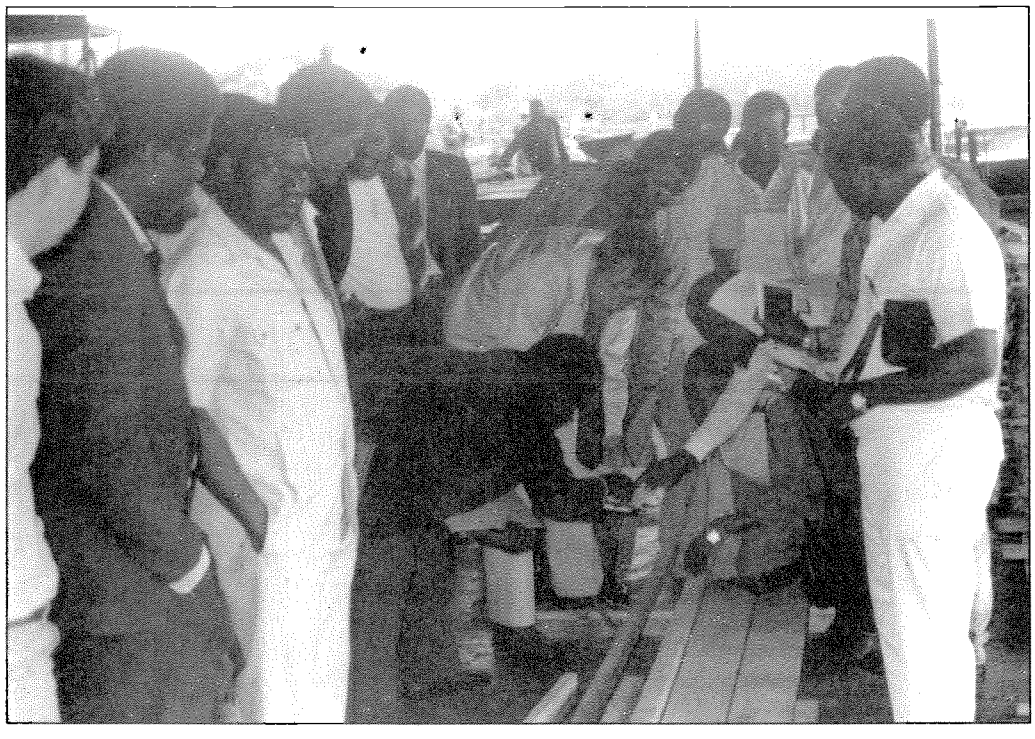

Report

INTRODUCTION

1. The Seminar was opened on Monday 13th November by the Minister of Forestry and Natural Resources of Malawi, Hon. Stanford Demba and the FAO Representative to Malawi, Mr. G.K. Mburathi.

2. In his opening statement the Minister stressed that good and accurate statistics on forestry are crucial for planning and decision making and to cut down risks and wastage in resource allocation. Forests contribute significantly to economic development and environmental protection of the country and good statistics are a weapon for attracting financial and other resources for the development of the sector.

3. The FAO Representative extended a warm welcome to the Participants on behalf of the Director-General of FAO and expressed a special thanks to the Government of Malawi for hosting this first Seminar on Forestry Statistics in Africa. He stressed the fundamental necessity of forestry statistics for such initiatives as the Tropical Forestry Action Plan and the National Action Plans directed at conserving the forests and developing their capability to contribute to the well being of the Community. It was most appropriate that this Seminar should be held in Malawi where the forests and trees are a vital resource in the daily life of the people for fuel material, food and the environment. In concluding he commended the commitment of the Government and people of Malawi to improving this contribution. (Full Statements are attached at Annex 4).

4. The Seminar was attended by 25 Participants from 14 countries namely: Botswana, Ghana, Kenya, Lesotho, Liberia, Malawi, Mozambique, Nigeria, Sudan, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe, together with Representatives of the African Timber Organization (ATO), the Southern African Development Coordination Committee (SADCC) Forestry Secretariat and the World Bank. (List of Participants Annex 5).

5. The Seminar was chaired by Mr. R. Nkaonja (Malawi).

Three Raporteurs were Mr. R.O. Aruofor, Nigeria (Fuelwood Statistics), Mr. C.D. Kahuki (Forest Product Statistics) and Mr. R. Sayinzoga, A.T.O. (Computers)

OBJECTIVES AND FUNCTIONS OF FORESTRY STATISTICS

6. Mr. P. Wardle outlined the primary objectives of forestry statistics in serving (i) national policy formulation, planning and decision making (ii) the more detailed requirements of planning and management of forestry and forest industry operations and (iii) international exchange of information in the forestry sector necessary to place national planning in an international perspective and to underpin international cooperation on the development of the sector. Initiatives under the Tropical Forestry Action Plan placed a particularly urgent demand for basic information on the forestry sector at the national level. In view of the cost of collection and dissemination of statistical information and limitations on resources it was important to concentrate resources on topics of high priority and to work at levels of detail and accuracy tailored to the needs of major decision areas.

7. The aim of the Seminar is to foster exchange between expert participants on major topics of forestry statistics with a view to identifying where and how to strengthen the statistical system supporting forestry and forest industry planning in Africa. The Seminar concentrates on three main subjects: (i) Fuelwood (ii) Production and Trade in modern sector forest products (iii) the Computer in forestry statistics. The international exchange of information and the organisation to support forestry statistics is an underlying theme.

8. It was agreed that the Seminar will draw up conclusions on the main subjects discussed and will make recommendations on priority areas for future action.

9. In discussing this introduction the seminar noted that forest resource information is of fundamental importance to policy formulation and planning in the forestry sector. This Seminar however, explicitly excludes detailed discussion of forest inventory and forest resource assessment as these are major technical subjects more appropriately covered at technical meetings specializing in these topics.

10. Many countries were involved or were considering participation in the Tropical Forestry Action Plan. It was decided, therefore, to devote a special session to discussion of the steps in the development of National Tropical Forestry Action Plan and the implications for work on forestry statistics.

11. The statistical organisation in many countries was either very small or not yet established. In order to meet future need explicit training was needed to build up capability in forest sector statistics. It was decided to devote a session to discussion of appropriate training and training opportunities.

COUNTRY BRIEFS

Case Study - Tanzania

12. Mr. Kowero introduced the case study on forestry statistics in Tanzania. In this study, he reviewed the organization of statistical collection, accuracy and consistency of statistics collected and drew some conclusions on the direction of action needed to improve the situation.

13. Concerning organization he noted that there was no one institution that collected all the data together in one place. Data were assembled by industries, persons, forestry authorities, the Customs, the Board of Trade. The central statistics office should in principle be the central custodian but in practice it collected only data supplied to it and the information it stored and published was usually too much summarized. Several authorities had partial responsibility for forestry: including the Forestry Department, regional authorities and the private sector. These were not coordinated to ensure a central location with comprehensive coverage of the sector.

14. Concerning accuracy and consistency he raised the problem of the variation in information from diverse sources. Taking the example of forest area, there was no complete inventory. Much updating of information was by adjustment of previous surveys rather than by new survey. In the case of plantation area thedata was divided between accurate information on the state owned plantations but estimated figures from communal and private plantations. Information on fuelwood production was of uncertain quality while no information was available on the production of fruits and other non wood products. This was because much was collected by and for households and no consideration was given to keeping records. The modern sector forest industry was divided between the small private mills which are rather dispersed and present problems of non cooperation in reporting. In large companies with higher capital investment record keeping is the norm and there is less difficulty in data collection.

15. Several recommendations include: the organization of reporting systems in the forestry sector in a central office, strengthening in the planning organization to include adequate staff funds and equipment and maintainance of a central data bank for the forestry sector. There should be training both for the statistics staff and for field staff respectively in collection, processing, storage and dissemination of statistics and in the significance of the statistics. Standard formats should be adopted for data collection and data should be analysed and results disseminated on a regular basis.

Discussion of country briefs

16. The Participants presented their Country Briefs to the Seminar. (See part III). These were designed to review the organization for collecting forestry statistics, the collection of statistics on informal sector products, fuelwood and charcoal and other forest products, collection of statistics on modern sector products, on trade and on forest product prices and to draw general conclusion and indicate priority areas of action for improvement. They also reviewed existing FAO statistics for their country in depth.

Organization of Forestry Statistics

17. General experience in relation to organization was that responsibility for collection of forest sector statistics involved:

Forestry Department
Regional Authorities
Energy Ministry
Industry Organizations
Timber Export Authorities
Customs Authorities
Trade Ministry
Central Bank
Central Statistics Office
Planning Ministry

In general there was a lack of any central authority that coordinated or brought together national statistics on the sector. High level authorities such as the Central Statistics Office tended to provide forestry sector information in a very summary form and often incomplete.

18. The Seminar stressed the importance of having an adequate organization to collect, assemble, analyse and report national forestry statistics so established that its reports would be fully available to forest sector planning.

The Seminar recommended that there should be a formal statistical body in the forest authority, that institutional arrangements should be established to ensure adequate linkages with other bodies involved in forest sector statistics and that responsibility for national coordination of forestry sector statistics should be designated.

Fuelwood Statistics

19. Estimates of fuelwood and charcoal production and consumption depended in many countries on the results of "one off" special surveys. These included some national surveys, more frequently however, these were limited surveys of urban household, rural households many for specific regions, and surveys of wood fuel consumption by specific industries. Many of these surveys were undertaken in conjunction with multilateral and bilateral agencies and included expatriate staff and external financial support. One country indicated the inclusion of fuelwood and charcoal in annual household surveys of the central statistical office. In several countries, fuelwood and charcoal were included in special energy surveys of the Ministry of Energy or Central Statistics Office.

20. The seminar emphasized the need for clear definition of fuelwood and charcoal. It should be clear whether fuelwood refers to wood from main stem and branches or whether it includes all the biomass, small branches, twigs, roots and leaves. Distinction is required between wood and the biomass originating in the forest and recycled residues used for fuel such as offcuts, slabs, bark and sawdust from mills. A clear distinction should made between treebiomass and other plant biomass such as agricultural crop wastes and animal dung used for fuel.

21. The Seminar recognized the wide variation between estimates resulting from different surveys because of the differing populations and diverse objectives and methods of surveys. The risk of bias, if general conclusions were drawn from surveys with limited objectives, or limited coverage was stressed.

Modern Sector Statistics

22. Presentation of the coverage of modern sector forest industry in the Country Briefs indicated that in several countries statistical returns were adequate. Larger industries maintained record systems and were able to report. There was a concern in some countries that industry withheld information or reported inaccurately. Information on small mills and pit sawing was difficult to obtain. Where recording systems exist, such as licensing systems for pit sawyard records may be inaccurate because of illegal or unauthorized operations. One country had carried out a survey of the sawmilling industry to check on licensing information. Several countries indicated the existance of systems for regular returns from industry to the forest authority. This mainly related to Public sector and large scale mills.

23. The Seminar recognized the existance of the resistance to disclosure and the risk of distorted reporting. The possibility of introducing statutary reporting was mentioned. There were also difficulties arising from weak organization of information communication and assembly and transfer of information where it was collected by other authorities. Information collected by industry authorities was in several cases found to be incomplete.

24. Trade statistics were mainly handled by Customs and Trade Ministries. In several cases the information was derived from exporting companies or wood export authorities. The Seminar

recommended that where detailed information on species is published, it should relate to a standard nomenclature such as the botanical name of the species.

Prices

25. The collection of forest product prices was reported by seven countries. These included stumpage fees and royalty rates (4 countries), prices for fuelwood, charcoal (4 countries) and sawnwood (3 countries) and average export unit values (3 countries).

Conclusion

26. The Country Briefs indicated the following major conclusions on the need for future action. There was a general need to strengthen the capability and organization for collection, assembly, analysis and dissemination of forestry statistics. This should be supported with adequate staffing funding equipment and salaries to motivate staff. There should be access to standard guidelines on statistical organization, collection mechanism and survey methods. Particular emphasis should be given to statistics on fuelwood and charcoal and other informal sector products as these constitute the most important social and economic contribution of the secotr. Information on forest resources land use and service functions of the forest should be integrated with information on the economic production of the sector.

STATISTICS ON FUELWOOD AND CHARCOAL

27. The discussion of statistics on fuelwood and charcoal was introduced by Mr. P. Wardle followed by a presentation on the design and execution of fuelwood consumption surveyed by Mr. James Allen, and the presentation of case studies from Zambia and Botswana by Mr. Keith Openshaw and from Swaziland by Mr. James Allen.

28. Mr. Openshaw provided the following information about the Household Energy Unit and the Energy Efficiency Unit which are part of the Industry and Energy Department of the World Bank. Both of the Units are jointly financed by UNDP and World Bank and undertake aid projects principally through UNDP but sometimes directly through World Bank. Both Units carry out research activities and run training courses in their particular fields. The Household Energy Unit has undertaken projects in the field of energy assessment, biomass supply, charcoal production, end use efficiency, particularly cooling devices, and work on various renewables. The Energy Efficiency Unit has looked at the production and distribution of electrical energy, refinery systems, border efficiency, power losses, etc. Both Units are open to requests for help from developing countries and can approach donor agencies for assistance.

29. A working Party was established to review collection of National information on fuelwood. The raporteur and Chairman of this group was Mr. Aruofor. Their findings are attached at Annex 1.

MEASUREMENT OF FOREST PRODUCTS

30. Mr. P. Wardle described the major problems of measurement of forest products and introduced the standard conversion factors utilized in the preparation of FAO tables of production and trade as well as a table of fuelwood and charcoal energy equivalents. He stressed the importance of examination of actual local measurement practice and the correct identification of measurement units. Where the conversion is from weight to volume is concerned, information on moisture content and density is required; where the conversion is from surface area to volume, for example of veneer of plywood, then information is required on the thickness.

FIELD VISIT: MEASUREMENT OF FOREST OF FOREST PRODUCTS

31. The field visit was hosted by the Wood Industry Corporation of Malawi at the Blantyre Sawmill. The party was received by the General Manager, Mr. Jana, the Deputy General Manager, Mr. Tongo and the Sawmill Manager, Mr. Kunje. The Blantyre Sawmill has an annual log input of 13,000 m3 and a sawnwood output of 6,000 m3. It is integrated with a furniture factory and a creosoting plant for transmission poles. The main raw material is Pinus Patula from Zomba mountain forest, a distance of 90 km from Blantyre. A general visit was made to the mill.

32. The sawmill management presented a demonstration of the measurement of log input and the recovery of sawn output. Logs are delivered in standard dimensions. Sawnwood is cut to standard lengths, widths and thicknesses. Thickness and width usually has a tolerance of about 3mm. The mill provided the attached demonstration of measured log volume input and measured sawnwood output. One log was measured exactly and then sawn and the sawn output measured exactly. This example showed the measurements in the following table:

Measurement of log input and sawn output

	Volume in m³		
	Log	Sawnwood	Recovery%
Sawmill measure	0.4423	0.1624	36.7
Actual measure	0.4323	0.1988	46.0

The Seminar expressed its thanks to the management of Blantyre Sawmill for the informative visit and excellent demonstration.

PROGRAMME ON MICROCOMPUTERS

33. Mr. Padovani introduced the programme of personal workshops on microcomputers. A Working Party was established to discuss the use of microcomputers in the collection, storage, processing, dissemination and exchange of forestry statistics and to draw conclusions and make recommendations in the future development of their use.

The Raporteur and Chairman of this group was Mr. Sayinzoga. The report of the working party is attached as Annex 2.

PRODUCTION STATISTICS

34. In an introductory statement, Mr. Wardle reviewed the definition of production and then considered the features of the production of major products: industrial roundwood, sawnwood, wood based panels and pulp and paper from the point of view of statistical collection.

Wood Industries Corporation Limited
Blantyre Sawmill Production Recovery Measurements

Log input				Timber output			Recovery
Log no.	Length	diametre (cm)	Volume (m^3)	Size (mm)	No Pieces	Volume (m^3)	
1	6 m	24 cm	0.271	5500 x 152 x 50	2 No.	0.084	
				5000 x 76 x 50	1 No.	0.019	
				5000 x 38 x 50	1 No.	0.010	
				5000 x 38 x 50	1 No.	0.006	50.2%
				3000 x 76 x 50	1 No.	0.011	
				2500 x 76 x 50	1 No.	0.004	
				1000 x 76 x 23	1 No.	0.002	
				Sub Total	8 No.	0.136	
2	4 m	24 cm	0.181	4000 x 152 x 50	2 No.	0.061	
				3500 x 102 x 23	1 No.	0.008	
				3500 x 76 x 23	1 No.	0.006	43.1%
				2000 x 76 x 23	1 No.	0.003	
				Sub Total	5 No.	0.078	
3	4 m	28 cm	0.246	4000 x 152 x 50	2 No.	0.061	
				4000 x 102 x 50	2 No.	0.041	
				4000 x 38 x 50	1 No.	0.008	51.6%
				3500 x 38 x 50	1 No.	0.007	
				2500 x 38 x 50	2 No.	0.010	
				Sub Total	8 No.	0.127	
		Grand Total	6.698		21 No.	0.341	48.9%

The alternatives of collecting data at the location of production or indirectly for measurement of supply of saw material inputs or consumption of products was considered. Collection of information on large scale formal sector production in relatively few units was generally easier than the collection of dispersed small scale and informal sector production usually involving large numbers of units.

35. Mr. Kowero considered the inputs in the production process: workers energy machinery and raw material and the output in volume and value of products. Records are kept in order to improve cost efficiency to control payments and receipts and to monitor profitability. Accurate statistics are essential to sustain the business. He described the primary records and the secondary analysis and reports that provided information on production. In order to design and carry through effective collection of statistics on the production of forest industries one had to be familiar with the production process and the nature and meaning of the records kept. He mentioned some major problems in the collection of production statistics: absence of recorded information and the lack of a record keeping culture, incomplete recording, pooling of information or absence of breakdown into relevant details, inconsistency in recording overtime and at different locations, denial of information. He mentioned in particular problem of the definition of capacity. Engineering capacity has to be modified to take account of realistic output capability. Capacity must be qualified by referring to the number and length of shifts worked and the number of days worked per year.

DISCUSSION

36. The Seminar raised a number of issues on the collection of statistics in production, these included:

(i) design of surveys to cover large numbers of mills of varying size and sampling approaches;
(ii) design of recording formats or questionnaires;
(iii) validation of recorded production on survey estimates.

It was agreed that a survey approach must include identification of the population of mills including number and size distribution. Any survey would carryout complete enumeration and intensive sampling of the relatively few large units which often account for a substantial proportion of total production. Small units would be covered by a sample survey. It was important that any survey be preceded by mill studies to ensure a clear understanding of the structure of the industry and features of the production process.

37. A working party was established to review the collection of production statistics in participating countries and to draw conclusions and make recommendations on the future development of statistical collection in the area. The Raporteur and Chairman was Mr. Kahuki. The report of the working party is attached as Annex 3.

COLLECTING PRICE STATISTICS

38. Introducing this subject, Mr. Kowero emphasized that the price of a commodity is a reflection of the value attached to it and is a part of the mechanism for balancing the supply with the demand for products. Prices may be determined in free market between willing buyers and willing sellers. In certain circumstances, there are few or only one seller who may have power to influence the price. In certain circumstances in the absence of a competitive market, prices have to be set by the selling authorities as for example with timber license fees and royalties. Determinants of price include the location, degree of manufacture and grade or quality of the product. In recording prices account has to be taken of variation. In reporting average prices it is necessary to weight the different prices observed by the quantity associated with each, over-time price may vary. In order to determine whether changes are real changes in the value of the good, it is necesary to correct for inflation of the currency, this is done by deflating.

39. Summary considerations in collecting price statistics include accurate recording of the units of measurement, clear specifications of the nature of the product, identification of the location of the sale and record of the date when the sale took place. It is important also to distinguish between free market prices and regulated prices.

DISCUSSION

40. In discussion of this subject the Seminar noted that there may be wide fluctuations in price with variation in seasonal demand. In some countries where prices were fixed by government for example of charcoal there was a very wide difference between the official price and the price actually prevailing in the market. Certain countries indicated that timber was sold from the forest by auction where as in many countries timber was sold at regulated prices or according to fixed fees and royalties that varies with species.

INFORMATION EXCHANGE BETWEEN MEMBER COUNTRIES OF SADCC

41. Mr. Nyirenda of the SADCC Forestry Coordination Unit described the organization of SADCC and the location of forestry in its work.

After providing a brief insight into the extent of forestry activities in the member countries, he described the agreed programme of information gathering and information exchange between member countries and the development of a data bank in

the Coordination Unit. At present there are data banks covering forestry research documentation, forestry manpower and non governmental forestry organization in the SADCC region. These are installed on an IBM PC-AT with 512 KB memory and are handled with software packages including: Lotus 1-2-3, word processor and dBase IIIplus.

42. The Seminar noted the existance of this system with appreciation. The success of such collaborative systems depended on the willing participation of the member countries which could be promoted through personal contact between the experts concerned with the data systems. The possibility of including a regular exchange of forestry statistical information which would help the SADCC Forestry Committee to be up-to-date on forestry information and could also strengthen exchange of information with FAO was tabled.

COLLECTING TRADE STATISTICS

43. This subject was introduced by Mr. Wardle with a description of the magnitude of trade in forest products in the participating countries. Forest product trade statistics are usually collected by the Customs office or Trade Ministry. Information may also be available from timber export authorities or exporting companies. The statistics are usually arranged according to international trade classifications. The main classifications are:

- The UN Standard International Trade Classification (SITC) the current version is revision 3 and
- The Customs Cooperation Council Nomenclature (CCCN), the current version is called the Harmonized System (HS)

44. Statistics are presented separately for imports and exports. Each product has an individual code. Quantity may be in weight units: kg. or tonnes or Volume: m^3; value is given in local currency. Quantity is usually broken down for imports according to the country of origin and for exports by the country of destination.

INFORMATION EXCHANGE BETWEEN MEMBER COUNTRIES OF ATO

45. Mr. Sayinzoga provided a briefing on the organization and objectives of the African Timber Organization (ATO) emphasizing the prominent position of statistical collection. ATO collects monthly, quarterly and annual data on tropical timber trade from its member countries, each series with different levels of detail and subject coverage. He mentioned the lack of response from some countries and the increasingly incomplete coverage of the quarterly and annual enquiries. He put forward proposals for improving response including careful choice of correspondent, incentives for respondents, administrative and logistical support to the correspondents and periodic meetings of correspondents to exchange ideas and experience. The Seminar supported these suggestions.

INTERTRADE BETWEEN AFRICAN COUNTRIES

46. Mr. Wardle drew attention to the work in the Preferential Trade Area for Eastern and Southern African States (PTA) in conjunction with an FAO project on promoting the potential of trade between African Countries in plantation based forest products. An important input is the development of better information on the cross border trade between neighbouring countries. This may require a combination of information from customs and from the companies involved in the trade.

THE COMPUTER IN DATA COLLECTION, VALIDATION PROCESSING, STORAGE, DISSEMINATION AND INFORMATION EXCHANGE

47. Mr. Padovani presented a background paper on concepts in data collection and exchange. Particular stress was placed on the importance of statisticians making their results useful to users through development of sound and relevant results and effective presentation. His suggestions were taken up by the working party on Computer (Annex 3).

THE FORMAT OF INTERNATIONAL STATISTICS

48. The framework, classification, definitions and summary questionnaire for the Yearbook of Forest Products were presented and the systems for collection of data for forest product prices, pulp and paper capacities and the wood based panels survey were introduced.

49. The Seminar discussed the need for clarification of definitions of fuelwood to make the inclusion of both fuelwood used directly by householders and industry and fuelwood used for charcoal making. The desirability of establishing uniform standards for measurement of quantity of wood products was emphasized. It was suggested that uniform utilization of either volume or weight would simplify comparison in trade statistics. The inappropriateness of the term "non coniferous" in tropical countries was mentioned. It was noted that in the framework for forest resource assessments, the terms coniferous, broadleaved, bamboo and palms had been adopted, supported by clear definition of the species included in each class.

THE TROPICAL FORESTRY ACTION PLAN

50. The Seminar held a discussion on the Tropical Forestry Action Plan following an introduction by Mr. Wardle in which several countries described their experience in working within the TFAP framework.

51. Mrs. Moshoeshoe mentioned that Lesotho was at the planning stage. They had requested FAO assistance. FAO has recruited an expert who was working with national counterparts. UNDP had set aside resources for the planning exercise. Other International and bilateral Agencies would finance their own inputs. 14 Agencies were interested; a country meeting was planned for February 1990.

52. Mr. Hisham Mohy El Din Mohammed Tahir described the project development resulting from a TFAP exercise involving FAO

and the World Bank and the participation of 26 governmental and non governmental agencies.

53. Similar experience but emphasizing particularly the initiation of village level agroforestry was described for Ghana by Mr. Yaya.

54. Mr. Kowero said Tanzania had completed the third draft of a National Tropical Forestry Action Plan and would submit it for consideration of the international community shortly. Finland provided the lead agency. The initial stage was the preparation of an issues paper. This was followed by preparation of some 20 study papers, brainstorming meetings were held, all international experts worked with national counterparts. The process mobilized the private sector, lawyers, women, agriculturists and many other experts and representation of many sectors. The draft plan was circulated to ministries. The process has taken from September 1988 to the present.

55. Mr. Aruofor, Nigeria, felt that real change had to be based on a profound understanding of socio-economic environment that caused people to destroy forests.

56. Mr. Gwaitta-Magumba of Swaziland mentioned the value of bringing in objective outside opinion through FAO to assist in crystalizing priorities and formulating a forest policy commensurate with the social and economic situation within the country.

57. Mr. Andrua, Uganda considered TFAP very important indeed and hoped that local policy and planning revisions could contribute to more advanced participation in the TFAP framework.

58. In summing up, it was stressed that TFAP provides a framework for collaboration and coordination of effort and the opportunity to bring in external insights which may catalyse national efforts in planning and setting priorities.

RECOMMENDATIONS

In conclusion the seminar adopted the following recommendations which are addressed to national governments and forest authorities, to FAO and the FAO African Forestry Commission and to International and Intergovernmental Agencies concerned with the forestry sector in Africa for their careful consideration.

INSTITUTIONS

Being aware of, and considering the important role that adequate and correct information and statistics play in sector and national planning and in facilitating international co-operation, the following *recommendations* are made:

1. It is advised and recommended to the national governments and national Institutions concerned with assembly of forestry related information and statistical data to undertake measures to strengthen the country's capability in data collection, analysis, storage and dissemination through:
   (i) establishment of a central forest products and resources statistical unit;
   (ii) provision of the statistical unit with adequate tools for information and statistics gathering and analysis;
   (iii) organization of training courses, seminars and workshops for forestry statistics personnel of all cadres.

2.(a) *It is recommended* that the African forestry sector undertake the establishment of a regional forestry information and statistical expert committee with mandate to hold periodic meetings to
   (i) review and update information and statistics on forestry resources, industry, production, marketing and trade;
   (ii) on basis of such review, assist national statistical units in the performance of their tasks;
   (iii) formulate programmes and mechanisms for improving forest products classification and standardization in production, marketing, trade and pricing.

(b) In the establishment and implementation of 2(a) above, technical and material assistance of the international community, and specifically FAO and other UN Agencies and existing regional organizations be sought and enlisted.

(c) An objective would be the development of a system to facilitate the periodic exchange of forestry related information and statistics between Member African Countries, through networks and periodic bulletins and newsletters.

3. To achieve coordination of national statistics on the sector, it is recommended that National Forestry Departments be responsible for forestry data collection, analysis and dissemination of data.
4. National forestry statistics should be published annually on a regular and timely basis.
5. To improve coverage and reliability, it is recommended that countries explore possibilities of legislation that would make Forestry Departments in the country a mandatory depositary and to coordinate information from private and public entities, and empowering the department to deploy methods it deems necessary to acquire such information.

Fuelwood

6. In view of the major importance of fuelwood and charcoal in their economies, it is strongly recommended that Governments give adequate priority to the survey of fuelwood and charcoal essential to support their energy and forestry planning.
7. The F.A.O. should take an active role in the promotion of the capabilities of each participating country to carry out its own woodfuel surveys. This should be done by promoting technical and financial support for establishing appropriate statistical units within Forestry Departments and in the context of surveys.
8. Due to the complexity and many practical problems encountered in woodfuel surveys, the Seminar recommends that F.A.O. take the initiative to publish a very practical guide to designing and carrying out

a woodfuel survey, with particular emphasis on sample design and measurement techniques.

USE OF COMPUTERS

9. In view of the immense value of computers in advancing capability in collecting, storing, processing and disseminating statistical data, countries are urged to give full consideration in the development of forestry statistical services to appropriate investment in computer hardware and software. The Seminar recommended that FAO give priority to assistance in the design of computer facilities and the mobilization of financial and technical support.
10. The Seminar emphasized the importance of training and *recommended* that FAO and other development agencies include support to training forestry statistics personnel in the use of computer, data processing and analysis.
11. The maintenance and expansion of direct communication using computer readible media, between country experts and FAO and regional organizations involved in exchange of forestry statistics was strongly supported.

PRODUCTION AND TRADE STATISTICS

12. To facilitate clarity and comparability in data classification, analysis, presentation and interpretation, it is recommended that further efforts be made at the international level to eliminate use of different definitions, classification and different units of measurement so that country information will be more easily comparable. Particular attention should be given to the clear definition of fuelwood and charcoal and other industrial round wood used in the unprocessed form.
13. It is recommended that countries give high priority in their statistical programmes to the collection and dissemination of price statistics, essential to national policy and planning relating to forest products as well as to sound management, and investment decision making in the forestry sector.

INTERNATIONAL EXCHANGE

14. The Seminar strongly supported the FAO programme on the collection and dissemination of forestry statistics and all efforts to improve effective contact with national forestry statistics units to ensure timely exchange of the most accurate information on the sector. The Seminar recommended the extension and strengthening of this exchange to include regional organizations such as ATO, SADCC and PTA and National Forestry Statistical Organization in the development of an active network for communication between statistical experts, in countries, regional organizations and FAO.

Annex 1

Report of the working party on national information on woodfuel

INTRODUCTION

After reviewing both the presentations and the ensuing discussions on woodfuel surveys, the Working Party endorses the following statements:

1. Fuelwood and charcoal (woodfuel) make up a very large proportion of total wood and energy consumption in African countries, and their production and consumption have very significant social, economic and environmental importance.
2. Just as with other resources of national importance, it is critical that detailed information on woodfuel consumption be obtained on a regular basis. Such information is critical for forestry policy formulation and development planning.
3. The present state of information on woodfuel consumption leaves much to be desired. There is currently little support for collecting the necessary information is poorly developed in most countries.
4. Since most of the woodfuel consumed never passes through the formal (record-keeping) sector of the economy, sample surveys are necessary for data collection.
5. Woodfuel surveys should be accorded higher priority in national planning, and adequate funding allocations should be made to Forestry Departments to facilitate the execution of such surveys.

PLANNING

Both the presentations and ensuing discussions highlighted the fact that woodfuel surveys can be both complex and expensive, and therefore good planning is absolutely essential.

To ensure that woodfuel surveys are well-planned, the following strategy is suggested.

1. Begin by carefully considering the objectives and scope of the proposed survey.
2. Conduct a thorough review of existing sources of information pertinent to the survey objectives.
3. In recognition of the legitimate interest that other parties may have in woodfuel, call a pre-survey workshop/ coordination meeting. Examples of parties that might be invited to this meeting include representatives of the Central Statistical Office, the National Energy Authority, and relevant Regional and National Political Authorities.
4. The parties with the greatest interest in the results of the woodfuel survey should be regularly informed of survey progress, perhaps by forming a steering or coordination committee which meets on a regular basis.
5. Conduct appropriate reconnaissance surveys and field studies to sharpen understanding of the composition of fuelwood consumption.

In addition to developing specific objectives and determining the scope of the survey, the following should be carefully considered in the planning phase.

1. *Sample Design:*
   (a) Sample design considerations include determination of the sampling frame, sampling method(s), sample stratification and sample size.
   (b) It is essential that the sampling design be developed through consultating with a qualified statistician. Other technical experts that may be consulted include energy experts, economists, and sociologists.
   (c) The sample design should strike an appropriate balance between statistical rigour (precision and accuracy) and cost. It should be simple and designed to fit both the objectives and any predetermined methods of analysis.
   (d) The sampling design should stratify for essential features of the population that are relevant in planning and policy formulation (e.g. political, and ecological divisions).
   (e) A greater intensity in sampling should be considered for major commercial and industrial users.
   (f) "Rule(s) of thumb" about sample size?
2. *Funding:*
   (a) In the planning phase, the total amount of funding required to complete the survey should be

determined as accurately as possible, and it should be very clearly decided who will be responsible for providing the necessary funds.

3. *Logistics:*

(a) Plans should be drawn up regarding the manpower needs of the survey, which may include supervisors, enumerators, data processing specialists, and support staff. Training needs should be considered carefully and training programmes should be developed.

(b) Lists of all necessary equipment and supplies should be drawn up, and plans made for their timely acquisition and distribution. Protection (security) of the equipment and supplies, as well as possible maintenance needs, should be planned for.

(c) Transportation needs and accommodations for field staff should be fully planned.

QUESTIONNAIRE DESIGN AND MEASUREMENT CONSIDERATIONS

The questionnaire and any associated measurements are an extremely critical element of any woodfuel survey.

1. *Questionnaire Design:*

(a) One thing that should be determined very early is whether more than one questionnaire will be necessary, such as an urban household questionnaire, rural household questionnaire, a restaurant/small industry questionnaire, and a larger industry questionnaire.

(b) Questionnaire designers should strike a balance between the desire to obtain all relevant information and the need to keep the questionnaire simple and relatively short. Each proposed question should be reviewed to ensure that it is both directly relevant to the survey objectives, and simple, precise, and unambiguous.

(c) In the case of household questionnaires, there should be some questions that will enable stratification by socio-economic status. These questions should be carefully worded so as to obtain the desired information without appearing threatening to survey respondents.

(d) In most cases, it will be desirable to include questions on the use of other fuels, such as electricity, coal, gas, cattle dung, and crop residues.

(e) Questionnaire designers should consult with sociologists and others with expertise in general questionnaire design; other forms of energy, and the various cultures/ethnic groups that will be included in the survey.

(f) The questionnaire will be written in the official language and should be supported by glossaries to ensure that translation into local languages is unambiguous.

(g) The questionnaire should be thoroughly pretested in the field.

2. *Measurement Considerations:*

(a) Measurement techniques have been one of the weakest elements of past woodfuel surveys, and every effort should be made to improve upon past techniques.

(b) Measurement techniques should be chosen to ensure the greatest accuracy possible given resource limitations, and should be applied in a consistent (standardized) manner.

RECRUITMENT, TRAINING AND SUPERVISION OF ENUMERATORS

Without good enumerators, a survey cannot be fully successful. It is therefore essential that the best enumerators possible be recruited, and that they be given proper training and supervision.

1. *Recruitment:*

(a) Enumerators should be literate, numerate and intelligent.

(b) Enumerators should be responsible, socially/culturally appropriate, include both male and female and conversant in the local language.

(c) Enumerators should be committed to the survey and available at the right time (s).

(d) Ideally, enumerators should have a good knowledge of forestry/woodfuels, or should be capable and willing to learn.

(e) Terms of payment of enumerators should be agreed upon at the time they are hired.

2. *Training:*

(a) Enumerators should be given through training in the use of the questionnaire and any associated measurement techniques.

(b) Training should include both lectures and practice in the field.

(c) As best as possible, enumerators should be thoroughly briefed on what field conditions will be like and what they should do when the unexpected happens (e.g. when a respondent gives an unplanned for response to a question).

3. *Supervision:*
   (a) Enumerators should be closely supervised. Ideally, supervisors should meet with their enumerators every day.
   (b) Supervisors should carefully review every completed questionnaire.
   (c) Supervisors should verify that enumerators actually conducted the interviews they were supposed to, perhaps by revising a selected subset of the units sampled and asking if the enumerator had in fact been there and conducted the interview. Supervisors in turn must be adequately controlled by the project management.

RECOMMENDATIONS FOR FOLLOW-UP ACTIVITIES

1. Due to the complexity and many practical problems encountered in woodfuel surveys, the working party recommends that F.A.O. take the initiative to publish a very practical guide to designing and carrying out a woodfuel survey, with particular emphasis on sample design and measurement techniques.
2. In view of the major importance of fuelwood and charcoal in their economies, it is strongly recommended that Governments give adequate priority to the survey of fuelwood and charcoal essential to support their energy and forestry planning.
3. The F.A.O. should take an active role in the promotion of the capabilites of each participating country to carry out its own woodfuel surveys. This should be done by promoting technical and financial support for establishing appropriate statistical units within Forestry Departments and in the context of surveys.

Annex 2

Report of the working party on use of microcomputer

INTRODUCTION

As a result of extensive discussions ensuing from the various presentations on data collection and dissemination, the role of computers and data analysis, during the Seminar on Forestry Statistics held in Malawi between 12 - 25 November 1989, the following points were endorsed by Participants.

DATA COLLECTION

The workshop agreed that data was very basic for good forestry planning and stressed that some emphasis be given to it by all participating member countries. In particular, the need for regular, timely and accurately processed data was emphasized and the computerization of the process was adopted. FAO, it was agreed, would respond to the need of organizing the network and providing the necessary floppy disks as means and media for exchange of data.

THE STATUS OF COMPUTER FACILITIES IN MEMBER COUNTRIES

1. The participants recognized the speed, accuracy and data handling capabilities of computer technology and agreed that they were very vital to forestry data processing and analysis.
2. The status of computer facilities in member countries revealed that a sizeable number of members still do not have such facilities. The workshop however, unanimously endorsed the use of computers by member countries to facilitate data processing and analysis. An inventory is attached.
3. Member countries were urged to avail themselves of the technology of computer services which will greatly advance their capability in collecting, storing, processing and disseminating statistical data. In making this development they could avail themselves of FAO facilities in terms of data exchange.

VALIDATION OF DATA

1. Members having endorsed the computerazation of data collection and reporting agreed on the importance of validating data both in space and time, both in advance of processing and in the course of processing.
2. The working party welcomed the validation routine provided by FAO in relation to FAO statistical questionnaire and considered this as an approach that could be adopted by country statistical offices.

DATA EXCHANGE

The participants agreed that the importance of exchange of data between member countries, FAO and other international organizations like ATO, SADCC, etc. cannot be over emphasized. Exchange in computer readable form greatly facilitates this process. In this connection member encouraged FAO to take the lead in adopting widely available software to facilitate effective exchange among these entities.

DATA REPORTING

Due to differences in objectives that exist between data producers and consumers and the conflicts which are sometimes apparent, the participants recommended the adoption of the following strategies for reporting data:

(i) data reporting should be timely. Members agreed to furnish FAO with relevant forest sector statistics annually;
(ii) framework and definitions should be clear, concise and unambiguous;
(iii) data should be presented according to the needs of various users;
(iv) graphics should be adopted for analysis and clarity;
(v) data must be clearly indicated and qualified to prevent misunderstanding by users.

RECOMMENDATION TO FAO

1. When Governments and organizations are considering the development of statistical units,

they must give full consideration to the appropriate investment in computer hardware and software. FAO could assist countries in the setting up of appropriate statistical units in the forestry departments of member countries by initiating discussions at top levels with the respective governments, as well as providing other relevant assistance, such as technical, financial and material support.

2. The working group emphasized the importance of training in computer applications. FAO should provide support to member countries in the training of personnel in the use of computers, data processing and analysis.
3. Follow-up of this kind of seminar through regular forums, workshops and conferences to review progress and exchange ideas should be pursued by FAO and at the same time the maintenance of communication between country experts and FAO was strongly supported.

Annex 3

Report of the working party on forest product statistics

STATISTICAL ORGANIZATION

Observation:

(a) The Committee notes that forest product statistics in Africa are characterized in many instances by three main deficiencies, namely:
- low quantitative sufficiency,
- poor reliability due to the high element of subjective estimation,
- non-availability on time and in forms that would serve the needs of different users.

(b) This is attributed to the weak base prevalent in the national information systems of African Countries due to lack of:
(i) adequate information gathering resources in personnel and equipment,
(ii) continuity in information and statistical data collection, the process being on *ad hoc* basis,
(iii) adequate disagregation and stratification in detail of data for different purposes and users,
(iv) coordination between different institutions and units dealing in data collection.

Recommendations:

Being aware of, and considering the important role that adequate and correct information and statistics play in sector and national planning and in facilitating international co-operation, the following recommendations are made:

1. Advise and recommend to the national governments and Institutions concerned with assembly of forestry related information and statistical data to undertake measures to strengthen the country's capability in data collection, analysis, storage and dissemination through:
(i) establishment of a central forest products and resources statistical unit;
(ii) provision of the statistical unit with adequate tools for information and statistics gathering and analysis;
(iii) organization of training courses, seminars and workshops for forestry statistics personnel of all cadres.

2.(a) African forestry sector undertake the establishment of a regional forestry information and statistical expert committee with mandate to hold periodic meetings to
(i) review and update information and statistics on forestry resources, industry, production, marketing and trade;
(ii) on basis of such review, assist national statistical units in the performance of their tasks;
(iii) formulate programmes and mechanisms for improving forest products, classification, standardization, production, marketing, trade and pricing.

(b) In the establishment and implementation of 2(a) above, technical and material assistance of the international community, and specifically FAO and other UN Agencies and existing regional organizations be sought and enlisted.

(c) An objective would be the development of a system to facilitate the periodic exchange of forestry related information and statistics between Member African Countries, through networks and periodic bulletins and newsletters.

DEFINITIONS AND MEASUREMENT

Observations

It is noted that despite the great effort made by the international community such as FAO UN Standard International Trade Classification (SITC), Customs Cooperation Council Nomenclature (CCCN) among others, there still exists a great deal of confusion in forest resources, products and trade terms, definition, classification and forms of measurement units.

Recommendations

It is recommended that to facilitate clarity and comparability in data classification, analysis, presentation and interpretation:

1. Efforts be made at the international level to eliminate use of different definition, classification and different units of measurement, so that countries' information be comparable.
2. Specifically it is recommended that:
   (a) the use of terms describing wood used for fuel such as fuelwood, woodfuel, wood for charcoal and firewood be re-defined so that fuelwood constitutes charcoal wood and firewood when used in context of household fuels derived for wood;
   (b) definition of minor forest products be made more clear to remove confusion in such terms as poles, posts, props, droppers, etc.;
   (c) definition of wooded areas be re-defined to remove ambiguities with respect to wooded areas of varying degrees of vegetation cover e.g. miombo lands, savannas, scrub forest, etc.;
   (d) with respect to trade, define imports to exclude imports in transit and define exports to include imports originally meant for domestic consumption which are instead exported and re-exports;
   (e) definition of self sufficiency to remove the implicit notion that exports reflect domestic self sufficiency or demand satisfaction;
   (f) in case of wood panels, where some countries and custom classifications use m^2, m^3 or mt, a common measure should be used universally with some indication of dimensional thickness.

PRICES

Prices are unrealistic. There is no basis for the existing price structures in all forest products.

Recommendations

1. National governments should give priority to price statistics in order to undertake periodic studies to establish economically and commercially realistic prices, taking into account forestry investments and market value of the product.
2. Standardization of trade names, definitions and units of measurement, with a view to harmonizing marketing and export pricing.
3. The Seminar recommended countries to support the endeavour to develop uniformity in a harmonized system of grading and specification of wood products especially in the case of sawnwood export being undertaken by A.T.O.

SURVEY METHODS, COVERAGE AND FREQUENCY

Problem/Observation

1. There are difficulties in data gathering due to lack of access to information obtainable from private entities dealing in forestry sector.
2. Lack of records with respect to the informal sector
3. Insufficient information from public organizations and institutions.
4. Frequency and coverage hampered by lack of trained personnel, financial and physical resources.

Recommendation

1. Countries explore possibilities of legislation that would make Forestry Departments in the country a mandatory depositary and to coordinate information from private and public entities, and empowering the department to deploy methods it deems necessary to acquire such information.
2. The implementation of recommendation on a central forestry statistics authority will minimize the other problems highlighted under this section.

RESPONSIBLE OFFICE AND PUBLICATION

Problems

1. Statistics collected by different organization result in inconsistencies in coverage, format, magnitude and detail.
2. Central statistical organizations lack provision on sectorial data and are overloaded.

Recommended

1. National Forestry Departments be responsible for forestry data collection, analysis and dissemination of data.
2. Implementation of recommendation on formation of national forestry statistical units.
3. FAO to assist in establishing and starting up national statistics units with personnel and other resources support and training as per recommendation in par. 1.
4. On publication: Countries should publish forestry related statistics on a regular annual basis.

Annex 4.1

Opening speech by Hon. Stanford Demba, M.P. Minister of Forestry and Natural Resources of Malawi

ON THE OCCASION OF OPENING OF THE SEMINAR ON FORESTRY STATISTICS IN AFRICA 13TH NOVEMBER 1989

I feel greatly honoured by His Excellency the Life President Ngwazi Dr. H. Kamuzu Banda, who has given me the privilege, to come and open this important seminar. Therefore, on behalf of the Government and the people of the Republic of Malawi, I welcome you all to Malawi, the Warm Heart of Africa, and do sincerely hope that you will enjoy your stay in the course of your seminar.

Mr. Chairman, the importance of this seminar, as regards the theme it carries, cannot be overemphasized in the development endeavours of the African region. Statistics on forestry, like on any other sector, play a crucial role in facilitating planning, management and formulation of policy, statistics also function to direct implementation of development programmes and proper allocation of the scarce resources to development activities. In this regard, statistics help to direct resources towards areas of need, thereby minimizing risks and wastage of resources. Proper and accurate collection, processing and dissemination of statistical data on forestry must therefore be promoted and intensified because effective policy decisions can only be made if based on sound statistical information.

It is observed in most situations that statistics on forestry are either lacking, inadequate or unreliable. This is particularly true with regards to wood supply and demand statistics. This seminar must thus provide an opportunity for participants to share experiences and knowledge on how to collect forestry statistics, where they are lacking or inadequate, and how to improve the quality of the statistics where they are unreliable. I, therefore, urge all of you to take this seminar seriously and use the opportunity for making recommendations on the best and most effective methods for the collection, processing and dissemination of forestry statistics for the benefit of forestry sector development in African region.

Mr. Chairman, Ladies and Gentlemen, as you are all aware, forests contribute significantly towards social and economic development and provide environmental protection in our respective countries. Also, forests provide the major source of energy in form of fuelwood, which accounts for 80% of all primary energy consumed, while electricity, oil, coal and new renewable sources of energy account for the remaining 20%. Furthermore, forests play vital functions in the supply of timber to the wood-using industries and in environmental protection and stabilization. However, because of increasing population pressures, the expansion of agricultural production and a growing infrastructural development, forests are being destroyed much faster than they are replenished. In most situations if Africa, wood supply falls far short of demand, thereby resulting in severe deforestation and fuelwood shortages. This situation triggers other negative impacts such as reduced agricultural production, low rainwater infiltration of soil and hence, soil erosion and low groundwater reserves, drought, desertification and many other adverse ecological disasters. It could have been better to quantify both the positive and negative impacts of deforestation to the social and economic well-being of our region rather than talk in general terms. This is the most convincing way to attract financial and other assistance for implementing remedial programmes either from, within or outside our national budgets. In other words, good statistics are a weapon for attracting financial and other resources for development programmes in the Forestry Sector.

In this respect, therefore, Malawi wishes to sincerely thank the Food and Agriculture Organization of the United Nations for the opportunity to host this important

seminar. I am told that the seminar has drawn participants from fourteen African countries who will discuss, exchange information and share experiences on the collection and dissemination of statistics on forestry. I am also informed that your workshop has included field excursions to an operating sawmill and possibly to a mature forest where logging is being done. This is important because by such exchange of information and experiences common problem areas can be identified and methods discussed for overcoming those problems. Please feel free to comment on anything that Malawi is doing in her Forestry Sector Development efforts so that, in that way, valuable lessons can be drawn during your plenary discussions.

As regards our experience in Malawi, lead by the Head of State, His Excellency Ngwazi Dr. H. Kamuzu Banda, we are actively involved in forest conservation and afforestation. His Excellency, Ngwazi Dr. H. Kamuzu Banda inaugurated the National Tree Planting Programme on 21st January 1976 by planting a Mbawa (Khaya Nyasical), tree at Sanjika Palace in Blatyre. Since that time, the tree planting ceremony is commemorated every year on 21st December which was then declared a public holiday so that every Malawian becomes fully involved in the tree planting programme. A network of tree nurseries and distribution points have been established throughout the country and, over 25 million tree seedlings have been planted every year over the past three years.

In the area of plantations for the promotion of construction timber, Malawi is one of the countries in Africa with the largest plantations. The country is now a net exporter of tropical softwood timber. The area that needs attention however is the promotion of our indigenous hardwoods, assessment of these valuable resources and the classification of forest types. There is also need for the collection of statistics on trade and prices of forest products. I hope your workshop will discuss these issues in detail, and I will look forward to your constructive recommendations.

At this point Mr. Chairman, Ladies and Gentlemen, I would like once again to thank the Food and Agriculture Organization of the United Nations for organizing this seminar and all the countries that have sent participants to this seminar. I wish your seminar the best of success.

With these few remarks, Mr. Chairman, the District Party Chairman, Malawi Congress Party, the District Party Chairman, League of Malawi Women, the District Party Chairman, League of Malawi Youth, Honourable Members of Parliament, his Worship the Mayor, the F.A.O. Representative, Resource Persons, invited Guests, Distinguished Participants, Ladies and Gentlemen, I declare this Seminar officially open.

Thank you very much.

Annex 4.2

Welcoming address by G.K. Mburathi FAO Representative

ON THE OCCASION OF OPENING OF THE SEMINAR ON FORESTRY STATISTICS IN AFRICA 12 - 25 NOVEMBER 1989

On behalf of the FAO Director-General Dr. Edouard Saouma, I wish to extend a very warm welcome to you all to this Seminar on Forestry Statistics in Africa. In particular I wish to welcome all the participants from the 14 countries, the African Timber Organization, from SADCC and the World Bank. Some of you, I am sure, might have spent some days to reach here while some might have taken just a few hours. However, I am sure all of you now feel quite comfortable in this Warm Heart of Africa.

You may wish to note that the invitations for participation in this seminar were directed particularly to the English speaking countries and we are delighted to have such a complete response. I wish to say just a few words if only to enrich what you will be dealing with in the next two weeks.

The importance of forests and trees in the daily life of the people is nowhere more apparent than in Malawi. Trees are the source of fuel for cooking, of wood for houses, furniture and equipment. The forest is the source of fruits and vegetables, medical herbs and the wild animals that enrich the food supply. The forest protects the soil and water that is the basis of the livelihood of the people, and it is in the forest that the rich wildlife and diversity of species in conserved.

In Malawi and in all the countries of Africa, we are conscious of the importance of the forest for the wellbeing of people and the conservation of the environment. We are also involved in an immense effort to develop the economy and improve the wellbeing of rapidly growing populations. This means that there is immense pressure on the limited resources of land, forest and water, and there are increasing conflicts for the use of these resources.

The challenge is to manage them well for the sustained development of the economy and people. All this means that every nation and every one of us has a duty to ensure the wise exploitation of our natural resources in the interest of maintaining a sustainable balance between man and nature. We have a joint responsibility at the level of Citizens, Governments and International Institutions.

For forestry to make its proper contribution, the forestry sector requires wise policy, good planning and sound decision-making. An essential basis for this is accurate and complete information about the sector and its activities. In the next two weeks I am sure you will be dealing with the modalities of achieving this objective.

FAO in collaboration with other funding agencies like UNDP has had the privilege of working with the Government of Malawi on a number of projects in the forestry sector, on forestry sector planning and community development, on wildlife and on fuelwood for the tobacco industry, and on the future of the important forestry development at Viphya. It is particularly opportune that we can welcome this seminar to compliment the work in these projects on the development of national forestry sector information.

FAO has been organizing informally working arrangements on Forestry Statistics in this region. However, this is the first formal session that English Speaking countries are having on Forestry Statistics in Africa. The next will be organized for French Speaking countries sometime in 1991. May I therefore express our gratitute for the Malawi Government for agreeing to be the host of this important first seminar. Indeed Malawi Government has made such excellent arrangements to host this seminar. I wish at this juncture to say that Malawi has to be highly recommended for the seriousness and commitment in its approach to reafforestation programmes and solving fuelwood problems by initiating programmes for people themselves to plant trees in their gardens. This is well exemplified even in urban centres like Blantyre where I am sure you will witness the success of the afforestation programme which has been going on for a number of years.

I cannot forget to express our thanks to the Organizing Committee, of this seminar and particularly Mr. Nkaonja, the Chief of Forestry Department, who has left no stone unturned to ensure that everything went on smoothly and on schedule.

In conclusion I wish all who have come to Malawi a pleasant stay and all those participating in the seminar success in their discussions and in the formulation of recommendations on the future of forestry statistics in their countries.

Once again thank you very much.

Annex 5
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Objectives and functions of economic and statistical information for the forestry sector

Phillip Wardle

INTRODUCTION

For forestry to be carried on and to contribute to the wellbeing of people, decisions are being made all the time in many different places and at all sorts of levels. Policy decisions, managerial plans, day-to-day decisions on the job; by governments, by forest planners, by foremen, millers, farmers; on land use, logging, tree planting, tree cutting, land clearing, burning or grazing, selling and buying, on investment in mills, on the products to make, by what process, on the markets in which to sell, and on training; they are made on investment, financing, the allocation of funds, on the control or subsidy of activities, on the location of activity and target groups within society. Information is the raw material for this decision-making. Sound decisions depend on good information as well as an adequate system for using it.

In some countries the information available about the forestry sector is not as good as it should be and this lack certainly prevents forestry and forest industries from generating as much benefit to the community as they might. In some countries sheer ignorance is resulting in damage to and destruction of the forest. This is done in the sincere belief that it will improve benefits from agriculture, grazing or immediate wood supply, while it has in fact disproportionately harmful consequences of soil erosion and loss of potential to produce needed forest products, eventually leading to a poorer community. Lack of objective and credible information contributes to the failure to mobilize communities and governments to corrective action. A poor level of awareness of the contribution and potential contribution of forestry and forest industries to the economic or social wellbeing of the community leads to the neglect of institutions and failure to finance investment in the sector.

There are reasons why it may be particularly difficult to get people to appreciate the benefits of programmes and to realize the costly consequences of their neglect. The availability of forestry supplies usually originating from natural forest has been taken for granted. Environmental damage from forest destruction is frequently more significant downstream and outside the area where forest is damaged or destroyed. With the exception of a few forest-rich exporting countries, the scale of forestry sector activity is usually not so great as to make it a prominent feature of the national economy. Finally the long term nature of forest production means that supply for current consumption can be maintained while stocks and future production potential are being depleted. The fact that the harm may come home to roost sometime after the damage is done makes it difficult to arouse alarm, and because the benefits of good investment come only in the impersonal future, the community is doubly cautious about meeting the immediate cost. The long term nature of these forestry problems greatly increases the difficulty of making the matter credible and gaining community commitment to action.

These are all reasons why it is necessary to have a strong information system in any country where forests have even moderate significance and it is important that these provide the needed data for economic and social policy makers and financial authorities, as well as the forest resource and forest products industry managers. The system should also provide for adequate monitoring of the performance resulting from decisions made.

THE APPROPRIATE STATISTICS

Information is a costly commodity and should only be collected where relevant and with the detail and precision appropriate to the decisions that have to be made. In particular there is a chronic shortage of people trained and capable to collect and process information. The forest sector information system should concentrate on subject areas of importance to a given country, to its local and central organization.

The big headings which are of significance in politics, to policy makers and to financial authorities are: level of the sector contribution to the economy, production, trade and investment, involvement of people, employment, and land use. Adequate data in these areas, which can be related to information on other sectors of the economy, must be available.

A major problem for forestry as for other activities is to obtain adequate information on its contribution to rural communities. Since in many countries activities not carried on in commercial markets are not recorded in the statistics, the most important forestry activity in the developing world - wood collection for fuel and material by rural households - is virtually without record. As an example to show the significance of this, the estimated total value added contributed by the forestry and forest industry sector in developing Africa amounts to about $ 7 000 million per annum (1980 values). $ 5 850 million of this is for fuelwood and unmanufactured roundwood used mainly by the rural community. The total of $ 7 000 makes nearly 5% of gross domestic product of the region. The recorded commercial activity valued at US$ 1 150 and 0.8% of GDP, is the only part of the sector contribution recognized; this of course leads to a gross underestimate and completely misses the vital contribution of forestry to community energy supplies and community wellbeing.

What sort of information has to be collected? The following pages provide some main headings and some detail which may be appropriate according to the circumstances of the country. Recognizing the prime importance of information on the sector's role for policy formation, a check-list of economic and social indicators is given first, and a check-list of basic data on policy and planning and control within the sector in second place.

TABLE 1
Summary Check List of Types of Information for Central Policy Information on the Forestry Sector

FORESTRY SECTOR AND NATIONAL INCOME	Value of Production - Value Added	(subdivided by forestry and individual industry*)
	Income from Employment	
	Value of Exports	
	Value of Imports	
	Investment	(subdivided by forestry and individual industry*)
FOREST PRODUCTS IN ENERGY SUPPLY		
POPULATION INVOLVEMENT IN FORESTRY	Employment	(subdivided by industry and including self-employed and work of family members)
	People with forestry holdings	
	People living in forests	(living from forest areas, shifting cultivators, forest graziers, hunters, collectors)
LAND USE		
	Land under forest	
	Forest area with environmental or protective role	
	Forest area with major pressure of other use	(shifting cultivation, grazing)

*Including imputed value of production within households or in unrecorded rural sector activity.

TABLE 2

A Summary Check list of Forestry Sector Information

Land Utilization and Forest Resources

1. TOTAL AREA	Inland Water Land Area Agricultural Land Forest and Other Wooded Land Other Land	
2. FOREST AND TREE RESOURCES	Forest and other Wooded Land Forest Fallows Trees Outside the Forest Forest and other wooded land are subdivided:	by Species: Coniferous, Broadleaved, Bamboos by availability for productive use: Production, Protection Data are collected on area, volume of Timber and Biomas
3. FUNCTIONS OF FOREST AND OTHER WOODED LAND	Information is collected on the importance of specific functions of forests:	Wood production Environmental protection Water Grazing (range) Hunting Nature Conservation Recreation Other products than wood

These classes are defined in "Towards a Common Framework for World Forest Resource Assessment" - FAO 1989.

TABLE 3

A SUMMARY CHECK LIST FOR FORESTRY SECTOR INFORMATION PRODUCTION TRADE PRICES AND EMPLOYMENT

1. FOREST PRODUCTION Units Volume 000m³

Fuelwood	Industrial Roundwood
Charcoal (mt)	
	Sawlogs and Veneer
	Pulpwood
	Other

2. PROCESSING INDUSTRY PRODUCTION Units Volume 000m³/mt

Sawnwood	Pulp
Panel Products	Wood Pulp
	Pulp (non-wood based)
Veneer	
Plywood	Paper and Paperboard
Particleboard (including non-wood based)	
Fibreboard	

3. FOREST PRODUCTS OTHER THAN WOOD Examples: resins, gums, cork, tannin, honey, nuts; hunting-users and yield, fodder; recreation - user numbers.

4. FOREST INDUSTRY CAPACITY

Number of Mills	Annual Production Capacity Units 000 m3/mt
Sawmills	
Panel Product Mills	
Pulp Mills	
Paper Mills	
Other	

5. TRADE IN FOREST PRODUCTS Units Volume 000m3/mt Value: Local Currency

Imports		Exports	
Volume	Value	Volume	Value
Sawlogs and Veener Logs		Sawnwood	
Pulpwood		Veneer	
Other Industrial Roundwood		Plywood	
Fuelwood		Particleboard	
Charcoal		Fibreboard	
Forest Products Other Than Wood		Pulp	
		Paper	

TABLE 3
A SUMMARY CHECK LIST FOR FORESTRY SECTOR INFORMATION PRODUCTION TRADE PRICES AND EMPLOYMENT (cont'd)

6. PRICES

7. EMPLOYMENT Professional Technical and Vocational Labourers

Public Forest Administration
Private Forests
Forest Industries and Logging
University and Research

DATA SOURCES AND STATISTICAL SYSTEMS

Traditionally forestry sector statistics are collected by forestry departments and encompass the field of activity that is the direct responsibility of the department. Collection of this information is of course a minimum requirement for the day-to-day operation of the department. Policy formation for the forestry sector and decision-making on investment and infrastructure-research, training, educational facilities and investment in tree planting programmes, forestry and forest industries and marketing development, tend to require information over a wider spectrum than is the direct responsibility of a single authority. This will mean collection of information beyond that obtained from operational records. This may require collection through special surveys of the forestry authority, through data systems and surveys of other government departments, and through the data collection made by private sector marketing and industry associations. A few examples illustrate the range of possibilities.

FOREST RESOURCES

The basic requirement of forest and land resource data for any forestry planning or decision-making does not need to be developed here. The possibility that the needed information will be generated most economically by collaboration with other survey organizations is perhaps wellknown. Certainly it will be unusual for the investment in large scale aerial photography or satellite data interpretation to be optimal if it is set up for the exclusive use of forest planning. In countries whose forestry is on a smaller scale it is likely that much of the needed survey information can be best obtained through systems set up for wider purposes.

The importance of woody biomas in energy production and the role of open woodland and setup in wood and biomas production and in many of functions of forest and other wooded land makes the inclusion of other wooded land and trees outside the forest of great importance in the complete assessment of forest and trees resources.

FOREST PRODUCTION

Information on forest production is frequently obtained through records of sale and licensing of timber removals. Sometimes there is also a formal control system relating to removals from private forests or a requirement for the return of records of delivery to mill. There is likely to remain a considerable volume of production for which no formal records exist. A major component of this will be production and consumption by families for their own use. To obtain information on this important area special surveys are necessary. In many countries fuelwood consumption surveys have been carried out by forest authorities either nationally or for particular sample localities. Current examples are surveys carried out with FAO assistance in Bangladesh, Mali, Upper Volta and Zambia. Estimates of fuelwood consumption have also been obtained through household budget surveys and agricultural production surveys carried out by central statistics offices. Once appropriate questions have been devised, the use of such central surveys has the merit of large sample size, low additional cost of the data and regular updating of the information.

INDUSTRY

As has been mentioned, data on forest industries may be obtained through special surveys, required regular ruturns from industry or from industry association statistics. A special survey of the sawmill industry in India was recently completed with the support of an FAO project. Information on capacity, employment,

material inputs, expenditure and investment may be available from central government census of industry.

PEOPLE IN FORESTRY

Information on population in forest area, employment in forestry and forest industries and population dependent on the forest for income may be obtainable from national population censuses. Government forestry enterprise records and industry data may cover a large part of modern sector employment. Most difficult is to obtain information on the involvement of family labour in forestry work when it is for the family enterprise or for family consumption. Another major unknown is the population of families living in or dependent on the forest for goods and services, and land for grazing or shifting cultivation.

STUDIES OF FOREST SECTOR STATISTICAL SYSTEMS

Many countries have recognized the need and are working on improving forestry sector information systems. FAO has had field project activities specifically directed to assisting in the development of forestry sector statistical services in Malaysia, Brazil, Paraguay, Mozambique, Nigeria, the Philippines and Indonesia in the last several years.

An informative review on the availability sources and adequacy of statistics for the forestry sector in one country is provided by the Report of the Review Committee on Forestry Statistics 1979 prepared for the Department of Statistics and Forest Service in New Zealand.

FAO AND FORESTRY STATISTICS

The objective of the FAO programme on international statistics of the forestry sector is to make relevant and objectively compiled international statistics available for all national and international agencies and to assist in the development of national statistical services for the sector.

The work done is of three main kinds:

(i) The collection and publication of information and trade, prices, industry capacity and forest resources. It is hoped to add the information on forest population and employment and the economic contribution of the sector to current series in the future.

(ii) The development and dissemination of standard approaches to the collection of forestry sector statistics. The questionnaire and enquiries are designed to be compatible with minimum national requirements and provide an appropriate framework for national collections. Standard classifications have been developed and with the assistance of advice of national authorities and appropriate international agencies have been revised overtime. The classification and definition of forest products was published in conjunction with ECE in 1982 on FAO Forestry Paper 32 this is currently being revised to take account of the introduction of the Harmonised System and SITC REv. 3, before publishing a second edition. Such classifications provide a uniform basis for development of national statistical systems that will facilitate the international exchange of information on the sector.

(iii) Direct assistance is provided in the design of national statistical services and surveys of sector activities. The development of standard approaches to survey problems and the organization of training in statistical systems for the forestry sector are other ways in which the programme aims to support the development of sound national systems.

The following are the main annual publications:

Yearbook of Forest Products
Annuaire des Produits Forestiers
Anuario de Productos Forestales
Forest Products Prices
Prix des Produits Forestiers
Precios de Productos Forestales

Pulp and Paper Capacities
Capacités de la Pâte et du Papier
Capacidades de Pasta y Papel

FAO provides basic statistics on forestry for the following United Nations publications:

United Nations Statistical Yearbook
United Nations Yearbook of Industrial Statistics
United Nations Energy Statistics Yearbook
Unesco Statistical Yearbook
United Nations African Statistical Yearbook
Economic Commission for Western Asia and FAO
• Agriculture and Development

The FAO Monthly Bulletin of Statistics includes forest product prices series of international significance. The Timber Bulletin for Europe is prepared by the Joint FAO/ECE Secretariat of the Timber Committee of the Economic Commission for Europe. It includes data on

production and trade and prices of forest products for the member countries of the commission and is published twice yearly. "Monthly Prices for Forest Products" is a quarterly supplement to the Timber Bulletin for Europe. The FAO "Monthly Bulletin Tropical Forest Products in World Timber Trade" provides monthly data on detail of tropical timber trade flows.

Statistics on fuelwood, an introduction

Philip Wardle

Fuelwood and charcoal consumption accounts for 80-90 percent of fuel consumption in many countries in Africa. Fuelwood accounts for 90 percent of wood consumption.

A first assumption is that fuelwood consumption increases with population. It is also expected that African countries will increase their income levels and the proportion of urban population will increase. In the movement from low population and abundant wood fuel supplies to an eventually richer urban population, initially one may expect fuelwood consumption to increase with population but eventually to become relatively scarce so that alternative fuels may become increasingly accessible, more acceptable and relatively less expensive.

Statistics on fuelwood and charcoal production which can be related to the social and economic status of the population and its dynamics are needed to monitor this process, and to provide information that allows prediction of the development and, for those responsible for forests, information to allow them to access the ability of forest resources to meet the need and the investment necessary to meet it in the future.

Consumption to a great extent is met by fuelwood gathering by members of the household. With increased urbanization a greater volume of fulwood and charcoal is produced for the market, but the production and marketing remain informal. Thus there is no easy access to recording of production and sales by enterprises. Production and consumption go on in innumerable households and small enterprises and varies with their needs and the season of the year, as well as the supply situation.

Assessment of fuelwood and charcoal production and consumption depends largely on ad hoc surveys.

These surveys have attempted to assess daily consumption in households, production in the forest, volume transported to consuming areas, volumes sold in markets. A small sample of porducing and consuming units is sampled over a limited period of time. The results of the sample are extrapolated to the population.

In this session we will discuss the problem of increasing this type of consumption, looking at the requisites in the design of sample surveys and exchanging experience.

Design and execution of fuelwood consumption surveys

James Allen

This presentation will begin with a brief review of the importance of fuelwood in the economy of African countries and the social and environmental effects of fuelwood shortages. The role that fuelwood consumption surveys can serve in forest policy and planning will also be covered briefly. The majority of this presentation, however, will be devoted to the technical aspects of design and execution of fuelwood consumption surveys.

Major design considerations will be covered, including determination of survey goals, specification of desired types of output data, questionnaire design, and design of a sampling scheme (including stratification, samp_e size, selection of sampling units, and sources of bias). The steps in survey execution covered include recruitment, training and supervision of enumerators, procedures for quality control, logistical considerations, data processing and data analysis. Emphasis will be placed on aspects of design and execution that are unique to fuelwood surveys (e.g. seasonal variation in consumption as a source of bias).

It is assumed that fuelwood surveys are likely to be severely constrained by available funds, time and personnel. Considerable attention will therefore be paid to the tradeoffs that can and have been made between the "ideal", completely statistically-sound survey, and less expensive surveys that may still be adequate.

Following a general introduction these topics are discussed in five "stages":

Planning
Sample Design
Questionnaire Design
Management of Fieldwork
Data Processing and Reporting

The main text is supported by headings in the annexes covering survey design and management.

What Is a Fuelwood Consumption Survey?

FUELWOOD

In this case, fuelwood more properly refers to WOODFUEL, which consists of *fuelwood* and *charcoal.*

CONSUMPTION

The amount of woodfuel used (burned) by a given entity, such as person, household, region, industrial sector, or nation.

Consumption is usually expressed in either volume (m^3) or weight (kilograms or tonnes) used per year.

SURVEY

A systematic collection of information on the use of woodfuels by a given study group or population, usually by means of interviews or questionnaires, using the principles of sampling and statistics.

ADDITIONAL POINTS

In most cases, fuelwood consumption surveys deal with more than just how much woodfuel is consumed. They also cover such factors as control of an access to woodfuel, costs of woodfuel, etc. A fuelwood consumption survey has much in common with a forest inventory. Both involve many similar steps, such as defining the objectives, deciding what to measure and how it will be done, sample design, training and supervising field personnel, data entry and checking, analysis, and report writing.

Why Are Fuelwood Consumption Surveys Important?

REASON 1

Fuelwood accounts for much of the total energy and total amount of wood consumed in many African countries, as shown in the tables below.

Fuel Wood Consumption in Tanzania, Gambia, and Thailand

	Fuelwood consumption per capita (tons/year)	Fuelwood as share of total timber consumption (percent)	Fuelwood users as share of total population (percent)
Tanzania	1.8	96	99
Gambia	1.2	94	99
Thailand	1.1	76	97

Source: Adapted from Keith Openshaw, "Wood Fuels the Developing World", New Scientist, Vol. 61, No. 883, 31 January 1974.

TABLE 1

1980 final energy consumption in PJ and the average annual growth rate for 1980 to 2000 in percentage per year. Coal figures do not include coal used for generating electricity (PJ - Petajoules = Joules x 10^{12})

Country	Grand Total	Commercial Fuel				Traditional Fuels
		Total Commercial Fuels	Electricity	Coal	Petroleum	
Angola						
PJ	105.5	23.9	2.3	0.0	21.6	81.6
%/Year	2.6	4.3	6.3	0.0	4.1	2.0
Botswana						
PJ	22.2	9.8	1.7	3.7	4.4	12.4
%/Year	3.3	4.0	4.3	3.6	4.1	2.8
Lesotho						
PJ	24.1	5.1	0.3	1.9	2.9	19.0
%/Year	2.4	4.2	6.4	5.1	3.2	1.8
Malawi						
PJ	165.2	9.4	1.3	1.4	6.7	155.8
%/Year	1.8	3.8	5.9	3.2	3.4	1.7
Mozambique						
PJ	281.7	30.6	2.5	5.8	22.3	251.1
%/Year	.6	3.9	7.2	3.0	3.7	2.4
Swaziland						
PJ	24.0	9.6	1.6	3.3	4.7	14.4
%/Year	3.5	3.9	4.4	4.7	2.9	3.2
Tanzania						
PJ	438.9	37.5	2.3	0.2	35.0	401.4
%/Year	3.4	4.1	7.7	3.0	3.8	3.3
Zambia						
PJ	150.8	62.9	20.4	11.2	31.3	87.9
%/Year	2.8	3.9	4.1	3.5	3.9	1.9
Zimbabwe						
PJ	244.0	117.2	24.9	65.8	26.4	126.9
%/Year	3.4	3.9	4.4	4.1	3.2	2.8
SADCC						
PJ	1456.4	305.9	57.3	93.3	155.3	1150.5
%/Year	3.0	4.0	4.7	4.0	3.7	2.6

REASON 2

According to the FAO and other sources, fuelwood is already scarce or may become scarce in many African countries. Such shortages may have serious social and environmental impacts.

Acute Scarcity Situations

Botswana: west
Burundi
Chad: north
Comoros
Djibouti
Ethiopia: Abyssinia
Ethiopia: Ogaden
Kenya: north
Lesotho
Mali: north
Mauritania
Mauritius
Namibia
Niger: north
Reunion
Rwanda
Somalia: north and south
Sudan: north
Swaziland

Deficit Situations

Angola: northeast/southeast
Benin: southern
Cameroon: north, west
Ethiopia: Eritrea
Gambia
Guinea: north
Kenya: coastal province and central
Madagascar: except Diego Suarez and Tamatave
Malawi
Mozambique: south
Niger: southwest
Nigeria: north
Senegal: central river plain, west
Tanzania: north
Togo: south
Uganda
Upper Volta: central
Zaire: south, west
Zambia: east

Prospective Deficit Situations

Benin: north
Chad: central and south
Ghana: north and south
Guinea: south
Ivory Coast: north and south
Madagascar: Diego Suarez, Tamatave
Mali: south
Mozambique: central and north
Niger: southeast
Nigeria: south
Sudan: central
Tanzania: south
Togo: north
Upper Volta: west east

REASON 3

Good information on fuelwood consumption is essential for forestry policy and planning.

- Forestry departments have limited resources.
- Forestry departments are faced with numerous forest resource-related problems, such as deforestation, soil erosion, shortages of fuelwood, poles, timber and other forest products, loss of forest plant and wildlife species, etc.
- Forestry departments are in a position to make significant contributions to national well-being, through the provision of forest products for domestic needs; creation of jobs in forest products industries; and earning of foreign exchange through exports of forest products.
- To allocate limited resources so that they are most productive, and achieve a desirable balance between domestic needs and needs for jobs and foreign exchange, forestry departments need INFORMATION, one critical element of which is information on the consumption of woodfuels (including the extent and location of fuelwood shortage situations in the country).

How Is a Fuelwood Consumption Survey Conducted?

- A fuelwood survey involves the same stages as other types of surveys, such as surveys of agricultural practices or voters' preferences for candidates in national elections.
- This diagram shows the various stages involved in a survey. Another way to look at this is to consider the first box to represent PLANNING, the second and third boxes to represent DESIGN, and the remaining boxes to represent EXECUTION.

Planning the content FORWARD LINKAGE —>
Arranging finances
Reviewing literature
Theorizing
Sample design
Sampling
Questionnaire construction
Pre-test (s)
Interviewer manual
Recruitment and training of interviewers
Field work
Code construction
Code training
Coding
Punching and verifying cards
Data processing
Analysis and report writing

BACKWARD LINKAGE Answering original questions of study

- In the above diagram, FORWARD LINKAGE merely refers to the order in which most surveys are conducted.
- BACKWARD LINKAGE may be the more important concept. This refers to the need to begin the planning process by imagining what the final product of the survey will be and how it will be used. Without a good idea of what is needed, it is impossible to plan a good survey.

THE FIRST STAGE: PLANNING

- The first step in planning should be STATING THE OBJECTIVES. The more specifically the objectives are stated, the better the chances will be for a successful survey.
  - Ideally, objectives should be stated in terms that allow for rigorous statistical analysis. An example might be "to estimate the average annual consumption (in tonnes) of woodfuel by region in the country. The estimate should be within 10 percent of true average, (with a 90 percent confidence).
  - In practice, objectives are usually stated much more vaguely. An example from a survey done in Zambia is "the consumption survey will aim at obtaining, by field measurements, the amounts of wood consumed both for energy and for durable uses of wood".
  - Regardless of whether they are stated in general or specific statistical terms, careful thought should be given to the objectives...the survey should meet a clear need of the forestry department.
- A good second step is to review existing literature that may be pertinent to the survey objectives.
  - NEVER RULE OUT THE POSSIBILITY THAT THE OBJECTIVES CAN BE MET WITHOUT CONDUCTING A SURVEY. Surveys can be very expensive and time consuming, and enough information may already be available from other sources (e.g. agricultural surveys or surveys done by the National Bureau of Statistics).
  - Even if not enough information exists to avoid doing a survey, what little that does exist may be very valuable in designing and carrying out a survey.
- The third step should be to ensure that the resources are available to complete the survey. You may want to answer the following questions:
  - Are the funds necessary to conduct this survey available?
  - Are trained personnel available to design the survey, carry out the survey in the field, enter the data and check it, and carry out the analysis?
  - Is the field equipment required (e.g. motor vehicles) available?
  - Are suitable computing facilities available?

- IT MAY BE POSSIBLE TO GET A FUELWOOD CONSUMPTION SURVEY DONE AS PART OF A LARGER SURVEY.
  - Combining a fuelwood consumption survey with a social survey, agricultural survey, or some other type of survey may allow forestry departments to make use of existing expertise and resources for conducting surveys.
  - In Malawi, a fuelwood consumption survey was added to a package of surveys comprising the National Sample Survey of Agriculture.
  - In Kenya, an energy survey developed as part of a fuelwood project was conducted by experienced enumerators from the Central Bureau of Statistics.
  - Combining with larger surveys can save a lot of money and effort.

THE SECOND STAGE: SAMPLE DESIGN

General Principles of Sampling

- Designing a sampling scheme for a survey requires a basic knowledge of sampling techniques and statistics. It is impossible to cover all that you need to know here, but a few of the most important principles are described below.
- POPULATION is a central concept in sampling and must be defined for any survey. Examples of populations for a fuelwood consumption survey are all the people (or households) in a certain district, all the households in urban areas, the tobacco-curing industry, etc.
- Populations are made up of individual UNITS. The most common unit for the purposes of a fuelwood consumption survey is the household.
  - Units are what are actually selected for measurement in a survey.
- BIAS is a systematic error leading to a difference between the estimate of the population value (e.g., mean annual fuelwood consumption) and the true value. Bias has no doubt had a significant impact in past fuelwood surveys, in part because there are so many possible sources of bias, some of which are quite expensive to avoid. Some of the main sources of bias are described on the following page.

NOTE
IT IS ALWAYS ADVISABLE TO CONSULT WITH A QUALIFIED STATISTICIAN WHEN DESIGNING A SAMPLING SCHEME

Sources of Bias in Fuelwood Consumption Surveys

- Bias can be due to measurement flaws.
  - If fuelwood is being weighed, an improperly calibrated scale is one source of bias.
  - Bias can be due to failure to account for moisture content of wood.
- Bias can be due to failure to account for seasonal variation in fuelwood consumption.
  - Most surveys are carried out over a very limited time period, usually in the dry season.
  - Fuelwood consumption has been shown to vary substantially at different times of year, such as in the winter (when more wood is used for heating), and in the rainy season (when people are too busy with planting, weeding, etc to collect much wood).
- Bias can be due to selecting samples that do not truly represent the population.
  - Many past fuelwood surveys have oversampled local leaders, larger households, households that are easily accessible (right along roadsides), areas where development projects are taking place, men, etc.
- Bias can be due to strict reliance on questionnaires, without supplemental measurements of wood consumption.
  - In Burkina Faso, people overestimated their fuelwood consumption by between 5 and 9 percent in urban areas and 15 to 20 percent in semi-urban and rural areas (as determined by comparing answers to questions on consumption with actual consumption measurements).
  - In a study in Nepal, it was found that people overestimated consumption by 76 to 95 percent.
- Bias can be due to people's responses to the survey.
  - In a study of fuel consumption using wood stoves in Burkina Faso, it was found that people reduced their consumption by 25% merely because their fuelwood consumption was being measured every day ... they became more conscious of their consumption and wanted to show the researchers they were not wasting wood.

Sampling Methods

- There are a variety of sampling methods available for use in fuelwood consumption surveys, four of which are briefly summarized below.

- SIMPLE RANDOM SAMPLING
  - Every unit in the population has an equal chance of being selected.
  - Works best when there are no distinct groups (strata) of units within a population that are obviously different in quantity (e.g., urban vs. rural households).
  - Can be expensive to use in practice because units that are selected may be very far apart, meaning that much time will be spent travelling between units, rather than actually sampling.

- STRATIFIED RANDOM SAMPLING
  - A modification of simple random sampling, wherein the population is first divided into distinct sub-populations (strata). This can increase the overall precision (and usefulness) of the sample.
  - Probably all national fuelwood surveys have used some form of stratified random sampling.

- The most common types of strata used in fuelwood surveys are population density and ecological zone.
- Population density strata might include urban areas, semi-urban areas, and rural areas.
- Ecological zone strata might include mountain areas, low rainfall areas, or areas with different amounts of forest cover.
- Other types of strata might include land tenure differences (privately owned vs. communal lands), ethnic strata, or industrial sector strata (tobacco-curing, fish drying, energy).
- Some types of strata can be identified after the survey data is collected, for example if information is collected on income, the main sample can be subdivided into wealthy, middle income, and poor households.

- CLUSTER SAMPLING
  - Most large fuelwood surveys have first identified major strata to be sampled, and then selected sample units using some form of cluster sampling.
  - An example of a cluster sampling method is to pick 20 points on a map within each strata, and then conduct interviews at the nearest 10 households to that point.
  - The main advantage of this type of sampling is that it can save a considerable amount of time and money. Travel costs are lower because many sampling units are close together. Less interviewers may be necessary, since each can sample more units in a given amount of time.
  - Cluster sampling may increase sample variability, however, especially if a large number of units are sampled in each of a few clusters. This can reduce the precision of the estimate.

- PANEL SAMPLING
  - Panel sampling involves sampling of the same units at more than one period in time.
  - This has been applied in fuelwood surveys to estimate changes in consumption due to seasonal variation. For example, the same households may be revisited once a month for an entire year.
  - Maintaining the cooperation of households or other units being sampled may prove difficult. Also, people may die or move, businesses may fold, etc., resulting in the loss of sample units over time.
  - Often, repeated visits may be needed during each time period due to respondents not being at home, not having wood to measure, etc.

Determination of Sample Size

- A major decision facing survey designers is sample size. There are three general ways to choose a sample size.
- Sample size can be selected arbitrarily, based on sample size used in previous surveys, or based on how many samples can be collected with available funds, time, etc. This is the most commonly used (but least rigorous) way.
  - Sample sizes that have been used in previous surveys include:

Sample Size	Country	Purpose of Survey
72	Zimbabwe	Households Use of Forests
600	Kenya	Fuelwood Consumption
640	Zambia	Fuelwood Consumption
1150	Swaziland	General Homestead Survey
1289	Zimbabwe	Wood Usage/Tree Planting
2408	Malawi	Energy Survey
6000	Bangladesh	Rural Fuelwood Use
11000	Nigeria	Regional Energy Survey

- Sample size can be selected to obtain a desired precision.
  - Formulas are available in textbooks on statistics for the various sampling methods.
  - These formulas require an estimate of population variability, which may require a preliminary survey.

- Sample size can be selected using formulas that include both desired precision and costs of collecting samples.

See Annex I overleaf for furtter discussion of sampling.

ANNEX I

Extract from 76 Agriculture Handbook 232, U.S. Dept. of Agriculture

• This extract from a U.S. Forest Service publication on forest sampling provides an excellent discussion of things to consider when designing a sample survey, and is provided as an additional source of information.

The objective must be stated. Specifically, identify the parameter to be estimated and the precision desired. An example of a lucid objective might be: "To estimate the number of plantable slash pine seedlings at the Riedsville Nursery. The estimate should be within 1 percent of the true number, with 95 percent confidence." Vague statements ("To study the results of spraying ..." "To estimate the effectiveness of ...") can and do result in an appalling waste of survey efforts.

The population should be defined. What are the units constituting the population? What are the unit values? What units are excluded from the population? Careful, accurate answers to these questions will forestall numerous difficulties at later stages. A generality worth repeating is that sampling design will be simplified if the specifications for the units used to define the population are identical with those used in the sample. Even at that, the definition and specification may be difficult. It may be easy to define a tree or a plot, but if a survey is to be made of farmers, pulpwood contractors, or seed orchards, the unit may be very hard to define. An attempt should be made to foresee the difficulties that might arise in classifying a unit as in or out of the population; the borderline instances will be a constant source of trouble to enumerators and analysts.

The data to be collected should be specified. Special attention must be paid to getting all the data necessary to the objective. It is a moot question how far one should go in taking supplementary data that is not pertinent to the main objective. Frequently cooperators and reviewers, sensing and opportunity to obtain information on some pet project, will request that additional observations be made "while you are there". Such requests must be carefully reviewed. "Free" information is not cheap if it is never used or has an adverse effect on the main objective of the survey.

Measurement techniques must be prescribed. The measurement procedures should be stated unambiguously. The detail needed will vary with the complexity of the measurements and the experience of the personnel, but in general it is better to be annoyingly specific than trustingly vague. Terms such as merchantable top, overstory, undesirable, stocked, board-foot volume, and plantable should be precisely defined.

The need for training and preliminary practice should be considered, and proficiency tests are not unwarranted - even for the old hands who may have forgotten some of their earlier training or developed bad habits.

The sampling units must be defined. Again, the totality of sampling units, however distributed, must comprise the population. If the unit is obvious, e.g. a sawmill, no particular trouble need arise. But if a variety of units are possible, a search of literature will frequently uncover some profitable experience; if not, a study of the optimum size and shape of sampling unit may be required.

The sampling method must be described. This handbook outlines a number of methods that have been found useful in forestry. Thought, experience, and a review of literature will help in deciding which method is most appropriate for a particular situation. The method of selecting the sample units should be carefully stated, and so should the procedure of locating the units in the field. Saying that a two-stage design will be used with primaries and secondaries selected at random is not enough. How will randomization be accomplished? And how will the unit be located in the field? The possibilities of and antidotes for bias in locating units deserve some thought. Timber cruisers will, for example, tend to veer away from dense brush and openings when locating plots by hand compass and pacing. House-to-house interviewers have been known to neglect top-floor apartments and homes with barking dogs.

At this stage it is also well to think out the procedures to be used for estimating the parameters and sampling errors. Collecting data and then asking someone how to use it is a good way to lose friends and waste survey money.

The sample size must be prescribed. Once the desired precision, choice of sampling unit, and method of sampling have been stated it is time to think of the size of sample. The sample should be just large enough to give the specified precision, and no larger. If the requisite information on costs and variances is available, this decision should be made prior

to the start of field work. In the absence of such information, a preliminary survey may be necessary.

Possible problems of data should be considered. If the preceding steps are meticulously followed, problems arising at the data-collection stage are usually those of organization and personnel. The greatest single stumbling block is the common failure of supervisors to continue training and checking field crews or to provide for editing of field forms. Some organizations find it worthwhile to make punched-card sorts to check for recording mistakes such as trees that are 3 inches in d.b.h. and have 14 logs (instead of a 14-inch tree with 3 logs).

Data processing should be planned. In most cases, procedures for computation and analysis are fixed by the choice of sampling methods. In organizing the computing, there may be some extraordinary considerations that merit early attention. If the volume of data is small, computing may be readily absorbed in the daily routine. If the volume if large, special staffing and special equipment may be desirable. If, for example, the analysis is to be on electronic computers, it would be advisable to become familiar with the special requirements necessary to electronic computing, such as data format for keypunching, availability of programs, and cost of programming.

THE THIRD STAGE: QUESTIONNAIRE DESIGN

- The two basic goals of using a questionnaire are:
  - Obtain information relevant to the purposes of the survey
  - Collect this information with maximal reliability and validity
- A frequent mistake is making questionnaires too long and detailed. A general rule of thumb is that a questionnaire should take no more than an hour to administer. For most fuelwood surveys it should be possible to design a questionnaire that can be administered in 30 minutes or less.
- Questions should be very clear and unambiguous, using words and terms that the respondents understand.
- In general, questions that depend on recall of frequently occurring events over a long period of time should be avoided, such as:
  - How many times did you purchase fuelwood in the last year?
  - How many trips to collect fuelwood did you take in the last six months?
- Avoid questions that respondents are unlikely to be able to answer, such as:
  - How many kilograms of wood did you burn this week?
  - What percent of the wood you burn is for heating and what percent is for cooking?

- ALWAYS PRETEST A QUESTIONNAIRE
  - Pretesting allows questions that cause confusion either for the enumerator or respondent to be identified and corrected before the real survey begins.
  - Ideally, each person who will be administering a questionnaire should practice using it.
- Design the actual questionnaire so that it is easy for the Enumerator to use and is also easy to transfer the answers into a form usable by computers. Below is a page from a village woodlot questionnaire used in Bangladesh in which the answers can be easily coded for computers.
- Below is a set of instructions for the enumerators that goes with the questionnaire on the previous page. Thise help ensures consistent use of the questionnaire by all enumerators.

Measurement Considerations

- Probably the best way to gather information on fuelwood consumption is through the combined use of a questionnaire and actual measurement of wood consumption.
- If wood is to be measured, the first thing that needs to be decided is whether to measure in terms of volume or weight. Both volume and weight have associated measurement problems (see Annex II for a discussion of this issue).
- Next, a system of measurement must be devised.
  - Several surveys have used a system wherein a pile of wood was measured, used for all household consumption for a specified time period (usually 1 to 3 days), and then remeasured. This works well as long as everyone in the household cooperates, and wood is neither added to the pile nor collected from another source and used.
  - An easier but potentially less accurate system is to ask survey respondents to set aside the amount of wood that will be used in a specified time period, and then measure the amount indicated.
  - When respondents regularly purchase their wood, and it is bought in regular amounts (e.g. "sugar bags" of charcoal), it may be possible to get households to keep track of the number of units they use in a specified time period.
- The variations in fuelwood consumption should be accounted for.
  - At the very least, a measurement should be made in each of the major seasons or times of year in which consumption is likely to vary (e.g., rainy season, winter, harvest time).
  - Ideally, measurements should be made on a regular basis for at least one whole year ... this has almost never been done in practice.

Note: examples of questionnaires are shown overleaf and in Annex III

VILLAGE WOODLOT HOUSEHOLD AND VILLAGE LEADER QUESTIONNAIRE

Value or Variable Code — Name

1.0 REGISTRATION (NOT TO BE ASKED)
Date of Interview .....
Questionnaire Serial No. ..... ☐☐☐ Vwnum
1.1 Zone/Circle ..... ☐ Zone
1.2 District/Forest Division ..... ☐☐ District
1.3 Block/Range ..... ☐☐ Block
1.4 Panchayat .....
1.5 Village .....
1.6 Year Established ..... ☐☐ Year
1.7 Established by:
(1) Forest Dept .....
(2) other Govt. Dept .....
(3) Voluntary Agency .....
(4) Panchayat...(5) Village .....
(6) Other ..... ☐ Estab
1.8 Managed by: (see codes in 1.7 above) ..... ☐ Manage
1.9 Management Plan Prepared:
(1) Yes .....
(2) No ..... ☐ Plan
1.10 Respondent Selection:
(1) Random household .....
(2) Village Leader .....
(3) Position ..... ☐ Sample
1.11 Respondent's Name .....
1.12 Respondent's Sex
(1) Male .....
(2) Female ..... ☐ Sex
1.13 Respondent's Social Category:
(1) Schedule Caste or Tribe .....
(2) Other ..... ☐ Group
1.14 Respondent's Economic Category:
(1) Below Poverty Line .....
(2) Above Poverty Line ..... ☐ Econ

2.0 KNOWLEDGE OF WOODLOT AND WOODLOT ESTABLISHMENT

2.1 Is there a woodlot in your village?
(1) Yes .....
(2) No ..... ☐ Woodlot

IF ANSWER TO Q 1.2 IS "YES" ASK Q 2.2
IF ANSWER TO Q 1.2 IS "NO" GO TO Q 4.2

2.2 When did you first came to know about the woodlot?
(1) Before it was started .....
(2) When it was started .....
(3) Several months afterwards .....
(4) Can't remember ..... ☐ Hear

2.3 Whom do you believe started the woodlot?
(1) Forest Department .....
(2) Agricultural Department .....
(3) Panchayat .....
(4) Panchayat and Forest Dept .....
(5) Other (specify) .....
(6) Don't know ..... ☐ Start

INSTRUCTIONS TO INVESTIGATORS

Q 1.1 - 1.13 These should be filled in by the interviewer after consulting appropriate records and through observation. Answers are *not* to be obtained by questioning the respondent. The first question for the respondent is Q 2.1. In addition to completing all initial information fill in the appropriate name of the villager or village leader in the "respondent" category, 1.11. Make sure that the respondent is a resident of the village. Codes will have been established for the Zones, Districts or Blocks by the MEU. Use them to code the answers. All questionnaires should be numbered serially when returned to the MEU and the number added at the top of questionnaire.

Q 2.1 This is the most important question. Make sure that the respondent understands that you are asking about the woodlot in his/her village. Not about social forestry generally, or other village woodlots. The emphasis must be on the word "your".

Q 2.2 Take the first response that the respondent gives. Do not enter into any discussion. If the respondent says "Agricultural Department" note that, even if you know it to be incorrect.

Q 2.3 Don't know should be ticked if the respondent cannot give an answer. This applies to appropriate questions throughout the questionnaire. If a respondent "does not know" the answer to a question and there is no appropriate code, then write "D.K." neatly beside the question.

THE FOURTH STAGE: MANAGEMENT OF ENUMERATORS AND FIELD WORK

Recruitment of Enumerators:

- Enumerators should be able to read and write fairly well, interpret questions, and keep good records. They should also be reliable, honest, and personable, yet firm when necessary.
- Examples of kinds of people who may make good enumerators include high school or college students, teachers who are on school holidays, agricultural extention officers, and forestry technicians.
- Make sure that the prospective enumerators know what to expect in the field, which may include bad weather, lots of walking, dealing with insects, snakes, etc., poor accomodations, periods of limited contact with supervisors, and encounters with people who may not appreciate being approached for interviews.
- Try to avoid choosing enumerators who feel they are too educated or otherwise over-qualified for the job, since they may get bored and quit prematurely.
- Consider cultural norms when selecting enumerators. For example, if you are planning to interview mostly women, it may be proper to select mostly women as enumerators.

Training of Enumerators:

- Training should begin with a thorough briefing on the purpose of the survey, the general strategy for carrying out the survey, and where the enumerator fits in to the overall survey process.
- The questionnaire should be carefully explained to the enumerators, and they should be given a chance to ask why certain questions are included, indicate whether any questions are unclear to them, and suggest additional questions that could be asked.
- The enumerators should each practice using the questionnaire several times. Supervisors should accompany the enumerators the first couple of times they try use the questionnaire, and after each interview provide constructive advice.

Supervision of Enumerators:

- Make plans for supervisors to meet with enumerators on a regular basis, such as once a week. Always make sure that in case a meeting is missed (e.g. because a vehicle broke down), a plan for communicating the problem exists.
- Supervisors should carefully check the completed questionnaires for completeness, possible mistakes in recording or interpretation of questions, etc.
- Supervisors should make sure that enumerators are told if their work is good ....look for opportunities to boost and/or maintain enumerators' morale.

Logistical Considerations:

- One way to reduce logistical concerns such as housing and transport is to recruit enumerators who live in the areas being surveyed.
  - For a general homestead survey in Swaziland, students where chosen from the university based on their performance at school, and they conducted interviews while at home for school holidays. This method was very inexpensive and provided both good enumerators and good geographical coverage.
- For a survey in Zimbabwe, a system that worked well was to create teams that consisted of three pairs of enumerators, a supervisor, and a cook. Each team had a pickup truck with trialer and camping equipment. Each day, the supervisor dropped and the three pairs of enumerators off in different areas; the pairs stayed close together, but split up to interview neighboring households.
- Ideally, both local leaders and people in the areas to be sampled should be made aware of the survey in advance. This can be done by calling meetings, briefing local leaders and asking them to tell the local people, and/or arranging for radio announcements.

THE FIFTH STAGE: DATA PROCESSING

Data Entry:

- Data entry is the process of transforming data collected in the field into a format usable for analysis, which in most cases will be done using a computer.
- The first step in data entry is code construction.
  - Each question asked should be assigned a variable name, and each possible response to the question given a code. For instance, if respondents are asked what district they live in, and there are five districts in the area surveyed, a variable might be created named "DSTRCT", and each individual district assigned a number from 1 to 5.
- The next step is training the people who will be doing the data entry.

- They should be briefed on the actual code to be used, and what the data will look like in its "raw" form (i.e., while it is on the questionnaire forms).
- It may be necessary to train the coders on how to use the computer and associated software that is available for data entry.

- Software packages that have been used successfully for data entry include spreadsheets (e.g. LOTUS 123) and data base management software (e.g., DBASE III). If nothing else is available, some word processing software can also be used, but it is definitely not as good.
- Once data is entered, it should be carefully checked for errors.
  - First, the data entered into the computer file should be manually checked against the original forms.
  - Second, the data should be checked by using basic computing procedures. For instance, most statistical software packages can be used to show minimum and maximum values for each variable ... looking at these can often help find erroneous entries. Plotting the data often helps, as well.

What to Look for in a Report on Fuelwood Consumption

- In some case, you will need to assess whether existing surveys are adequate for your needs. Also, in cases where fuelwood surveys have been contracted, it is important to be able to evaluate the quality of the work done by the contractor, which will be based largely on the contractor's report.
- The report should have a good introduction, which describes the background to the survey (why it was done) and the survey objectives.
- The survey methods should be thoroughly documented.
  - The sampling method should be described.
  - The sample size should be stated, as well as the percent of the entire population that was sampled. The rationale for sample size determination should be stated.
  - A copy of the questionnaire should be included as an appendix.
  - Measurement techniques should be described.
  - Any assumptions used should be stated.
  - Field execution methods should be described, including information on the qualifications of the field personnel and any logistical difficulties encountered that may affect results.
- There should be a discussion of the area that the results are applicable to. Are they valid for the nation as a whole? Just specific regions? Specific socioeconomic groups?
- There is no standard way to present results.
  - One thing to look for is whether the results are presented clearly.
  - Ideally, results should be separated from any conclusions or discussions based on the results. In practice, these sections are often combined; in such cases care must be taken to ensure that it is possible to discern conclusions based directly on research findings from those based more on the author's interpretations or speculation.

ANNEX II

Measuring Fuelwood and Charcoal

Keith Openshaw[1]

When measuring the consumption of fuelwood and charcoal, conversion factors have to be used in order to convert field observations into standard units. These factors will have to be compiled for the particular country in question but certain procedures are common to all countries.

1. FUELWOOD

1.1 Average bundle size

Much fuelwood is collected by the headload. A number of headloads could be measured either by volume or weight and an average for a particular district or country could be established. The main collectors of fuelwood in each district should also be recorded, for if children are the principal collectors in one area, the headload size may differ considerably from another district where women are the collectors. Therefore it is advisable to record the incidence of collectors by sex and age. Again the bicycle or handcart may be used to collect the wood in some areas and naturally the size and weight of the bundle will differ from the average headload size, so the method of conveying the wood should also be recorded.

1.2 Volume measurement

The two methods of measuring, by volume or by weight, each has drawbacks. If volume is used, then the conversion factor from the bundle to solid measure can vary enormously, depending on whether the headload consists of one large log or many small branches, though the average headload conversion factor may be between 0.35 and 0.40. For example, in the Machakos district of Kenya the average headload volume was found to be 0.087 m^3 and the average conversion factor measured by the water displacement method was 0.38, so the solid volume of the average headload was 0.33 m^3.

In some countries the stere or stacked cubic metre is the standard measure, but in using this measure the surveyor does not know the correct conversion factor to apply. If the stere is made up from bundles, then the conversion factor will be much lower than if it is made up from stacked stem wood. Again the stacked measure is not an exact measure and be up to 20 percent more than a true stere (but it is rarely less than a true stere). This also applies to other stacked measures in use such as a cord (4 feet x 4 feet x 8 feet = 128 stacked cubic feet or the metric cord 1 m x 1 m x 3 m). One advantage the volume measure has over the weight measure is that the volume of "wet" wood does not differ greatly from air dry wood (may be up to 5 percent); if a standard conversion factor to convert weight into volume is used, without accounting for the moisture content of the wood, then there can be 100 percent difference in volume estimation, depending on whether the wood is green or oven dry.

1.3 Weight

(i) *Convenience*

Weight may be a more convenient measure to use to ascertain solid volume, for the weight of a bundle of wood (or crop residue) is easier and quicker to determine (using a spring balance) than trying to determine the gross volume of an irregularly shaped headload of fuelwood. If the solid volume is to be measured, then every piece of wood will have to be measured separately, or the water displacement method used. This entails the submerging of a fuelwood bundle in a tank of water and determining the volume of displaced water. Of course, if the fuelwood is dry then some water will be absorbed, unless the displaced water is measured immediately.

(ii) *Moisture content*

From surveys in Gambia and Tanzania, the average headload weighed about 26 kg whereas in Kenya it weighs 25 kg in Sri Lanka 20 kg. However, if weight is used two drawbacks must be noted.

[1]From Woodfuel Surveys , FAO 1983

First, the weight of wood depends upon the moisture content (m.c.). If wood is cut green and then collected, the moisture content could be 100 percent or more (dry basis measure), i.e. its weight is double the oven dray (bone dry) weight[1]. If the wood is first allowed to dry out and become "air" dry then the moisture content may be around 12 to 15 percent, depending on the relative humidity of the atmosphere, so the same piece of wood may weigh up to 75 percent more if it is freshly felled compared to air dry.

Therefore, *it is important to know the moisture content of the wood* if weight is the measure for assessing the solid round wood volume. In areas where wood is reasonably available then dead (air dry) wood is collected. However, in areas of scarcity, live branches are lopped. The collecting of green wood means that the collector is carrying "unwanted moisture"; second, if green wood is burnt, energy is required to evaporate this water and less energy will be available for cooking and heating.

The following table gives an idea of the volume of wood at different moisture contents for an average tropical fuelwood species per tonne weight, using a standard conversion factor of 1 t = 1.39 m^3 at 15% m.c.

Moisture content % (dry basis)	100	80	60	40	20	15	12	10	0
Volume (m^3) solid	0.80	0.89	1.00	1.14	1.33	1.39	1.43	1.45	1.60

Therefore, if the wood was assumed to be air dry (15 percent m.c.) when in fact it was green (100 percent m.c.) then the estimated solid volume of 1 tonne would be 1.39 m^3 and not 0.80 m^3, an error of 74 percent.

The above table could be reworked using 1 m^3 as the standard and the weights for different moisture contents would be as follows:

Moisture content % (dry basis)	100	80	60	40	20	15	12	10	0
Weight (tonnes) per (m^3)	1.25	1.12	1.00	0.88	0.75	0.72	0.70	0.69	0.625

Therefore, if weight is going to be the unit of measure then the approximate moisture content should be ascertained. There are moisture content meters which give immediate readings, but they may be difficultu to obtain. Another method is to collect samples of the wood in airtight containers and measure the moisture content in a laboratory.

(iii)*Density*

The second problem with using weight as a measure to determine solid volume is that the weight depends on density, and the density within and between wood species is not uniform. Juvenile wood in young trees is less dense than mature wood in old trees of the same species, and sapwood is less dense than heartwood. Similarly, non-conifers are usually denser than conifers. However, what is important to note is that if the moisture content is the same, *the energy given off from a piece of wood is more or less the same on a weight basis irrespective of species,*

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[1]Moisture content can be measured in two ways:

(a) on a dry basis, that is:

$$\frac{\text{Wet weight - dry weight}}{\text{dry weight}} \times 100$$

(b) on a wet basis, that is:

$$\frac{\text{Wet weight - dry weight}}{\text{wet weight}} \times 100$$

In this section all moisture contents have been given on a dry basis but in some countries fuelwood moisture content is given on a wet basis. The formula for changing from dry to wet basis is as follows:

$$\frac{D}{1 + D/100} = W$$

where D = moisture content as a percent of the dry weight basis

and W = moisture content as a percent of the wet weight basis

If the moisture content is 100 percent on the dry basis then the wet basis moisture content = 50 percent

Similarly a 15 percent dry basis moisture content = 13% (wet basis).

The reverse formula for changing from wet basis moisture content to dry basis moisture content is as follows:

$$\frac{W}{1 - W/100} = D$$

and this is an important factor when planning the needs of a household, community or industry.

One kilogram of wood at 15 percent moisture content when burnt will give off about 16.0 magajoules (16 x 10^6 J) (MJ/kg) that is 3,820 kilocalories (kcals) or 15,170 British thermal units (Btus).[1]

Wood with 40 percent m.c. has a heat value of 12.7 MJ/kg and that of a 100 percent m.c. 8.2 MJ/kg.[2]

One survey could conclude that the average per capita consumption of fuelwood in an area is 1.4 m^3 whereas in another area it is 2.4 m^3. If the principal species in the first case is *Acacia meansii* and in the second case *Pinus patula* then the two different volumes would yield approximately the same amount of heat, therefore it is important to record the species of firewood used in order to work out an approximate energy yield value. When planning fuelwood plantations the potential energy yield per unit area rather than volume is the important measure.

Some preferred fuelwood (and charcoal) species are very dense, and even for air dry logs 1 tonne may give a volume less than 1 m^3, whereas the average is about 1.4 m^3 per tonne (air dry) and for conifers it can be 2.0 m^3 per tonne.

2. CHARCOAL

2.1 Volume and weight

Charcoal is usually sold by volume - per standard bag or basket, per tin or per pile but sometimes directly by weight. If it is sold by weight and is dry (1-15 percent m.c. but on average about 5 percent) then the energy value of the charcoal will be about 33.0 MJ per kilogram (7,890 kcals/kg or 31,300 Btus/kg), or twice that of wood per kg.

Most frequently charcoal is sold by the standard bag, which can vary from area to area and country to country. A 50 kg "sugar bag" in many areas is considered standard and this has a volume of about 0.1 m^3. The weight of charcoal, like fuelwood, depends on the moisture content and the density of the parent wood. Unless the charcoal has been deliberately wet or stood out in the rain the moisture content will be about 5 percent, with little significant variation. Therefore the weight of charcoal will only depend on the density of the parent wood assuming it has been completely or near completely carbonized. Normal tropical hardwoods with a volume of approximately 1.4 m^3/tonne (15 percent m.c.) will weigh about 33 kg per bag whereas preferred charcoal species will give an average weight of 36 kg per bag. This is equivalent to a wood volume of about 1.3 m^3/tonne (15 percent m.c.).

If the charcoal is made from softwood then each bag will weigh on average about 23 kg equivalent to a wood volume of about 2.0 m^3/tonnes (15 percent m.c.). On the other hand mangrove *(Rhizophora)* charcoal will give a bag weight of 56 kg (wood volume equivalent 0.8 m^3/tonne of 15 percent m.c.). It can be seen that there is over 100 percent difference in weight between the two extremes quoted here and therefore *it is important to know the species from which the charcoal is made*, and as will be discussed later the method by which it is made. When undertaking a survey, a number of bags in each district/region should be weighed and if there are several sizes of bag (baskets) then they should be categorized (large, medium and small) and the average weight of each class of bag obtained by district.

Charcoal is also sold by the tin and the pile. The tin can vary in size, but if it is a 20-liter paraffin tin then it will contain about 7 kg of charcoal (tropical hardwoods) as mentioned above; if the sides have been forced in, the weight may be reduced to 4-5 kg. The tin and the bag are sold at prices which fluctuate according to season, inflation and statutory controls. On the other hand, the pile is usually sold at a fixed price and therefore the quantity in the pile varies from season to season and

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[1]This is the low heat value and is equivalent to the heat available when cooking food etc. It can be calculated as follows:

$$\frac{100x - 2.4\,(54 + m)}{00 + m} \text{ MJ/kg}$$

where x = (high) heat value of wood — 20.0 MJ/kg
and m = the moisture content. The factor of 2.4 MJ per kg of water is the amount of heat required to drive off 1 kg of water from the wood.

[2]The *low head values* of 111 tropical woods from Africa, Asia and South America were found to be on average 18.3 MJ/kg (oven dry state) with a coefficient of variation of less than 8%. The lowest value was 16.7 MJ/kg and the highest 20.3 MJ/kg. The corresponding values for temperate zone non-resinous hardwoods vary from 18.0 to 18.8 MJ/kg and between 19.2 and 20.1 MJ/kg for resinous softwoods (Bialy 1979). To obtain high heat values add 1.3 MJ/kg to the above values.

over time. Therefore, if the pile is being used as a measure then it should be weighed periodically to see if there are variations. At the same time as recording weight of charcoal, the price per bag, tin, pile should also be recorded.

2.2 Fines

When charcoal is manufactured there is always a certain amount of powdered charcoal or "fines". This may be as much as 30 percent of the volume. Some of these fines, maybe up to 5 percent of the volume, are always included in a bag of charcoal and the quantity of fines will increase more or less in proportion to the distance the charcoal is transported due to the vibration of the lorry, etc. If the charcoal is sold by the pile then it must be remembered that the pile does not contain fines and when converting back to bags from piles (and to a lesser extent tins) then only the solid volume in each bag should be considered. This may be 80-90 percent of the weight but it can be determined by actual weighing.

If briquetting of charcoal is undertaken then the output by weight of charcoal may be increased by as much as 50-100 percent because powdered charcoal weighs approximately three times that of unpowdered charcoal on a volume for volume basis. Therefore, the conversion factor will have to be adjusted accordingly.

2.3 Converting to roundwood equivalent

Once the weight of a charcoal bag or tin has been determined a consumption figure by individual end uses could be obtained in a similar fashion to that described for fuelwood. However, conversion factos are required to convert the weight of charcoal back to roundwood equivalent and three basic problems arise; wood density, moisture content of the raw material and the method of conversion.

The density of the wood governs the yield of charcoal and therefore as explained above a given volume of charcoal will give different weights of charcoal. For example, 1 m^3 of air dry (15 percent m.c.) wood will give the following weight of charcoal including fines for various species.

Average

Species	*Pines*	*Tropical hardwoods*	*Preferred tropical hardwood charcoal species*	*Rhizophora*
Weight of charcoal per m^3 (kg)	115	170	180	285

Moisture content also has an effect on the yield of charcoal; the drier the wood the greater the yield of charcoal. As a first approximation the yield of charcoal from silar wood at various moisture contents is as follows:

Wood moisture content %		12	15	20	40	60	80	100
Yield as a percentage	(a)	100	93	76	59	44	38	35
	(b)	108	100	82	63	47	41	38

Source: (Adapted from Earl, 1973)

Air dry wood at 12 percent moisture content will give approximately three times more charcoal than green wood (100 percent m.c.). Therefore, charcoal production could be increased by using suitably dried wood.

Lastly the method of production can affect the yield considerably and the range for average tropical hardwoods at 15 percent moisture content can be from about 4,5 m^3 per tonne produced in a metal retort where most of the fines are briquetted to 27 m^3 per tonne at a 100 percent moisture content in a poorly designed earth kiln with no sale of fines. It is therefore important to know the method of production, the species and their moisture content in order to arrive at a meaningful roundwood conversion factor. Most of the charcoal produced in developing countries is produced in earth kilns and the conversion factor can vary from about 10 m^3 per tonne of charcoal up to 27 m^3 per tonne depending on the moisture content, species and skill of the operator. Therefore, in order to determine the roundwood equivalent, the production method should be known - earth, portable steel kiln, brick kiln, a retort, etc. Then local conversion factors may be worked out from actual observation, knowing the species and their moisture content. However, the following conversion factors are given as a guide: Conversion factors per tonne of charcoal sold[1].(Average volume 1.4 m^3/t at 15% m.c.)[2]

	Unit m^3 n Moisture content								
Kiln type	15%	20%	40%	60%	80%	100%			
Earth kiln	10	13	16	21	24	27			
Portable steel kiln			6		7	9	13	15	16
Brick kiln	6	6	7	10	11	12			
Retort		4.5	4.5	5	7	8	9		

[1]It is assumed that the fines are briquetted in the retort.
[2]With softwoods about 60 percent, more volume is required per tonne of charcoal and with dense hardwoods such as mangrove about 30 percent less volume is required.

Annex III
Questionnaire

Area: ..... Date: .....
Homestead No: .....
Name of Homestead Head: .....
Name of Respondant: .....
Relationship to Homestead Head: .....

A. General Homestead Information
1. How many households (tindlu) are in the homestead? .....
2. How many kitchens (emadladla) are in the homestead? .....
3. For each household:
..... How many adult men are there? ....
..... How many adult women are there? ....
..... How many children are there? ....
..... How many people are away at work? ....
..... How many people are away at school? ....
..... Does the household own cattle? ....
..... Does the household own a car? ....
..... Does the household own a tractor? ....
..... How many panels of land are available? ....

B. Wood use
1. Is wood used for cooking ..... If so, what is the source?
..... own land
..... grazing land
..... other .....
2. Who collects firewood?
..... adult men
..... adult women
..... children
..... other
Note: Additional information was added here, including the usual number of collectors, an estimate of the time taken per trip and the number of trips per week
3. How is firewood collected?
..... carried by headloads
..... carried by sledge
..... collected by motor vehicle Type? .....
..... other .....
4. Is firewood collected from live trees or dead ones?
5. Is it harder to collect firewood, or to fetch water?
..... firewood ..... water
6. How many fires are made per day?
For what purposes?
..... cooking
..... washing
..... other .....
Are fires indoors? ..... In a stove? .....
7. Do you use other fuels besides wood? About how often?
..... paraffin .....
..... handigas .....
..... electricity .....
..... candles .....
..... maize stalks or dung .....
..... other .....
8. Do you use wood for building or fenceposts? .....
If so, where does it come from?
..... own land
..... grazing land
..... other .....
9. What kinds of trees do you prefer for firewood?
.....
What kinds of trees do you prefer for building poles?
.....

C. Tree Planting
1. Has anyone ever planted trees on this homestead? ...
If so, what kind? About how many?
..... wattle .....
..... gums .....
..... hedge .....
..... fruit trees .....
..... other .....
If you haven't planted trees, why not?
..... don't know how to plant trees .....
..... don't know where to get trees .....
..... not enough land .....
..... not enough time (labor) .....
.....
other reasons .....
.....

Fuelwood Case Study Zambia and Botswana

Biomass assessment with particular reference to recent work done in Zambia and Botswana by the World Bank Urban Household Energy Projects.

Keith Openshaw

SUMMARY

An assessment of biomass availability in areas of Botswana and Zambia most under threat from woodfuel demand was undertaken in 1988/1989. Some ground measurements were made in Zambia to augment previous data but only existing information was used in Botswana. While information on the area of biomass types is adequate there are serious gaps in the assessment of biomass growing stocks and yield. More ground truthing is required and permanent sample plots have to be expanded or established to monitor growth in woodland and forest areas.

INTRODUCTION

In Botswana and Zambia, as part of the World Bank Urban Household Energy Projects, assessments were made of biomass availability particularly that for the urban supply areas. In Zambia a literature search was followed by field work including aerial photography analysis and ground truthing, whereas in Botswana only a literature search was undertaken to assess the reliability of data and to make recommendations on further work. This paper will describe the work in both countries and make suggestions for improving data gathering[1].

ZAMBIA BIOMASS SURVEY

Background

The total area of Zambia is about 753,000 km² (75.3 million ha.) most of which is high plateau ranging in altitude from 1000 to 1500 meters above sea level. The bulk of the country is classified as woodlands (Table 1), about 592.200 km2, much of it still relatively undisturbed although the woodlands are being cleared continually either by shifting cultivators or for permanent cultivators or for permanent agriculture.

Table 1
Extent of Eight Major Vegetation Types in Zambia

Vegetation Type	Extent (Mha)	Percent of Total Area
Forest	2.4	3.2
Miombo woodland	35.3	46.9
Munga woodland	3.8	5.0
Chipya woodland	2.4	3.2
Mopane woodland	4.4	5.8
Mkusi woodland	1.0	1.3
Kalahari sand woodland	10.0	13.3
Grassland	15.0	19.9
Lakes	1.0	1.4
Total	75.3	100.0

Note: The shifting cultivation areas of 5.2 million hectares are scattered throughout the various woodland and grassland types. There are also about 0.1 million ha. of waterways and semi-permanent lakes, plus 60,000 ha of urban areas and roads in the above vegetation types.

Source: Chidumayo (1986).

Miombo woodland is the dominant vegetation type not only in Zambia but throughout Southern and Eastern Africa. Its productivity is strongly correlated to rainfall and in Zambia four classes of miombo have been described with rainfall ranging from about 600 mm per annum to 1400 mm/a. (Chidumayo, 1987). In undistributed miombo woodlands, the estimated standing stock of above ground woody biomass averages from about 97 m³/ha (54 t/ha bone dry) in the driest class to 180 m³/ha (99 t/ha bone dry) in the wettest class.

An extensive woody biomass area survey was recently undertaken by the ETC Foundation on behalf of the Southern Africa Development Coordination Committee (SADCC) Energy Co-ordination Unit (ETC Foundation 1987) which used satellite imagery to deliniate nine vegetation types - eight woodlands and onw swampland.

[1]In Zambia the work was undertaken by Dr. E. Chidumayo of Zambia University: (Chidumayo 1989), and in Botswana by P. Eskely formerly of the Botswana Forestry Association: (Eskeli, 1989)

The above ground woody biomass growing stock was assessed using published data from various sources but no ground truthing was undertaken. This study estimated that the growing stock was in the region of 2950 million air dry tonnes, equivalent to 3540 million m3 (47.200 PJ) with an annual increment of approximately 83.5 million t of wood - 100 million m^3 (1300 PJ). Because no ground truthing was undertaken, the above figures must be taken as orders of magnitude rather than precise numbers. Bearing this in mind, the annual increment is over six times the estimated of 1986 woody biomass consumption 192 PJ (WB 1988) so at present the overall picture is that Zambia has sufficient woody biomass resources to meet demand on a sustained basis.

Zambia has a mid 1989 population of about 7.7 million of which 4.6 million live in rural areas (60%) and 3.1 million live in urban areas (40%); compared with other SADCC countries Zambia is highly urbanized. The principal urban household fuel is charcoal accounting for about 57% of energy demand. The next most important fuel is firewood - 28% of demand - and even crop residues supply 3% of demand so biomass accounts for about 88% (24.67 Peta Joules) of urban household energy, or in terms of roundwood equivalent, taking into consideration charcoal conversion losses, 3 million air dry tonnes. Thus while the annual increment from woodlands could more than meet the demand if population was scattered evenly throughout the country, the concentrated urban population bring pressure on woodland resources in the vicinity of towns and may be causing overcutting in these woodlands hence the reason for focussing on urban biomass supply areas.

URBAN CATCHMENT AREAS

The 1988 World Bank demand survey showed that small towns in Zambia were mainly using fuelwood indicating that at present supply is not a problem. However, Lusaka and the Copperbelt towns of Ndola and Kitwe were large charcoal consumers therefore it was decided to look at the state of the woodlands in these areas. Aerial photographs were obtained for the Copperbelt, Kabwe, Lusaka and Mambwa and they were analyzed by land use and topography.

Aerial photographs were not available for Kafue catchment area. Kafue has a total area of about 14.700 km^2 of which 5 900 km^2 is flood plain (grassland), 5 900 km^2 Munga/Mopane woodland and 2 900 km^2 Miombo woodland. Only the latter is currently used for charcoal production and two areas are being exploited to supply Lusaka (Fig. 1).

Table 2 gives the land classification for the biomass catchment areas (BCA). The copperbelt is supplied from the Copperbelt and the north of Kabwe BCAs and Lusaka is served by Lusaka, Kabwe and Mumbwa BCA's (Fig. 1).

Half the land area in the Lusaka/Copperbelt urban catchment area is classified as unused woodland, although only about one quarter of this land - 14% of the total land area - is actual forest reserve and this mainly serves the Copperbelt. It is unused woodland that will supply the bulk of the woodfuel to urban area, although in time if the cleared woodland and degraded woodlands are allowed to remain as forest areas they will regenerate naturally and could supply some urban woodfuel.

However, if past trends continue, the woodlands will be looked on as a source of agricultural land both permanent and temporary. Most of the cultived area shown in table 2 was claimed from the woodlands as opposed to the grasslands as the following table 3 shows. Table 3 gives a breakdown of the natural vegetation clearance in the biomass catchment areas.

Only twelve percent of woodland clearing can be directly attributed to woodfuel production. What is more, most of this land will regenerate and once again become productive woodland. Nearly half of the cleared land (44%) was cleared for permanent agriculture and another 38% for shifting cultivation so that *the major cause of natural vegetation destruction in the urban biomass catchment areas is conversion to cropland* either permanently or on a rotation system. Together these land use changes account for over eighty percent of woodland clearance.

Before an assessment can be made of biomass availability in the urban biomass catchment areas, the land topography has to be considered. Thus the land was divided into three types namely grassland/swamps; plateaux/interfluves; and escarpment/hills. Obviously there are no trees in the first category and clearfelling trees on escarpments or hills can be detremental to the soil stability. Therefore from the point of charcoal production clearfelling on plateaux or interfluves is preferable. Table 4 gives the relative importance of the different catchment areas.

Excluding the grasslands, Lusaka has over one third of the area classified as escarpment or hills, this means that there are physical and ecological constrants to cutting wood in at least one third and up to two thirds

TABLE 2

Land Classification for the Biomass Catchment Areas[a] (Units in km²)

Catchment area	Total Area	Urban	Cultivated	grass land	Forest plantation	Woodland cleared for wdfuel	Woodland degraded[b]	unused	of which forest reserve[c]
Copperbelt	27785	309	2763	3802	635	1633	2486	16157	7539
%		1	10	14	2	6	9	58	27
Kabwe	15059	127	2510	3084	3	117	1256	7962	863
%		1	17	20	0	1	8	53	6
Mambwa	13589	0	1280	6492	0	39	834	4944	238
%		0	10	48	0	0	6	36	2
Lusaka	11936	58	2155	1063	4	573	2671	5412	451
%		1	18	9	0	5	22	45	4
Total	68369	494	8708	14441	642	2362	7247	34475	9081
%		1	13	21	1	3	11	50	

[a]As analysed from the aerial photographs.
[b]Degraded woodlands have a severely reduced woodland cover which on aerial photographs resembles parkland. This degradation has been brought about by selective falling for shifting cultivation and/or charcoal production. Although woody biomass is available in degraded woodlands it is too scattered to be exploited commercially and is principally available for rural demand.
[c]Excluding forest plantations.

TABLE 3

Natural Vegetation Clearance in the Biomass Catchment Areas[a]

(Units in km²)

Catchment Area	Cleared and degraded Woodlands[b]	Cause of Woodland Clearing: Urbanization[c]	Cultivat. GrassInd	from Wdlnd	Shifting Cultivtion[d]	Plantat. Forestry	Woodfuel Clearingtion[e]
Copperbelt	7752	309	(74)	2689	2486	635	1633
%		4	-	35	32	8	21
Kabwe	3921	127	(92)	2418	1256	3	117
%		3	-	62	32	0	3
Mumbwa	2114	0	(39)	1241	834	0	39
%		0	-	59	39	0	2
Lusaka	5461	58	(0)	2155	2671	4	573
%		1	-	39	49	0	11
TOTAL	19248	494	(205)	8503	7247	642	2362
%		3	-	44	38	3	12

[a]As analyzed from aerial photographs.
[b]Excluding cultivated land acquired from grassland.
[c]Includes land cleared for mining and industrial development.
[d]This also includes some land that will revert to permanent woodlands.
[e]Some of this land may be converted to arable agricultural land.

of the unused woodlands. The other three catchment areas have relatively little escarpments or hills and so it would be safe to clearfell the woodlands in these areas.

BIOMASS ASSESSMENT

Growing Stock

In order to estimate standing stock and annual increment, representative sample sites were chosen in miombo woodlands of the biomass catchment areas (Figure 1). Sixteen sample plots of 20m x 10m were randomly chosen, one from each site, half of which were mature woodlands and the other coppice regrowth of known age ranging from 6 to 22 years. Half the plots were in the wet miombo areas (copperbelt) and half in dry miombo areas (around Lusaka). All woody stems in each plot over 1.0m tall were identified, enumerated and girthed at stump height (0.3) and breast height

TABLE 4

Relative Importance of Land Forms in the Biomass Catchment Areas

Catchment Area	Total Area	Percentage of area by land form		
		Grassland Swamp*	Plateau/ Interfluve	Escarpment/ Hill
Copperbelt	27785	15	85	0
Kabwe	15059	21	77	2
Mumbwa	13589	47	53	0
Lusaka	11936	6	62	32
TOTAL	68369	21	73	6

*These are semi permanent or permanent water logged areas.

(1.3m). In practice before areas are felled for charcoal production timber trees and pole wood are removed, about 5% of the growing stock. About half the trees in the sample plots were felled, divided into cord wood (woodfuel), twigs and leaves and each part was measured, weighed and assessed for moisture content. Table 5 gives the total number of trees in the four 0.02 ha plots in the Copperbelt and Lusaka Areas.

TABLE 5

Total Number of Trees per Four Plots and Number Felled and Measured

Area	Stand Type ha	Total Area	No. of trees	Number of felled trees
Copperbelt	Coppice	0.08	335	155
Copperbelt	Mature	0.08	94	66
Lusaka	Coppice	0.08	537	222
Lusaka/Mumbwa	Mature	0.08	132	78

A regression model of diameter/girth against volume was constructed to estimate cord wood, twig wood and leafy material, and this was compared to a semi-logarithmic regression model against of diameter/girth against volume and a model based on diameter at breast height classes (DBH). These models were tried out on measurement made by the Natural Resources Department in 1986 in four, 0.33 ha plots. The results showed that the DBH and the regression-model were in close agreement where as the semi-log method gave a consistently high reading. Therefore the DBH class method was chosen and the following information was calculated from the eight mature plots in the two areas - Table 6. It should be pointed out that the height of trees can vary considerably in the same diameter class. Therefore these volume estimates are reliable for specific "local" areas. For the country as a whole it would be better to construct "volume tables" based on at least two variables namely diameter/girth and height.

The results in table 6 are based on only a small number of plots and trees (94 and 132 for the two areas) and are therefore subject to errors associated with small sample sizes. During 1982-86 the Department of Natural Resources enumerated stems at 24 sites in the Lusaka area and 7 sites in the Copperbelt area with the areas of the sample plots ranging from 0.16 ha. to 0.60 ha. All stems over 1.0m tall were girthed at stump height and at breast height. These data were pooled with the data from the present survey to give a mean cord wood weight of 72 (for -5) bone dry tonnes per ha. for the Lusaka area and 130 (for -23) bone dry tonnes per ha. for the Copperbel area. The above figures are considerably lower than those given in Table 6 namely 109 t/ha. and 221 t/ha. respectively. They are also substantially different to those used in the ETC/SADCC Study (ETC 1987) of 9 t/ha. and 81 t/ha. respectively; but at least for the Lusaka area within the ranged assessed by Chidumayo in 1987 of 60-75 t/ha. (Chidamayo) although his assessment for the Copperbelt of 75-105 t/ha. is again lower than the 130 t/ha. Therefore there is still much work to be done to obtain more accurate and reliable standing stock data. Permanent sample plots need to be set up and more measurements on production by rainfall, soil type and woodland type have to be undertaken. Nevertheless the figures of standing cordwood of 72 t/ha. and 130 t/ha. have been used to obtain an estimate of growing stock.

TABLE 6

Biomass Weight at Mature Woodland Sample Plots in the Copperbelt and Lusaka Areas Units: tonnes (bonedry) per hectare

Catchment Area	Cord wood[a,b]	Twig wood	Leaves	Total (%)
Copperbelt	221.48 (93)	12.12 (5)	4.75 (2)	238.35 (100)
Lusaka/Mumbwa	108.55 (90)	8.94 (7)	3.20 (3)	120.69 (100)

[a]Note mean top diameter of cordwood on the Copperbelt was 2.38 cms and that in Lusaka was 1.33 cms. Thus the above results are not strictly comparable.
[b]Including timber trees and pole wood.

BIOMASS ASSESSMENT
Annual Increment

The eight coppice regrowth plots were used to assess mean annual increment. These are even aged stands thus mean annual increment can be determined by dividing the weight or volume per hectare by the age of the stand. As for the mature stands, all trees were identified, and girthed; a percentage were cut down, divided into cordwood, twigs and leaves and weighed. The results from the Copperbelt and the Lusaka areas are as follows (Table 7).

The above figures only measure standing biomass, no records are available of removals (if any) over the lifetime of the coppice stand and therefore they are probably minimum figures. However, they are much higher than previously recorded in many journals for wet and dry miambo woodlands. FAO gives an estimated annual yield of 1 m^3/ha. (approximately 0.5 tbd) (FAO 1983). Clearly the above figures can only be taken as tentative because a small number of trees were measured from only eight sites (Table 5). However, the annual yield represents about 3% of growing stock which is not an unreasonable figure. Clearly more work is needed to disprove or verify these figures and permanent sample plots are urgently required.

TABLE 7
Mean Annual Increment from the Copperbelt and Lusaka Sample Plots

Catchment Area	Age/Yrs	Mean Annual Increment			Units bone dry Tonnes/ha.
		Cordwood	Twigs	Total Wood	Leaf biomass*
Copperbelt	13.75	3.79	0.46	4.25	4.12
Lusaka	15.25	2.15	0.53	2.68	4.68

*Leaf biomass is an accumulation of not more than two years growth. Therefore annual production will range from half the above figure to the full amount of the above figure.

BIOMASS ASSESSMENT
Growing Stock and Yield Assessment on Catchment Areas

The above figures can be applied to the unused woodland areas assuming that only wood from these areas will be available to meet the demands of the large urban centers of Lusaka, Kitwe and Ndola. Table 8 gives an estimate of the growing stock and annual increment (yield) for the various catchment areas serving the above towns.

At present the demand for fuelwood and charcoal in the urban areas of the Copperbelt is less than 0.5 million tonnes of cordwood equivalent. Therefore, it appears from the above table that there is sufficient growing stock in the Copperbelt region to give a sustained supply of woodfuel and other wood products for many years to come even from the gazetted forest area, provided that these areas are maintained and managed. Of course the areas nearest the demand centers tend to be exploited first for charcoal production and it is also these areas that are the source of firewood for the poorer sections of the urban communities. It is socially and economically desirable to maintain these firewood sources because burning wood directly is more energy efficient and they are accessible to foot or bicycle transport.

The current household demand for charcoal in Lusaka is approximately 233,000 t and that for fuelwood 87,000 t equivalent to a household demand of over 1 million tonnes of cordwood. The gazetted forests that presently supply Lusaka from Kabwe, Mumbwa, Lusaka and Kafue biomass catchment areas give a sustained supply of approximately 350,000 t of cordwood. Clearly this is insufficient to meet demand. However there is sufficient wood from the accessible woodlands in these catchment areas, - about 3.2 million t of cordwood - to meet present and future demand provided that most of these areas are kept under tree cover and managed properly. Undoubtedly there will be a change of land use on some of the woodland areas, including gazetted areas. It is important that these areas be chosen with care, for in the past some areas were unable to support arable agriculture on a sustained basis. Also it is important to ensure that the wood on these areas is used productively rather than burnt in situ. It cannot be over-emphasized that these woodland resources are a substantial asset for the country; they supply the bulk of household energy, they create employment, particularly rural employment, they save considerable foreign exchange and if properly managed the resource is renewable.

AGRICULTURAL RESIDUES AND DUNG

The demand survey found that some urban households particularly those in the sugar growing areas were using agricultural residues, an estimated 67,000 t in 1988 (1.0 PJ). Therefore an estimate of crop residues and dung production was undertaken based on the 1987

TABLE 8

Standing Stock and Annual Increment of Unused Woodland by Total Area, Accessible Area and Gazetted Area (Units in million tonnes)

Catchment Areas	Total Areas				Accessible Area			Gazetted Area		
	Area (km²)	Growing Stock	Annual Increm.		Area (km2)	Growing Stock	Annual Increm.	Area (km²)	Growing Stock	Annual Increm.
Copperbelt a/	16157	210.0	6.1		16157	210	6.1	7079	92.0	2.70
Kabwe	7962	57.4	1.8		7616	55	1.7	863	6.2	0.20
Mumbwa	4944	35.6	1.1		4906	35	1.1	238	1.7	0.05
Lusaka	5412	39.0	1.2	L	1692	12	0.4	447	3.2	0.10
				H	3552	26	0.8			
Total	34475	342.0	10.2	L	30371	312	9.3	8627	103.1	3.05
				H	32231	326	9.7			
Charcoal equiv. million/t			2.5				2.3 - 2.4			0.08

L = low estimate for Lusaka; } Taking into consideration non cutting
H = high estimate; } on escarpments (table 4)

*Coordwood standing stock, cordwood 130 t/ha;annual increment (MAI) 3.8 t/ha. All other areas cordwood standing stock 72t/ha; MAI 2.2 t/ha.

published crop production figures and animal numbers using standard conversion factors. About 1.6 million t. of crop residues, including 0.1 million tonnes of sugar cane waste and 1.1 million tonnes of animal dung were produced in 1987. While these figures represent a potential source of biomass energy, with the large reserve of woody biomass it is unlikely that they will be used unless they are easy to obtain as is bagasse (sugar cane waste) from the sugar factories.

BOTSWANA BIOMASS SURVEY

Background. The total area of Botswana is about 580,000 km² (58.0 million ha.). The average annual rainfall varies from 250mm in the South to 650mm in the North and two thirds of the country is classified as semi-arid. The estimated mid-1989 population is 1.3 million of which about 1.0 million live in Eastern Botswana whose area is 144,000 km². 62% of the Eastern Botswana is classified as woodlands, but over half of this is low density woodlands. 37% is bare or covered with sparse vegetation and 1% urbarn, lakes, mines and irrigated farms. The urban population, including large villages is approaching 0.5 million of which about 0.4 million live in Eastern Botswana. It is this population concentration in Eastern Botswana, especially the relatively high urban population that could be affecting the woodland resources. This is because fuelwood is the principal urban household fuel accounting for over half the energy demand. Therefore information on woody biomass supply was gathered for Botswana with particular reference to the eastern part of the country.

BIOMASS SUPPLY

Two main studies were examined to gather data on the growing stock and yield of woody biomass. These were:

(a) A Study of Energy Utilization and Requirements in the Rural Sector of Botswana (ERL 1985); and

(b) Wood Energy Development: Biomass Assessment, a study of the SADCC region (ETC 1987).

Both studies used satellite imagery but whereas ERL just used one set "Landsat" of data taken in the month of August, ETC used all year round data but it used imagery from a weather satellite with a resolution of only 8 kms. Therefore the latter should have a better definition of the different ground cover types and the former a more precise area assessment. However, no ground truthing was done in the ETC study and the biomass assessment was made using information from various sources. The ETC study covered was a regional one that included Botswana where as the ERL study only covered Eastern Botswana (Fig. 2). This study did do some ground truthing but only felled and measured 56 trees and used the pooled information to determine standing stock and yield for the whole of Eastern Botswana. Clearly this small number of trees is insufficient to give any accurate data, but for what it is worth ERL, gave the following figures for growing stock and annual yield for different woodland types in Eastern Botswana -Table 9.

For each of the 9 areas given in Figure 2, ERL made an estimate of growing stock, annual yield and demand. Table 19 summarizes these results.

TABLE 9

Estimates of Growing Stock and Annual Yield for Major Woodland Density Classes - Eastern Botswana[a]

Density Class	Growing Stock bone dry tonnes/ha	Annual Yield bone dry tonnes/ha
Higher density woodland	48.0 + 10.6	2.1
Mid density woodland	25.9 + 12.7	1.4
Low density woodland	18.9 + 6.6	1.0
Sparse vegetation	2.6 + 4.3	0.3

[a]The growing stock estimate for each density class can vary by up to 50%
Source: ERL 1985.

Bearing in mind the reliability of the ground measurements, the above table gives orders of magnitude rather than accurate supply data. Regions 1 to 4 and 9 have sufficient annual yield to meet current and future demand although there may be local shortages. It is in regions 4 to 8 - South Eastern Botswana -where there could be sustainable supply problems. Further detailed work is needed especially in this area. Sample plots should be established to measure growing stocks and annual yield.

Also pilot schemes should be set up to look at the regeneration and management of the woodland areas.

TABLE 10

Eastern Botswana, 1989 Estimate of Woody Biomass and Demand

Area	Growing Stock Units million tonnes bone dry	Annual Yield[a]	Demand
1	47.80	2.91	0.10
2	28.70	1.57	0.02
3	68.90	1.36	0.11
4	53.10	0.96	0.05
5	15.30	0.13	0.09
6	16.40	0.14	0.07
7	4.30	0.03	0.04
8	2.10	0.02	0.01
9	8.70	0.22	0.08

[a]Fuelwood species only

DISCUSSION

The biomass assessments undertaken in Botswana and Zambia indicate that the techniques for area determination using satellite imagery and aerial photograph are of sufficient detail to give accurate information on woodland and forest types, provided the people doing the interpretation know the forest types in the particular areas or countries. However what is lacking not only in these two countries but in most if not all African countries is sufficient ground surveys to give reliable information on woody biomass growing stock and yield. There is an urgent need to do considerably more ground measurements in the various forest types to determine growing stock and annual yield. Such measurements by species should include diameter/girth at stump and breast height total height of trees, crown diameter, crown depth timberwood, pole wood, fuelwood, twigs, leaves, proportion of stem wood and branch wood etc. Also permanent sample plots should be established or expanded to make periodic measurement of growth and removals. One thing that is not important in Botswana and Zambia, but could be important in other countries is trees outside the forest, particularly those on farm land. Measurement of woody biomass stock and yield need to be made in these areas, if they are a source of supply. Besides measuring stock and yield, there should be species determination, for some trees are unsuitable or undesirable for particular end uses. Also access and environmental considerations should be taken into account. One tentative conclusion from the field measurements undertaken in Zambia is that the unit area growing stock and yield is greater than conventionally assumed. Thus it is even more important to do more ground measurements within vegetation types, even across national boundaries to verify or disprove this conclusion for it could have a significant impact on sustained management plans. It could also indicate that proper woodland and forest management may be the cheapest way to ensure a sustainable supply of woody biomass.

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Standard adopted for Zambia and Botswana

	Zambia	Botswana
Crop residues		
(15% mc = 10% ash)	13.7 MJ/kg	13.7 MJ/kg
Wood (15% mc 11% ash)	16.0 MJ/kg (5-10%)	17.0 MJ/kg
Charcoal (5% mc 2% ash)	30.0 MJ/kg (5% mc)	30.0 MJ/kg
Coal (18% ash)	25.0 MJ/kg (20% ash)	24.0 MJ/kg
Paraffin (kerosene)	43.3 MJ/kg	43.1 MJ/kg
	(34.5 MJ/litre)	(34.1 Mj/liter)
L.P.G.	-	45.2 MJ/kg
Electricity	3.6 MJ/KWH	3.6 MJ/KWH
Tonne of oil equivalent	41.9 GJ	
Candles		45.0 MJ/kg
Solar water heater (180 litres per day heated 60°)		16.5 G Jenergy per year
(elec. equiv)		

1 mega joule = 10^6 joules

1 *giga joule* = 10^9 *joules*

4.184 joules = 1 calorie

KWH = kilowatt hour - 1000 watts per hour

Statistics on fuelwood case studies

Fuelwood in energy consumption and Biomass assessment with particular reference to recent work done in Zambia and Botswana by the World Bank Urban Household Energy Projects

Keith Openshaw

The presentation includes notes on consumption surveys in Botswana and Zambia and a description of the biomas assessment in those countries.

CONSUMPTION SURVEYS: CASE STUDIES, BOTSWANA AND ZAMBIA

A. *Purpose of the projects*

1. To obtain baseline data on energy consumption
2. To train nationals in survey techniques, data collection analysis
3. To start a series of surveys on consumption, prices, supply systems, etc.
4. To use the data as a check on supply
5. To use the data for energy planning, forecasting, formulating projects, etc.

B. *What kind of data was collected*

1. Surveys concentrated on urban household energy consumption because it was thought that these areas were putting greatest pressure on woody biomas resources;
2. Collected data on all types of energy consumption in households namely: a) crop residues, b) fuelwood, c) charcoal, d) coal e) paraffin (kerosene) f) L.P.G., g) electricity from 1) grid 2) own generator 3) solar h) solar water heaters i) batteries (dry or wet) j) candles.
3. Looked at non-household consumption where it affected household consumption such as a) food shops, canteens, restaurants b) bakeries c) grain mills;
4. Looked at the link in the supply/demand chain and survey sellers/traders of fuels especially biomass
5. Desired demand or actual demand.

C. *What kind of variables were considered*

1. Income (social) - High, <Medium - Low (Kitchen practice) mining, non-mining.
2. Seasonal - winter, summer, rains, non-rains.
3. Availability of energy - Physical, logistical, foreign exchange
4. End use - cooking, heating, warming water, lighting, ironing, beer/brewing, etc.
5. Sustitution - price and availability

D. *Logistics of the survey*

1. Time period - short period to obtain one seasons figures
2. Type of surveys; sport, revisit, continual assessment
3. Sampling methodology: money, personnel (enumerators, supervisors) training, sample framework, sample size, equipment

E. *Conversion factors*

1. Biomass - moisture content, ash content, unit of measure (wet and dry basis)
2. Converted biomass - conversion efficiency, degree of conversion; (carbon content) unit of measure (bag. size/tin/pile)
3. Non renewable fuels - coal, petroleum products, electricity (partially renewable)

Botswana results see following takes

Mean Annual Urban Household Energy Demand (1989) - Botswana

Estimated Consumption of Energy (Units = TOE)

Urban Household Energy Demand	Cooking	Water Heating	Cooking Ironging	Space Heating	Space Cooling	Lighting	Fridge	Kitchen Appliance	Beer Brewing	Total Demand per Annum	% Total
Firewood	82,490	(INCL	COOK)	2,823	-	-	-	-	1,753	87,066	78.5
Coal	447	-	51	319	-	-	-	-	-	817	0.7
Paraffin	1,886	-	-	122	-	3,374	518	-	-	5,900	5.3
L.P.G.	6,140	247	833	71	-	198	1,254	-	-	8,743	7.9
Electricity	857	842	-	106	723	1,735	1,444	757	-	6,464	5.8
Sub-Total:	91,820	1,089	884	3,441	723	5,307	3,216	757	1,753	108,990	98.3
Candles (1) (2) (3)	-	-	-	-	-	478	-	-	-	478	0.4
Solar Heat (1) (4)	-	1,455	-	-	-	-	-	-	-	1,455	1.3
Total	91,820	2,544	884	3,441	723	5,785	3,216	757	1,753	110,923	100.0

Notes:
(1) Electrical equivalent
(2) 5% of electricity consumption
(3) Actual TOE = 673 tons
(4) 17% of electricity consumption

Mean Annual (1989) Survey Urban Household Firewood Demand - Botswana (TOE)

Urban H/H Firewood Demand	Cooking	Lighting	S/Heating	W/Heating	Ironing	Refrigerators	Total Beer H/H Usage	BREWING BOJ	KHA
% of Firewood Using H/H	90.3	-	6.8	91	76	-	53%	4.65	0.7
Ave H/H Daily Use (kg)	0.005	-	0.002	(incl)	(incl)	-	0.005	0.002	0.009
Total Winter Demand (mt)	82,490	-	2,823	-	-	-	85,280	1,753.45	
Total including Beer Brewing							87,033		

Note: TOE = Tons of Oil equivalent

Fuelwood case study
SWAZILAND

James Allen

The Government of Swaziland seeks to assure a sufficient supply of fuelwood for rural families on a sustained basis. Yet according to a variety of sources, Swaziland is already experiencing a scarcity of fuelwood. During 1985 and 1986, I carried out a study designed to evaluate two potential approaches for increasing fuelwood production in the rural areas of Swaziland. The two options considered were farm forestry (i.e. planting trees on individual family farms) and community forestry (i.e. tree planting on communal grazing areas).

This study was conducted as part of a Master's degree programme, and was quite limited in funding and time available for field work. Therefore, instead of conducting this research on a national scale, two smaller areas, which represent regions of the country most likely to be experiencing fuelwood shortages, were chosen as study sites. In these two areas, which were both roughtly 130 km^2 in size, information was obtained on existing forest resources, tree planting practices, and patterns of fuelwood consumption.

This presentation will primarily cover the design, field execution, and results of the fuelwood consumption survey, which involved a total of 95 farms. I will also discuss in less detail the inventory of existing forest resources in the two areas, including the tree planting survey.

Forestry sector production statistics

Philip Wardle

INTRODUCTION

When we refer to production we are concerned with the transformation of a raw material into a product; that is the change from raw material into processed product. In the forest products industry there are many stages of production and each stage generates products - or intermediate products. The first stage of production, harvesting in the forest, produces logs. These are delivered to the sawmill where they are manufactured into sawnwood. Sawnwood delivered to the furniture factory is manufactured into furniture. Logs and sawnwood may be described as intermediate products, while furniture is the final product. In forest products statistics we are dealing with the direct products of the forest - logs and sawnwood. Statistics of production are the statistics on the quantity of these products produced.

DEFINITION OF PRODUCTION

The production volume is the volume of the product delivered by the producer to the user or to the location for sale. This includes the volume delivered to stock for later sale or use.

ROUNDWOOD PRODUCTION

Roundwood production is the process of harvesting or cutting of tree and cutting it into specific roundwood dimensions for delivery to place of utilization or further sale which may be the household, enterprise or market, for use as fuelwood, wood for charcoal for processing into sawnwood veneer or chips or other uses or for use unprocessed. This is the volume despatched from the forest or received for use or onward sale (stocks and stock change). Specified products include fuelwood, industrial roundwood including logs, pulpwood, other industrial roundwood -pitprops, poles, posts.

CHARCOAL PRODUCTION

The volume (weight) of charcoal produced for delivery includes commercial production of charcoal for sale, household production and production for own use by industry and production by industry from wood residues.

SAWNWOOD PRODUCTION

This is the volume of sawnwood produced by sawmills, portable saw mills, pit sawyers for delivery to users of for further sale. Users may be integrated mills, households, or other users.

VENEER (MARKET VENEER)

The volume of veneer produced by veneer mills for delivery to users other than veneer produced for integrated production of plywood (international statistics exclude veneer utilised within the country for plywood manufacture, whether in the same enterprise or sold as market veneer to another plywood enterprise).

PLYWOOD, PARTICLEBOARD, FIBREBOARD

Volume produced for delivery to users or further sale including volume for delivery to integrated further processing or manufacturing plants.

WOODPULP

Volume (weight) of pulp produced for delivery to users or further sale. The volume of pulp for utilization in an integrated paper or cellulose operation is included. The pulp produced for sale to other manufacturing units or the export is known as market pulp and is included.

PAPER

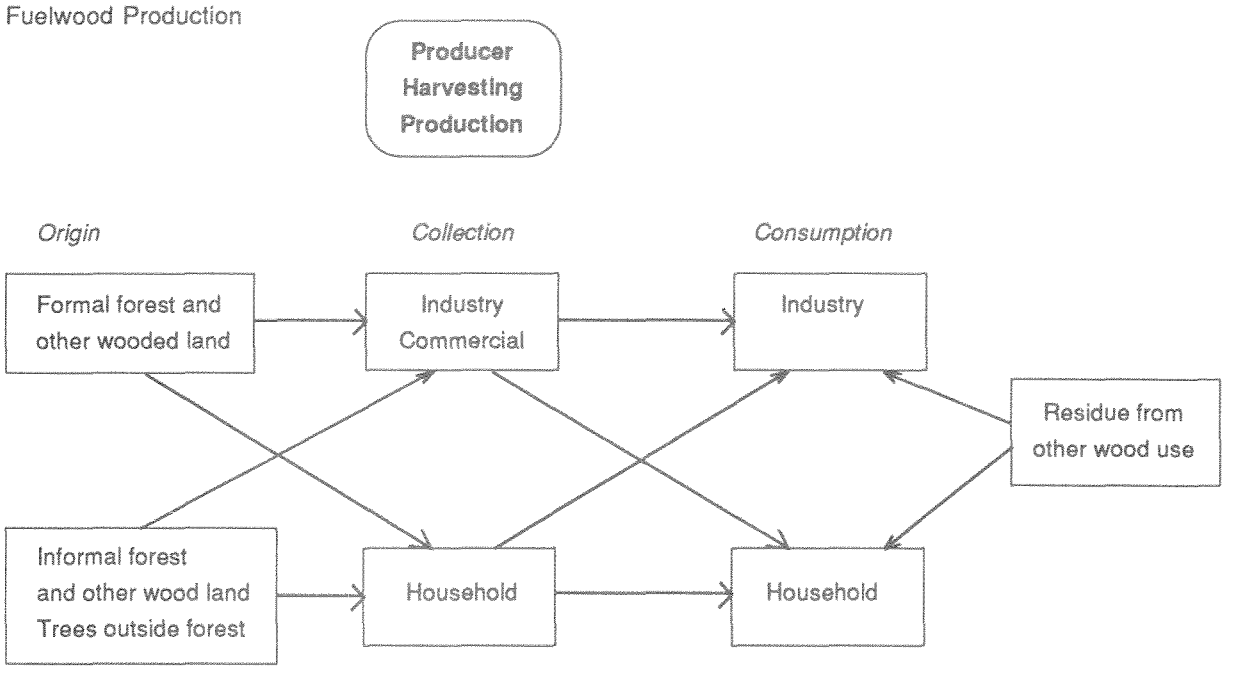
The volume of paper produced in the form of roles or sheets for delivery to users or further sale. The volume produced for delivery to integrated converting, coating or further processing plant is included.

PROBLEMS

Delivery to stock and shipment form stock. Risk of distortion due to difference P and S. Double counting primary product and final product.

Veneer	-	plywood
Sawnwood	-	wood manufacturing as moulding furniture
Paper	-	paper manufacture

Figure 1
Fuelwood Production



CONSIDERATION OF PARTICULAR PRODUCTS

Fuelwood

Figure 1 illustrates the problems of recording and measurement of fuelwood production at point of harvesting through harvesting agent to point of consumption. All origins and all destinations are possible. Many of them may have no formal recording arrangements.

DEFINITION

Fuelwood

A narrow definition: fuelwood is roundwood (wood in the rough) from mainstem or branches to be used as energy source for cooking, heating, power production, kilns, drying or smoking installations for charcoal production. Delivered by producer to user or to market for later delivery to use as fuel. The term firewood is often used for fuelwood.

A broader definition: fuelwood as above but including wood and tree biomass other than main stem and branches used for energy source - including woody biomas from tops, small branches, twigs, stumps, roots as well as bark and leaves.

In practice in international statistics frequently based on consumption surveys, the volume of fuelwood includes roundwood from main stem and branches for use as energy source plus other tree biomass harvested from forest, other wooded land or trees outside the forest for use as energy source.

Wood as energy source

Wood as an energy source may also include processing residues, sawmill offcuts, edgings, peeler cores, sawdust shavings, bark removed in processing and waste wood recycled as fuel. This volume is not included in "Fuelwood".

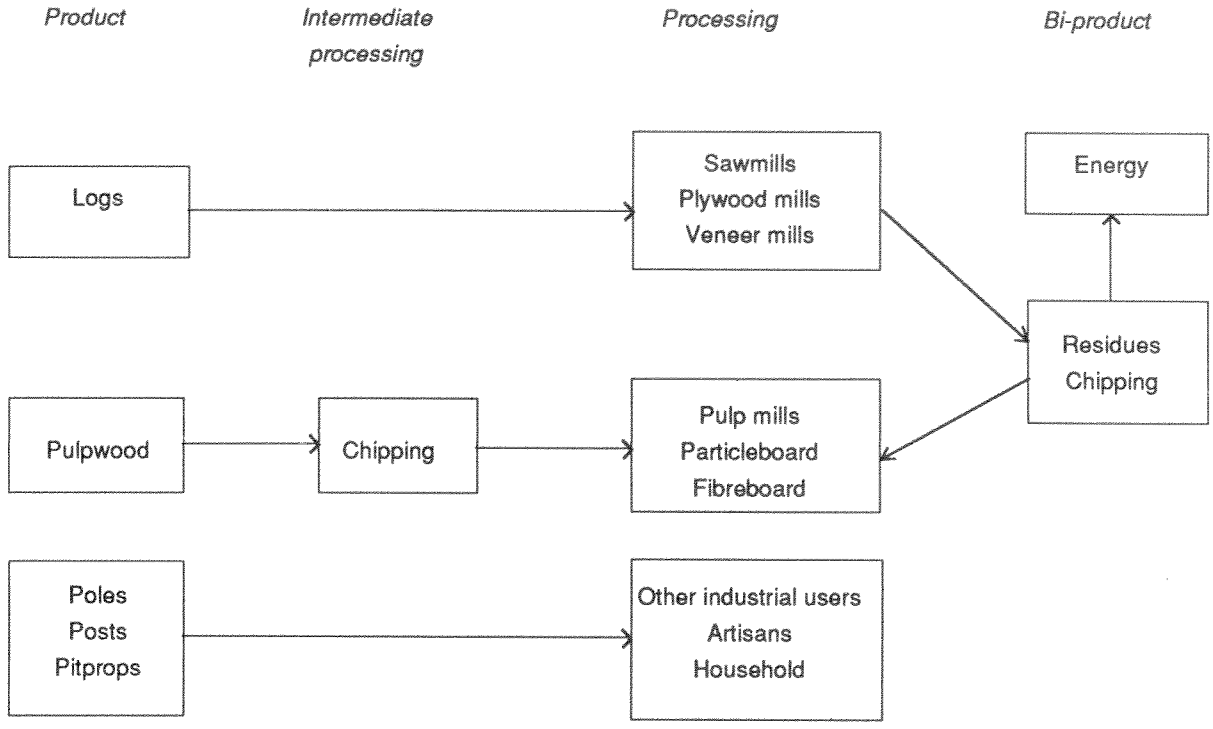
Energy may also be generated from processing residues from wood using industry such as waste fibre and spent liquors of the pulp industry.

ESTIMATION OF FUELWOOD PRODUCTION

In some countries the production of fuelwood is measured by assessment of the volume harvested from the forest or the volume produced by commercial and industrial enterprises and by households.

More frequently it is assessed by survey of industrial and household consumers estimating production from consumption. Where wood using industry is of significant size, it is important to distinguish between (A) fuelwood delivered directly from the forest or from tree harvesting for use as energy source and (B) wood residues recovered from industrial processing and delivered for use as energy source either to industry or household.

Figure 2
Industrial Roundwood Production Process



CROSS REFERENCE

Surveys of household consumption (of wood for energy, surveys of consumption of wood for energy by industry, surveys of recovery of wood residues for energy use, studies of trends in use of wood for energy.

Indirect estimating via cooking, heating and industry use budgets.

INDUSTRIAL ROUNDWOOD

Composition: logs
pulpwood - chips
poles, posts, pitprops - other industrial wood

DEFINITION

Industrial roundwood is wood in the rough from the main stem (trunk) or branches of trees delivered for use as the raw material of production in wood using industry or for use by artisans or households as material for construction or manufacture of articles, implements, furniture. Included is wood in the rough for utilization in the unprocessed form as poles, posts, pitprops. Industrial roundwood may be further processed in the forest into chips or at an intermediate location before delivery to the consuming industry (pulp, particleboard, fibreboard). The roundwood input used to make chips is part of industrial roundwood.

Production is made up of sawlogs, pulpwood, other industrial roundwood such as pitprops, poles and posts.

DIRECT ASSESSMENT

In some countries production is assessed at the point of harvesting from the forest, in some at the point of delivery to user. The difficulty of accurate survey is greater when a large part of production comes from informal forest and trees outside the forest or where a large part of consumption is by small mills, artisans and households.

INDIRECT ASSESSMENT

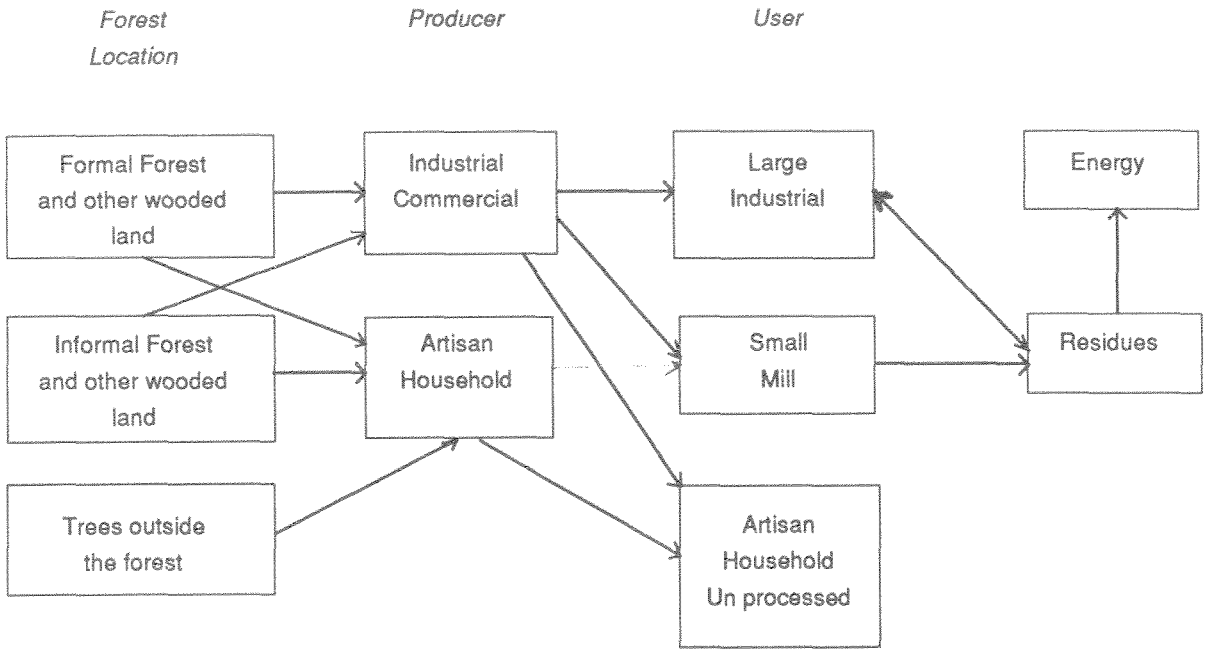
In certain cases it has been found easier to survey the production of end products, thus

Roundwood production = roundwood exports

plus F (sawnwood production)
plus G (veneer production
plus H (plywood production)
plus K (particleboard/fibreboard prod.)
plus J (wood pulp production)
plus other industrial round-wood prod.
plus roundwood imports

Where F.G.H.K.J. are recovery conversion factors.

Figure 3
Diagramme of Production and Delivery to User



Alternatively some combination of direct roundwood input and indirect assessment from product volume may be used.

It is important and interesting to identify the volume of waste or residues which is recovered in the manufacture of one product for recycling in the manufacture of another product. From the statistical point of view it is important not to double count the roundwood equivalent of those residues by crediting them both as input to the residue producing industry e.g. sawmilling, and to the residue consuming industry, e.g. particleboard. It is interesting because the degree of utilization of residues is an important indicator of efficiency in roundwood utilization and of the potential for further improvement.

SAWNWOOD

Definition

Wood, which has been sawn lengthwise (sometimes produced by a profile chipping process) exceeding 5mm in thickness. It includes planks, beams, joists, boards, rafters, scantlings, laths, boxboards. The term "lumber" is sometimes used. It also includes sawn railway sleepers or railway ties. Sawnwood may be planed, finger jointed, tongue or grooved, or otherwise finished.

The production process

Sawnwood may be produced in large integrated mills, or in small mills, by portable mills, or by hand sawing or pit sawing. Production may be in public or privately-owned mills, or in small mills, on farms or in households, or by individual pit sawyers.

Log Input Source	Producers	Users
state forest	large sawmills integrated mills	exports
		processing mills
• large private	small sawmills	artisans
• small private	portable mills	builders
Forest other wooded land trees outside the forest	pit sawyers imports	households

Estimation of Sawnwood Production

i. Estimation of mill production volume

Ideally the volume of sawnwood produced is obtained from the records of producers. In many countries producers are registered and required to submit returns. Sometimes only larger producers are registered. For example, many statistical offices conduct a periodic industrial census but usually only covering large mills with more than a minimum number of employees (20-100). In most countries there is a large population of small mills. In many countries sawnwood is produced by pit sawyers, by hand sawing or household saw benches. Thus comprehensive coverage of the industry will require survey of returns from large sawmillers and survey of small mills and pit sawyers. Sawmilling may be carried out by state-owned mills. In some countries these are the main large mills. It must be remembered, however, that very significant volumes may be produced by large private mills and by the large number of small private mills or pit sawyers. These last two may constitute an important part of the supply, utilise significant quantities of roundwood and make an important contribution to the economy through product supply, employment and income generation.

Thus to obtain complete coverage of mill production volume it will be necessary to combine records of large producers with survey information on small producers and pit sawyers.

ii. Estimation from roundwood input

In some circumstances it may be possible to estimate sawnwood production from the volume of wood delivered to mills. This may be an accurate method when all the production and destination of logs from the forest is recorded, which may be the case for the production from state forests.

In most countries there are both state and private forests and not all the production is recorded. A great deal of wood may be obtained from other wooded land and from trees outside the forest, so to use this method, it may be necessary to combine records of delivery from large producers with surveys to complete the coverage of small and informal producers.

Sawnwood production estimated by the use of estimates of log input requires also an estimation of the recovery in sawmilling in order to convert the log input volume into sawnwood output.

Sawnwood production = log input x C

(C is the recovery factor)

WOOD BASED PANELS

Veneer, plywood, particleboard, fibreboard.

Definitions

Veneer. Thin layer or sheet of wood of uniform thickness, less than 5mm in thickness, produced by slicing, peeling and sometimes by sawing. Used for making plywood, for veneering furniture, for the veneer surface of other panels than plywood, for containers, chip baskets, match boxes, matches.

Plywood. A panel consisting of veneer sheets (plies) bonded together with the direction of grain in alternate plies, generally at right angles. Veneer plywood consists of three or more veneer sheets. Core plywood (industry blockboard) consists of veneer sheets with a core or certain layers of solid wood or other wood material such as particleboard.

Particleboard. Flat-pressed or moulded panels manufactured from particles of wood or other ligno-cellulosic materials bonded by a suitable, usually organic, binder in the presence of heat and pressure. They may also be manufactured by extruding the materials into a mould under heat and pressure. Extruded particleboard may be solid or with hollow cavities. The density of particleboards varies with the density of raw materials used and the binder, pressures and temperatures used in manufacture. They are usually in the range 0.6 to 0.8 g/cm^3.

Included in this group are such special types of particleboard as waferboard, oriented particleboard and thin particleboard. Wood wool board or other boards with mineral binders are excluded.

Fibreboard. Sheet material usually exceeding 1.5mm in thickness manufactured from fibres of wood or other ligno-cellulosic materials with the primary bond deriving from the felting of the fibres and their inherent adhesive properties. Bonding materials and/or additives may be added. This includes insulating board (or softboard) with a density usually not more than 0.35 g/cm^3, medium board produced by wet process with density up to 0.8 g/cm^3.

Estimating wood based panels production

Factories producing wood based panels are usually medium scale to large scale manufacturing plants and statistics on production are obtained from production records. In many countries reporting of basic statistics by the producing plants is mandatory and the data are assembled by forest authorities, industry ministries or central statistics offices. Where mandatory reporting is not available, the assessment may be by periodic survey or questionnaire enquiry. In some countries industry associations collect information on production.

As with sawnwood, there are the alternative possibilities of estimating wood based panels production from surveys of wood input and recovery factors, or from surveys of product consumption.

PULP AND PAPER

Definitions

Wood pulp. Pulp of wood and other ligno-cellulosic materials broken down into fibres by mechanical or chemical means so as to be suitable for the manufacture of paper, paperboard or products of dissolving pulp.

Pulp of other fibre. Included are pulps made of straw, bagasse, bamboo, reeds, cotton linters, flax.

Paper and paperboard made from pulp or waste paper in rolls and sheets including newsprint, printing and writing paper, including other paper and paperboard, wrapping and packaging paper and paperboard, as well as household and sanitary paper.

Estimating pulp and paper production

Factories producing pulp and paper are usually medium to large scale manufacturing plants and statistics on production are obtained from production records. In many countries reporting of basic statistics is frequently the subject of national industry survey. In countries with a number of mills, statistics are frequently assembled by an industry association.

Collection of production statistics

G. S. Kowero

INTRODUCTION

Production statistics are basically the numerical values of the resources used and products generated by the production process. These include physical quantities of resource inputs like labour, machinery and materials consumed in the production process together with the associated output.

The physical quantities can then be transformed into production cost and revenue information on the basis of market prices. Such information is very useful and underlines the importance of collection, storage and analysis of production statistics. For example, production cost and revenue information can be used to:

- facilitate cost comparisons
  - between alternative methods of doing the same job so as to assist decision on selection of cheapest method
  - between various operations within or between firms so as to provide a basis for improving efficiency
  - between various treatments so as to select the most cost efficient treatment
- assist decision on methods of payment which reward the workers' efforts fairly, in addition to motivating them to increase efficiency
- facilitate productivity measurements
- assist profitability calculations
- assist planning and control of all activities in a production facility.

The recording, storage and analysis of production information is influenced by several factors including the nature of the organization, its objectives and organization/ administrative structure. One may therefore find data pooled according to the department structure of the organization or synthetically built according to operations.

When collecting such data one has to be conversant with definitions of the terms used, measurement units and the time span (coverage) involved. In order to collect data one has to know where to locate it.

SOURCES OF PRODUCTION STATISTICS

In many production concerns, production statistics are usually found in primary and secondary data sources.

There are three basic primary sources of data:

(a) *Time sheets/job cards*

These keep a record of direct cost of labour. They specify the type of job executed, where and when executed, number of people involved and payment.

(b) *Log or machine (equipment) book*

This keeps the history of the machine/equipment by tracing its use. It records data on nature of work performed, where and when performed, use of oil and fuel, irregularities associated with the machine and preventive maintenance.

(c) *Material record book*

This records the movement of materials, their quantities and values.

Since these three record sources are filled in by different people, a clear understanding of them is essential so as to reduce/eliminate erroneous recording.

The prominence of either of the three primary data sources will depend on the nature/type of production facility. For example, time sheets and job cards are very common in primary forest production.

The secondary sources of information are several including reports from the organization like daily, weekly, monthly, quarterly and annual reports. These could be at department level or at company level.

The level of detail required in production statistics will determine the extent to which either of these sources is used. For a general overview of the production situation, secondary sources will probably suffice. However, for detailed productivity analysis primary sources will be more useful.

SPECIFIC ATTRIBUTES OF PRODUCTION DATA

Although some data can be obtained from these two basic sources, there are attributes specific to various data types which have to be considered if distortions are to be avoided.

(a) *Log data*

In primary forest production a distinction has to be made between standing total volume and

merchantable volume in order to assist harvesting and utilization plans. In addition, amount of merchantable volume accessible to should be known. Often plans are made on inaccessible wood resources.

For felled trees, log volumes will depend on method of measurement (e.g. caliper or tape), points of measurement, form/state of logs (e.g. straight or crooked) and the formula used for volume estimation.

Volumes and weights should be specifically stated as overbark or underbark so as to know the actual amount of wood available. For production cost analysis the various operations associated with the log, from felling to the point of conversion, should be clearly known. If the wood processing facility carries out all harvesting operations then data collection begins with felling operations, however if harvesting is done by someone else, log costing starts at either forest landing or at mill log yard, if logs are delivered to the mill.

In either case it is advisable to identify the appropriate cost centres for the activities related to the logs. For example such cost centres could be:

- felling
- skidding
- sorting and measurement
- transport to mill
- storage at mill yard

There could be various operations associated with each of these cost centres. For example, felling will include limbing and cross cutting. These details have to be worked out and maintained for consistency of records.

(b) *Wood processing*

There are various activities associated with primary wood processing depending on the conversion process employed. Production statistics therefore differ between conversion processes on the same basis. Even within a given category of conversion process, some differences occur. For example, in mechanical and chemical pulping of wood different operations are involved irrespective of the fact that the general conversion process is pulping. The implication is that a generalization of a format for production statistics for wood processing would be very comprimising, sketchy and probably misleading, consequently it would be advisable to separately deal with each process or product line. This will permit a more in-depth analysis of, for example efficiency of various equipment and operations in terms of time taken to execute certain functions or by use of other productivity measures. Such information is useful in planning of operations and identification of areas needing more control.

Whereas the primary and secondary data sources may provide the data necessary for such purposes, one invariably finds production data by such processing facilities recorded by administrative/ organizational departments of that facility. Such departments include logging, mechanical, electrical, processing, stores and administration. Production information collected from such sources had better be collected by people very familiar with the production processes involved so as to avoid duplication or omission of some data. Such information gives statistics on materials, costs, output and revenues, in addition to production time span and manpower resources.

For a more detailed analysis of production processes, an alternative way of collecting data could be through time studies. This requires detailed knowledge of every step involved in each operation studies. Production statistics can then be built up synthetically. As an example, the various steps involved in sawmilling are outlined.

Sawnwood production:

- debarking of logs
- moving logs to breakdown saw
- sawing of logs
- sorting of green sawn timber
- drying of sawn timber
- trimming and grading of dry sawn timber
- treatment of dray sawn timber
- storing

There are a number of activities associated with each of these steps. These have to be identified if a good study has to be made. A similar breakdown is necessary for other conversion processes like those for production of wood based panels (e.g. plywood, fibrewood and particleboard) and pulp and paper. Units of measurement will vary with operations/ activities depending on the end use of the production data. For labour intensive operations production as related to labour input could be a desirable unit of productivity i.e. efficiency assessment. For production related to speed of machinery, production per unit of time will be the relevant unit of efficiency assessment. In all activities involving

labour the production statistics will be influenced by the experience of such manpower. It is difficult to measure the "experience" attribute but this can be potrayed by trends in work performance.

An important aspect of production is the relationship between quantities of wood raw material and output. The recovery rate is used to denote this and is in a way a measure of the efficienty of the conversion process. However, this rate should be considered cautiously because it can be influenced by a number of factors not related to the conversion process. For example in sawmilling the recovery rate is influenced by:

- end product demanded. Prime sawn timber has a lower rate than rough sawn timber;
- shape of logs. Crooked logs have a lower rate than straight ones;
- state of logs. Logs with heart rot have a lower rate than healthier ones. Also the bigger the proportion of sapwood the lower the recovery rate for prime sawn timber;
- thickness of saw blade;
- skills of saw operators.

These prevent a strict comparison of recovery rates between sawmills. The same analogy holds for other wood conversion processes, albeit to a different degree.

(c) *Overheads*

There are certain resources which are shared by various operations in production facilities; as such they cannot be claimed to be specific to any of these operations. These resources assume an overhead character and when priced they are referred to as overhead costs. For example staff of the central administration of the production facility serve all service and processing departments; as such their costs have to be rationally distributed among the different departments/sections of the production facility. When such resources are costed they usually appear in the records of production facilities as salaries, allowances, office expenses, research expenses and insurance. In collecting production statistics one has to know the origin of such overhead resources and the levels at which they occur in the organization studied. Often people forget overheads whose origin is not within the production facility. For example in a country with centralized planning and organization of wood processing, one often finds a holding company for the subsidiary processing mills. When collecting production statistics considerations should be given to resources availed or rendered by the holding company to the subsidiary mills.

The question is then how to share such resources. If costed, overheads have to be identified and summed up. Also the total direct costs have to be known. An overhead rate can then be calculated as the ratio of the sum of the overhead costs to total direct costs expressed as a percentage. This percentage allows the distribution of such overheads.

However a more common and fairly easy way is to use allocation keys. These denote attributes common to the centres using such shared resources. They could be value of output, number of mandays, area, volume of output, etc. It is difficult to select the correct key, and different keys give different results. For example, volume and revenue parameters may not be good keys because at the initial phase of production overheads are there but production (volume) and revenue may not be there. It is therefore advisable to avoid routine distribution of overheads by use of allocation keys.

Different results will be obtained depending on the allocation method used. Such results will not be consistent over time because overhead costs are fairly independent of factors inherent in these methods. The implication is that production statistics on overheads are difficult to collect accurately.

(d) *Level of aggregation*

The level of aggregation affects the detail and at times accuracy of production statistics. At company (firm) level it is possible to get reasonably detailed information on various production parameters. However at industry level (or national level) pooling of information from various firms and of different levels of detail and accuracy necessitaties recording of average statistics on the parameters considered thus compromising on both detail and accuracy. However firm and industry data usually serve purposes which require different levels of detail and accuracy. For example planning at macro level will require different levels of detail and accuracy. For example planning at macro level will require more of industry data whereas at the micro level firm data will be more useful. Both types of data are required at both levels, but at different degrees.

On the whole collection of production statistics is influenced by the objectives of such an exercise

(i.e. end use of such data) and method of analysis. This will decide on the level of detail required, collection methodology, and consequently on data sources.

PROBLEMS IN COLLECTING PRODUCTION STATISTICS

A number of problems are usually encountered in collecting production statistics on wood processing concerns. These include:

(a) *Absence of recorded information*

This is characteristic of such entities like pit sawing and small scale operating units like village carpentry shops. The reason behind this is the lack of a record keeping culture plus absence of strict commercial orientation.

(b) *Omission of data*

Some services provided by production units are not costed. For example one often finds cost of storage facilities like log and timber yards not accounted for.

(c) *Pooling of data*

Apart from overheads there are some services or resources which are pooled for convenience and cause a lot of problems in apportioning. For example, one often finds water or electricity consumed by a production facility monitored through one metre only. The situation becomes even more complex when the production facility consists of integrated units producing different products. When collecting such data one gets only one mere reading for all units. Without more technical information on the individual units it will be very difficult to calculate how much electricity or water is consumed in production of each product.

(d) Inconsistencies

Management and recording conventions usually change. For collection of historic production statistics this may affect accuracy of data collected if consistency and data recording formats change over time. Account heads of same titles may contain different contents. It is therefore advisable to look out for such changes and iron out any differences which may occur in successive data recording regimes. This is especially true of data based on accounting information where different procedures can be employed.

Another source of inconsistencies is change of data recording personnel especially where clear ready made data recording material are not available and personnel are not adequately educated on proper record keeping. Good examples are data in log books and material record books.

(e) *Denial of information*

A certain element of information confidentiality is inherent in practically all production concerns. This is more pronounced in the private sector. This inhibits collection of all desirable production data, and especially so on financial matters.

Collection of price statistics

G.S. Kowero

INTRODUCTION

The price of a commodity is a reflection of the value attached to it. This value could be dictated by market forces regulating the supply and demand of that commodity, or by the producer of that commodity if he is in a monopolistic situation or a price leader in the industry, or by any other method employed in pricing.

Prices of forest products are affected by the same factors and sometimes by peculiarities of the forest production system. Collection of price statistics is influenced by objectives, use of the price information, and method of data analysis, among other things.

PRICES OF LOGS

It is usually not difficult to obtain the price of logs because selling authorities have these set out for their customers. Perhaps to the seller of logs it would be more interesting to reflect on the meaning behind such prices and find out whether or not they adequately reward his timber growing business.

Often one finds prices of logs especially from natural forests set arbitrarily. For example a certain fee charged per unit volume harvested. Such a fee could represent a royalty for the priviledge of using such a resource. Under such a situation, there is no guarantee that the fee adequately reflects the true value or the willingness of buyers to pay for such timber. In addition, one is not sure whether or not the fee adequately compensates the owner for this tree growing efforts. If the fee is set too low, then forest owners will be subsidizing the wood processing industry. Additionally low fees on very demanded processed products have contributed to overexploitation of certain tree species especially from natural forests. A knowledge of the relationship between the price of logs from such products and the prices of the processed products is important especially when price is used as a management tool.

In other instances, prices of logs are more systematically determined. Stumpage prices which take into account the sellers and buyers of stumpage are useful in establishing fairly acceptable values of stumpage. However these also may have limitations largely due to their administration. One often finds that these prices are pan-territorial and not location specific. For example the stumpage value of pine sawlogs would be the same all over the country, irrespective of variations in location of the forests, accessibility, sawmill type and location of mill in relation to forest. Ignoring such considerations may make such prices unfair to some buyers.

Another factor worth considering is whether to calculate prices on basis of midlog diameters as opposed to prices of logs derived from stumpage prices.

PRICES OF PROCESSED PRODUCTS

In collecting data or statistics on prices of processed products one has to identify the level at which the products is priced e.g. ex-mill, ex-sales branch office, etc. price lists are usually available at such places.

Of interest may be who decides on the price, how to account for price fluctuations, how to account for some sales practices.

(a) *Determination of prices*

In a system where prices are controlled, producers accept prices set externally. Usually considerations are given to production costs by the body setting such prices. In a system of free pricing the producers set prices taking into account customers reactions. In both pricing systems producers will strive for a production cost lower than the price set for him or price he is willing to charge and acceptable by customers, so as to be profitable.

(b) *Accounting for periodic price fluctuations*

Usually prices vary over time and even in one year prices of same products may vary. In collecting price statistics one has to identify the time regimes corresponding to those prices and this is especially important when calculating average prices which would have to be weighted because price regimes will be characterized by differences in volume of production.

(c) *Accounting for different levels of grading and sizes*

Usually price lists are made for each size and grade of product. However care should be exercised in

collecting average price information. For example, the average price of hardboards produced by a given mill should be an average taking into account the various sizes and grades. Often one is given the figure for the most common size as the average price.

(d) *Accounting for some sales practices*

Even with the drawing up of price lists, it often happens that customers do not pay for the products as indicated on such lists. Such a situation arises due to the desire, by producers, to promote sales. Often discounts are given on sales. For example quantity discounts which can be given as price deductions connected with quantity purchased may not be reflected on price lists. When calculating weighted average product prices assessed on quantities sold and prices as appearing in price lists such discounts will not be accounted for and if they are frequent and significant the calculated weighted average price will be an overestimate of the price level. However, for profitability determined from financial statements, such discounts are fully accounted for. Another sales practice is that of paying commission to sales agents. These usually take the form of a certain proportion of revenue from sales. This has the effect of lowering the actual price of the product as viewed by its owner or person employing a sales agent. One has therefore to know which price he/she is collecting i.e. gross price or net price. The latter is gross price minus traceable costs to certain customers (e.g. discounts) or specific sales (e.g. sales commissions).

(e) *Accounting for inflation*

Prices given in price lists or by sales people are usually specific for the time or duration of the price lists or sales. They are referred to as current prices. When comparisons are to be made over time, an adjustment of such prices is required because of inflation so as to arrive at real prices. This can be done using deflators based on indicies of relevant prices like the consumer price index or general price index.

In many cases information on such deflators is not found in wood processing mills. Such data can be found in ministries dealing with finance or planning and publication from statistical bureaux.

(f) *Accounting for market distortions*

There is empirical evidence that markets seldom operate perfectly and consequently are characterized by imperfections which cause distortions on prices of some resources. As such in economic evaluations shadow prices or accounting prices for the resources are used instead of market prices. The shadow price measures the true value or opportunity cost to the economy of such a resource.

For labour its price is the wage or salary. However its relative abundance and level of skills influence its value. For this, we need to categorize labour as unskilled, semiskilled and skilled in addition to local and expatriate. This permits adjusting wages and salaries using appropriate shadow price factors.

For other inputs we have to identify those imported and those locally produced. Even for those locally produced their foreign exchange content should be estimated. This permits shadow pricing of foreign currency involved since the exchange rate of local to foreign currency does not always reflect the true value of foreign currency.

These accounting prices are normally not found in our production mills. Use can be made of ministries responsible for finance and planning in addition to financial and consultancy institutions.

Measurement of forest products

Philip Wardle

In this session we shall discuss some of the problems of measurement of wood. Fuelwood may come in many forms - stacks, bundles, baskets, headloads. The conversion to solid volume and the assessment of energy content will be considered.

Industrial roundwood may be measured in the log, overbark or underbark. Different conventions of measurement are considered. Various rounding conventions are applied. When measured by weight, assessment of moisture content applies.

The measurement of sawnwood and wood based panels is simpler because the products are regular in shape. Some measurement and rounding conventions may apply.

Pulp is measured by weight - conventions of moisture content apply.

Paper is measured by weight.

Standard conversions to metric measure are attached, together with some approximate equivalents to forest measure and weight. Because of the particular importance of wood as a source of energy in African countries, a table of approximate conversions from volume and weight to units of energy content are included.

Forest Products Measures
Mesures pout les produits forestiers
Medidas de productos forestales

Product and unit Produits et unites Productos y unidades	Cubic metres Metres Cubes Metros cubicos	Cubic feet Pies Cubes Pies Cubicos	1 000 board feet Pieds Pianches Pies Madereros	Standard (Petrograd)
ROUNDWOOD-BOIS ROND-MADERA EN ROLLO				
1 hoppus cubic foot - 1 pied cube hoppus - 1 pie cubico hoppus	0.03605	1.273		
1 ton of 5 hoppus cubic feet - 1 tonne de 50 pieds cubes hoppus - 1 tonelada de 50 pies cubicos hoppus	1.8027	63.66		
1 cunit	283.16	100		
1 cord[1] - 1 corde[1] - 1 cuerda[1]	3.625	128		
1 stere[1] - 1 stere[1] - 1 estero[1]	1	35.315		
1 fathom[1]	6.1164	216		
SAWNWOOD - SCIAGES - MADERA ASERRADA				
1 standard (Petrograd)	4.672	165	1.98	1
1.000 board super feet[2] - 1 000 pieds planches superficiels[2] - 1 000 pies madereros superficiales[2]	236	83.33	1	0.505
1 ton of 50 cubic feet - 1 tonne de 50 pieds cubes - 1 tonelada de 50 pies cubicos	1.416	50	0.6	0.303
PANELS - PANNEAUX - TABLEROS				
1.000 square metres (1 millimetre thickness) 1.000 mètres carrés (1 millimetre d'épaisseur) 1.000 metros cuadrados (1 milimetro de espesor)	1	35.315	0.4238	
1.000 square feet (1.8 inch thickness) 1.000 pieds carrés (1.8 de pouce d'épaisseur) 1.000 pies cuadrados (1.8 de pulpaca de espesor)	0.295	10.417	0.125	

Fuelwood and Charcoal

	MTCE	Energy Equivalents		
		Gigajoules (10^9)	Gigacalories (10^9)	TOE
1 mt Anthracite	1.0	31.4	7.0	0.70
1 mt Coal	1.0	31.4	7.0	0.70
1 mt Lignite	0.67	21.6	4.8	0.48
1 mt Coke (BR)	0.81	28.5	7.0	0.70
1 mt Gasoline	1.50	44.0	10.5	1.05
1 mt Charcoal	0.99	28.9	6.9	0.69
1 mt Wood (20-30 mc)	0.5	14.3	3.5	0.35
1 mt Wood (Green)	0.35	10.0	2.5	0.25
1 m³ Fuelwood (Solid 20-30%)	0.33	9.4	2.6	0.26
1 m³ Fuelwood (Solid 0% mc)	0.43	14.0	3.4	0.34
1 m³ Fuelwood (Solid Green)		7.2	1.8	0.18
1 m³ Fuelwood (piled)	0.18	5.0	1.2	0.12
1 mt Bagasse (30%)	0.50	14.3	3.5	0.35
1 mt Dung Cakes	0.30	8.6	2.1	0.21
1 mt Ethyl Alcohol	0.94	27.6	6.6	0.66
1 mt Sawdust	0.39	11.1	2.7	0.27
1 mt Crude Oil	1.46	42.7	10.2	1.00

Note: 1 mt Crude Oil = 7.30 bb (barrels)
1 MTCE = 0.68 Crude Oil
1 MTCE = 5 barrels Crude Oil
1 m³ Fuelwood (0.33) = 1.6 bb Crude Oil

MTCE = Metric ton coal equivalent
TOE = Metric ton oil equivalent
bb = barrels mc = moisture content
mt = metric ton m³ = cubic metre

Weight and Volume
Poids et volume
Peso y volumen

Product Produits Productos	Kg/CUM			CUM/MT		
	G	C	NC	G	C	NC
FUELWOOD - BOIS DE CHAUFFAGE - LEÑA	725	625	750	1.38	1.60	1.33
CHARCOAL - CHARBON DE BOIS - CARBON VEG	167					
SAWLOGS - VENEER LOGS - GRUMES SCIAGE - PLACAGE - TROZAS, ASERRAR+CHAPAS						
Tropical - Tropicales		730			1.37	
Other - Autres - Otras	700	800		1.43	1.25	
PITPROPS-BOIS DE MINE-MADERA PARA MINAS	725	700	800	1.38	1.43	1.25
PULPWOOD - BOIES DE TRITURATION - MADERA PARA PULPA	675	650	750	1.48	1.54	1.33
OTHER INDUST. ROUNDWOOD-AUTRE BOIS ROND INDST- OTRAS MADERAS EN ROL INDUSTRIAL	750	700	800	1.33	1.43	1.25
SAWNWOOD-SCIAGES-MADERA ASERRADA		550	700		1.82	1.48
SLEEPERS - TRAVERSES - TRAVIESAS	780		1.28			
VENEER SHEETS-FEUILLES DE PLACAGE - HOJAS DE CHAPA	750		1.33			
PLYWOOD-CONTREPLAQUE-MADERA TERCIADA	650		1.54			
PARTICLEBOARD-PANNEAUX DE PARTICULES-TABLEROS DE PARTICULAS	650		1.64			
FIBREBOARD COMPRESSED-PANNEAUX FIBRES DURS - TABLEROS FIBRA, PRENSADOS	950		1.053			
FIBREBOARD NON COMPRESSED-PANNEAUX FIBRES ISOLANTS-TABLEROS FIBRA NO PRENSADOS	250		4			

Note:
G = General général
C = coniferous coniferes coniferas
NC = non-coniferous non-coniferes no-coniferas

Approximate equivalents for forest measures
Equivalents approximatifs des mesures pour les produits forestiers
Equivalentes aproximados de las medidas de productos forestales

Products and unit Produits et unités Productos y unidades	Cubic metres Metres cubes Metros cubicos	Cubic feet Pieds cubes Pies cubicos
	Solid volume without barks Volume solide sans écorce Volumen sólido sin corteza	
SAWLOGS-VENEER LOGS-GRUMES, SCIAGE+PLACAGE-TROZAS, ASERRAR+CHAPAS		
1.000 board super feet - 1 000 pieds planches superfiels 1.000 pies madereros/superficiales	4.53	160
PULPWOOD - BOIS DE TRITURATION - MADERA PARA PULPA		
1 stere - 1 stere - 1 estereo	0.72	25.4
1 cord - 1 corde - 1 cuerda	2.55	90
PITPROPS - BOIS DE MINE - MADERA PARA MINAS		
1 piled cubic fathom - 1 fathom (pied cube empile) - 1 fathom (pie cubico hacinado)	4.28	151.1
1 cord - 1 corde - 1 cuerda	2.416	85.3
FUELWOOD - BOIS DE CHAUFFAGE - LEñA		
1 stere - 1 stere - 1 estereo	0.65	23
1 cord - 1 corde - 1 cuerca	2.12	74.9
1.000 stacked cubic feet - 1000 pieds cubes empiles 1.000 pies cubicos hacinados	18.41	650

Collecting trade statistics

Philip Wardle

Involvement in trade in the participating countries includes the export of tropical logs, sawnwood and plywood, local trade in sawnwood and panels made from raw material from coniferous plantations and the export of wood pulp. Imports include sawnwood and panels by some countries and of paper by all countries. The export of non wood products such as gum arabic is important in some countries.

Statistics on forest products exports are collected by the producing enterprises, by forest authorities and by the customs offices. The assembly of formal statistics on trade is usually carried out by the customs office in relation to trade ministry central statistics office or central bank.

Trade statistics are arranged according to internationally agreed trade classifications. Most countries use either (i) the UN Standard International Trade Classification - SITC - (the latest version is revision 3, introduced in 1988 - SITC Rev. 3), or (ii) the Customs Cooperation Council trade classification (CCCN or BTN), up to 1988. From 1988 many countries introduced the new classification called the Harmonised System (HS).

FAO collects international trade data on forest products according to a standard format which follows SITC.

The computer in data collection, validation, processing, storage, dissemination and information exchange

Felice Padovani

Information processing technology and knowledge is no longer a problem. Microcomputers are widely used in all kinds of offices by all sorts of people to assist their work or to enjoy as a hobby. Such phenomena started late in the 1970s in developed countries, spreading into developing countries at a rather faster speed. In the field of forestry, we have to consider the use of microcomputers to handle various kinds of forestry data and eventually integrate this with data coming from other disciplines, in order to create substantial statistical information support to decision-makers. This demonstration will introduce some aspects of computer application.

Special emphasis will be given to the role of data producers and data consumers and the tools (hardware and software) available to produce clean and reliable data, as well as how to make effective use, and prevent misuse, of statistical data.

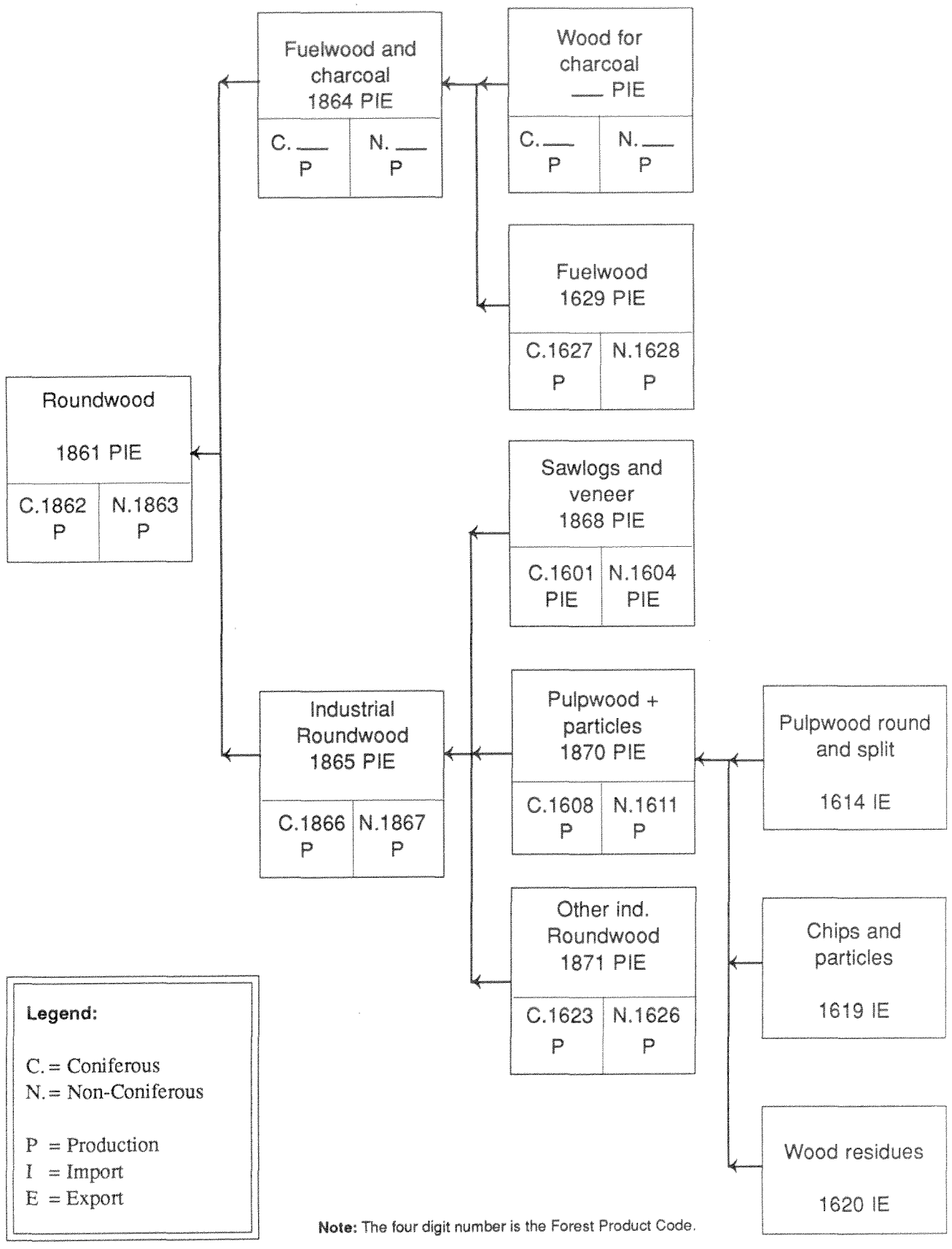
The FAO Forestry Department data collection and data dissemination networks experience will be presented and how to implement effective collection use and dissemination networks of forestry statistics in your country will be discussed.

The data structure classification and definition of forest products in the FAO Yearbook of forest products questionnaire is described.

The use of computer in data collection for forestry sector statistics in participating countries is summarised in the final tables.

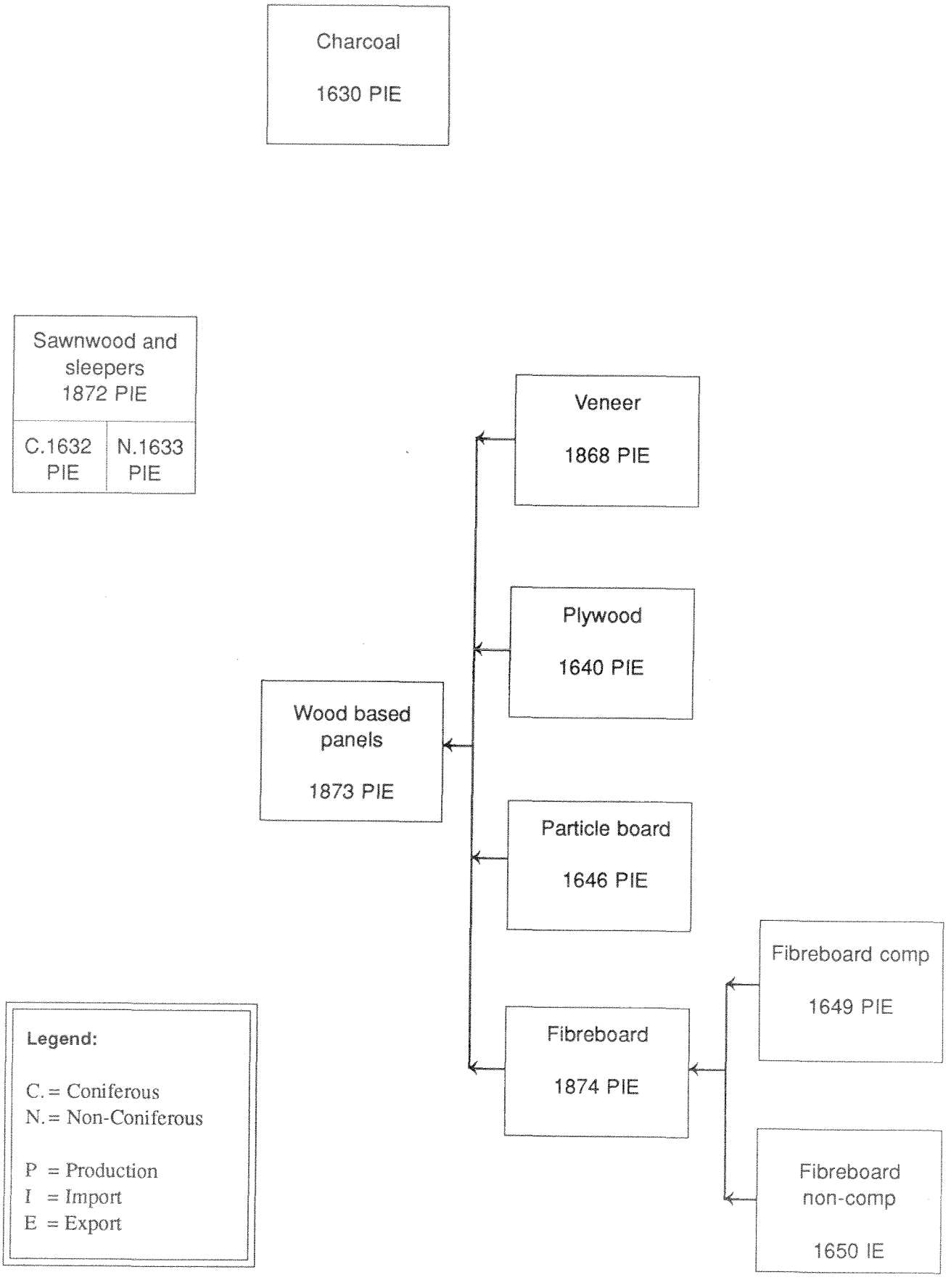
Data structure

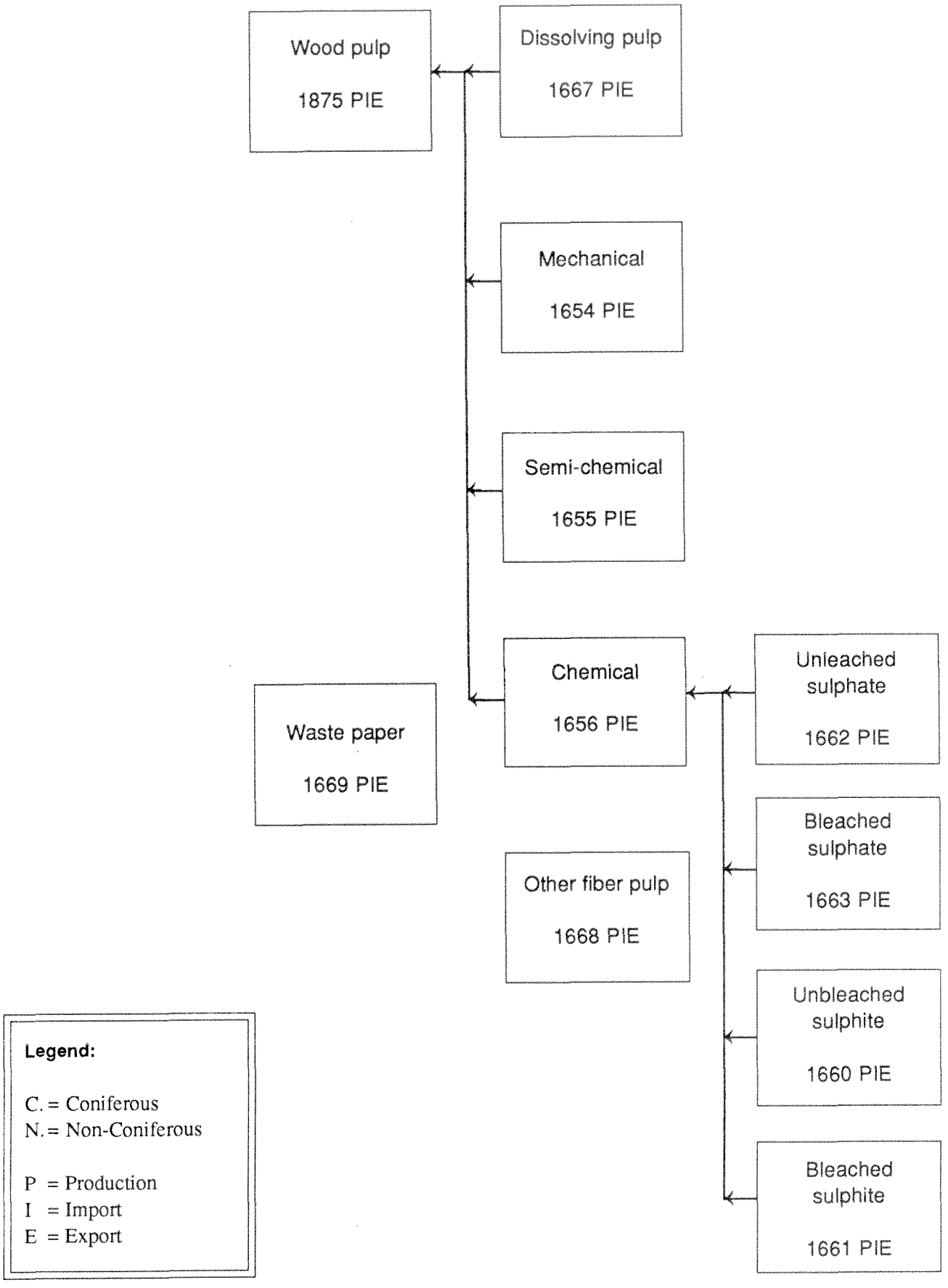
Removals of roundwood

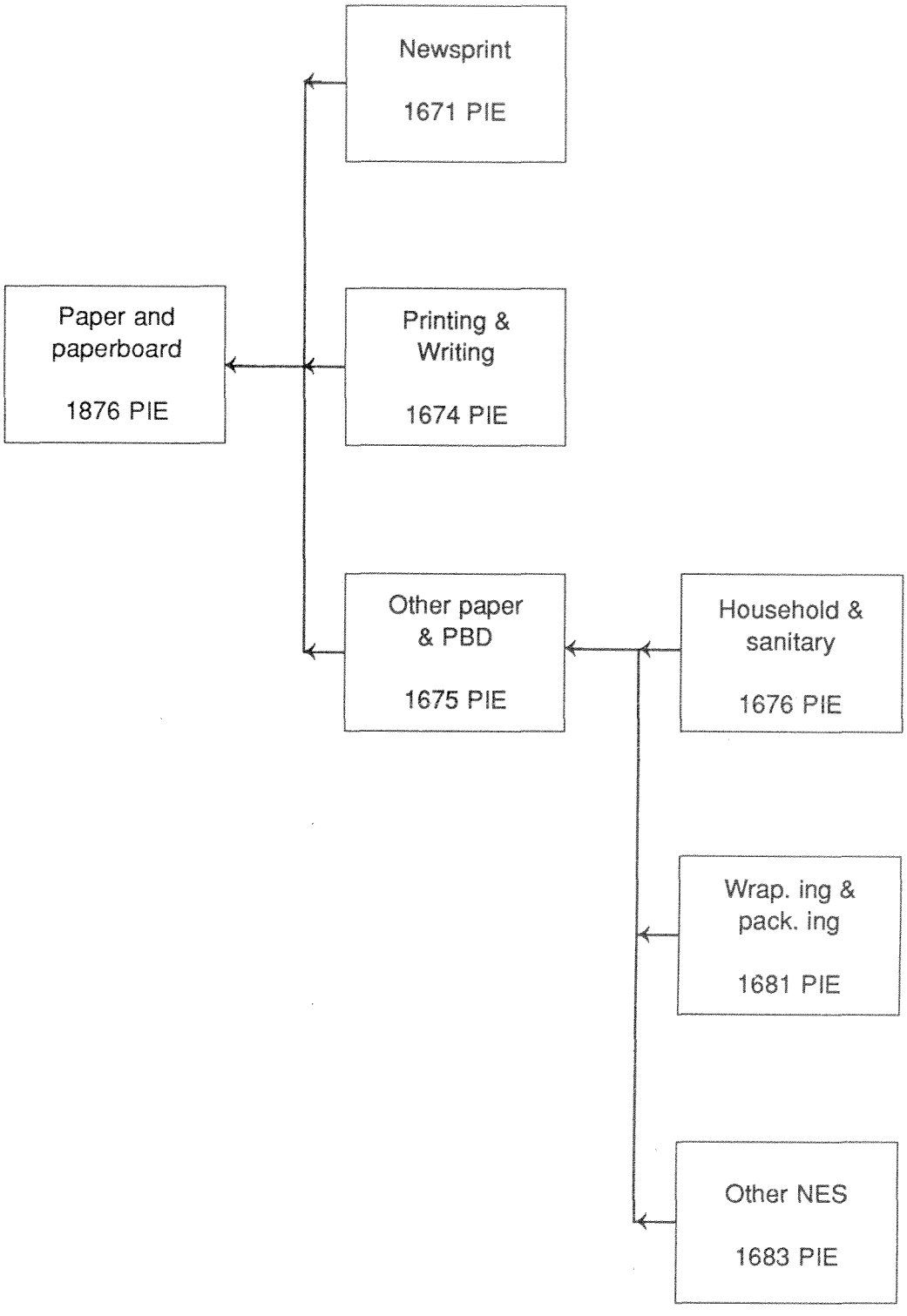


Note: The four digit number is the Forest Product Code.

Processed wood and panels products




Wood pulp
1875 PIE
Dissolving pulp
1667 PIE
Mechanical
1654 PIE
Semi-chemical
1655 PIE
Chemical
1656 PIE
Waste paper
1669 PIE
Other fiber pulp
1668 PIE
Unleached sulphate
1662 PIE
Bleached sulphate
1663 PIE
Unbleached sulphite
1660 PIE
Bleached sulphite
1661 PIE
Legend:
C. = Coniferous
N. = Non-Coniferous
P = Production
I = Import
E = Export


Newsprint
1671 PIE
Paper and paperboard
1876 PIE
Printing & Writing
1674 PIE
Other paper & PBD
1675 PIE
Household & sanitary
1676 PIE
Wrap. ing & pack. ing
1681 PIE
Other NES
1683 PIE

Definitions

Yearbook of Forest Products

ROUNDWOOD[1]

Code	Heading	Definition
1861	ROUNDWOOD	
1862	ROUNDWOOD (C)	
1863	ROUNDWOOD (NC)	Wood in the rough. Wood in its natural state as felled, or otherwise harvested, with or without bark, round, split, roughly squared or other forms (e.g. roots, stumps, burls, etc.). It may also be impregnated (e.g. telegraph poles) or roughly shaped or pointed. It comprises all wood obtained from removals, i.e. the quantities removed from forests and from trees outside the forest, including wood recovered from natural, felling and logging losses during the period - calendar year or forest year. Commodities included are sawlogs and veneer logs, pulpwood, other industrial roundwood (including pitprops) and fuelwood. The statistics include recorded volumes, as well as estimated unrecorded volumes as indicated in the notes. Statistics for trade include, as well as roundwood from removals, the estimated roundwood equivalent of chips and particles, wood residues and charcoal.
1864	FUELWOOD + CHARCOAL	The commodities included are fuelwood, coniferous and non-coniferous and the roundwood equivalent of charcoal (using a factor of 6.0 to convert from weight (MT) to solid volume units (CUM)).
1629	FUELWOOD	
1627	FUELWOOD (C)	
1628	FUELWOOD (NC)	Wood in the rough (from truncks and branches of trees) to be used as fuel for purposes such as cooking, heating or power production.
	WOOD FOR CHARCOAL	Wood in the rough used for Charcoal production in pit kilns and portable ovens etc. (estimated from statistics for Charcoal using a factor of 6 to convert from weight (MT) to solid volume units (CUM)).
1865	INDUSTRIAL ROUNDWOOD	
1866	INDUSTRIAL ROUNDWOOD (C)	
1967	INDUSTRIAL ROUNDWOOD (NC)	The commodities included are sawlogs or veneer logs, pulpwood, other industrial roundwood and in the case of trade, chips and particles and wood residues.
1868	SAWLOGS + VENEER LOGS	These commodity aggregates include sawlogs and veneer logs coniferous and non-coniferous.
1601	SAWLOGS + VENEER LOGS (C)	
1604	SALOWGS + VENEER LOGS (NC)	Sawlogs, veneer logs and logs for sleepers. Logs whether or not roughly squared, to be sawn (or chipped) lengthwise for the manufacture of sawnwood or railway sleepers (ties). Single bolts and stave bolts are included. Logs for production of veneer, mainly by peeling or slicing. Match billets are included, as are special growth (burls, roots, etc.) used for veneers.

[1]Figures are given in solid volume of roundwood (or roundwood equivalent) without bark.

ROUNDWOOD (cont'd)

Code	Heading	Definition
1870	PULPWOOD + PARTICLES	
1608	PULPWOOD (C)	
1611	PULPWOOD (NC)	Pulpwood, chips, particles and wood residues. In production the commodities included are pulpwood coniferous and non-coniferous. In trade the aggregate includes, in addition, chips or particles and wood residues.
1614	PULPWOOD (Round & Split)	Wood in the rough other than logs - for pulp, particleboard or fibreboard. Pulpwood may be barked or unbarked and may be in the form of roundwood or splitwood. In production, it may include the equivalent of wood chips made directly from roundwood.
1619	CHIPS + PARTICLES	Wood chips and particles Wood that has been deliberately reduced to small pieces from wood in the rough or from industrial residues, suitable for pulping, for particleboard and fibreboard production, for fuelwood or for other purposes.
1620	WOOD RESIDUES	Miscellaneous wood residues Wood residues which have not been reduced to small pieces. They consist principally of industrial residues, e.g. sawmill rejects, slabs, edgings and trimmings, veneer log cores, veneer rejects, sawdust, bark (excluding briquette) residues from carpentry and joinery production, etc.
1871	OTHER INDUST ROUNDWOOD	
1623	OTHER INDUST ROUNDWOOD (C)	
1626	OTHER INDUST ROUNDWOOD (NC)	Other industrial roundwood Roundwood used for tanning, distillation, match blocks, gazogenes, poles, piling, posts, pitprops, etc. **Note**: "OTHER INDUSTRIAL ROUNDWOOD" include pitprops.

SAWNWOOD[2]

Code	Heading	Definition
1630	CHARCOAL	Wood carbonized by partial combustion or application of heat from an external source. It is used as a fuel or for other uses. Figures are given in weight (MT).
1872	SAWNWOOD + SLEEPERS	The aggregate includes sawnwood and sleepers, coniferous or non-coniferous.
1632 1633	SAWNWOOD (C) SAWNWOOD (NC)	Sawnwood, unplaned, planed, grooved, tongued, etc., sawn lengthwise, or produced by a profile-chipping process (e.g. planks, beams, joists, boards, rafters, scantlings, laths, boxboards, "lumber", sleepers, etc.) and planed wood which may also be finger jointed, tongued or grooved, chamfered, rabbeted, V-jointed beaded, etc. Wood flooring is excluded. With few exceptions, sawnwood exceeds 5 mm. in thickness.

WOOD - BASED PANELS[2]

Code	Heading	Definition
1873	WOOD-BASED PANELS	The aggregate includes the following commodities: veneer sheets, plywood, particleboard and fibreboard compressed or non-compressed.
1634	VENEER SHEETS	Thin sheets of wood of uniform thickness, rotary cut, sliced or sawn, for use in plywood, laminated construction, furniture, veneer containers, etc. in production the quantity given excludes veneer sheets used for plywood productions within the country.
1640	PLYWOOD	Plywood, veneer plywood, core plywood including veneered wood, blockboard, laminboard and batten board. Other plywood such as cellular board and composite plywood. Veneer plywood is plywood manufactured by bonding together more than two veneer sheets. The grain of alternate veneer sheets is crossed generally at right angles. Core plywood is plywood whose core (i.e. central layer, generally thicker than the other plies) is solid and consists of narrow boards, blocks or strips of wood placed side by side, which may or may not be glued together. (This item includes veneered wood in sheets or panels in which a thin veneer of wood is affixed to a base, usually of inferior wood, by glueing under pressure). Cellular board is a plywood with a core of cellular construction while composite plywood is a plywood with core or certain layers made of material other than solid wood or veneers.
1646	PARTICLEBOARD	A sheet material manufactured from small pieces of wood or other ligno-cellulosic materials (e.g. chip, flakes, splinter, strands, shreds, schives, etc.) agglomerated by use of an organic binder together with one or more of the following agents: heat, pressure, humidity, a catalyst, etc. (Flaxboard is included. Wood wool and other particleboards, with inorganic binders, are excluded.)
1874	FIBREBOARD	Fibreboard (fibre building board) The aggregate includes compressed and non-compressed fibreboard. A panel manufacture from fibres of wood or other ligno-cellulosic materials with the primary bond deriving from the felting of the fibres and their inherent adhesive properties. Bonding materials and/or additives may be added. It is usually flat pressed but may be moulded. (Similar products made from pieces of wood, wood flour or other ligno-cellulosic material with added binders are excluded - as are, for example, boards of gypsum or other mineral material).
1649	COMPRESSED FIBREBOARD	Compressed includes hardboard with a density greater than 0.40 g/cm³.
1650	N. COMPRESSED FIBREBOARD	Non-compressed includes insulating board with density not more than 0.40 g/cm³.

[2]Figures are given in solid volume.

PULP[3]

Code Heading	Definition
1835 WOOD PULP	The following commodities are included in this aggregate: mechanical, semi-chemical, chemical and dissolving wood pulp.
1654 MECHANICAL WOOD PULP	Wood pulp obtained by grinding or milling the following into fibres: coniferous or non-coniferous rounds, quarters, billets, etc. or through refining coniferous or non-coniferous chips. Also called groundwood pulp and refiner pulp. It may be bleached or unbleached. It excludes exploded and defibrated pulp, and includes chemi-mechanical and thermo-mechanical pulp.
1655 SEMI-CHEMICAL WOOD PULP	Wood pulp, chemi-mechanical and semi-chemical. Wood pulp obtained by subjecting coniferous or non-coniferous wood to a series of mechanical and chemical treatments, none of which alone is sufficient to make the fibres separate readily. According to the order and importance of the treatment, such pulp is variously named: semi-chemical, chemi-groundwood, chemi-mechanical, etc. It may be bleached or unbleached.
1667 DISSOLVING WOOD PULP	Wood pulp, dissolving grades chemical pulp (sulphate, soda or sulphite) from coniferous or non-coniferous wood, or special quality, with a very high alpha-cellulose content (usually 90% and over), readily adaptable for uses other than paper making. These pulps are always bleached. They are used principally as a source of cellulose in the manufacture of products such a man-made fibres, cellulosic plastic materials, lacquers, explosives.
1656 CHEMICAL WOOD PULP	Sulphate (kraft) and soda and sulphite wood pulp except dissolving grades, bleached, semi-bleached and unbleached. Where detail is available, statistics for the following four component pulps are given.
1660 UNBLEACHED SULPHITE PULP	Wood pulp, sulphite, except dissolving grades. Wood pulp obtained by mechanically reducing coniferous or non-coniferous wood to small pieces which are subsequently cooked in a pressure vessel in the presence of a bi-sulphite cooking liquor. Bi-sulphites such as ammonium, calcium, magnesium and sodium are commonly used. The class includes semi-bleached and unbleached pulps.
1661 BLEACHED SULPHITE PULP	Wood pulp, sulphite, except dissolving grades. Wood pulp obtained by mechanically reducing coniferous or non-coniferous wood to small pieces which are subsequently cooked in a pressure vessel in the presence of a bi-sulphite cooking liquor. Bi-sulphites such as ammonium, calcium, magnesium and sodium are commonly used. The class includes bleached pulp.
1662 UNBLEACHED SULPHATE PULP	Wood pulp, sulphate (kraft) and soda, except dissolving grades. Wood pulp obtained by mechanically reducing coniferous or non-coniferous wood to small pieces which are subsequently cooked in a pressure vessel in the presence of sodium hydroxide cooking liquor (soda pulp) or a mixture of sodium hydroxide and sodium sulphite cooking liquor (sulphate pulp). The class includes semi-bleached and unbleached pulps.
1663 BLEACHED SULPHATE PULP	Wood pulp, sulphate (kraft) and soda, except dissolving grades. Wood pulp obtained by mechanically reducing coniferous or non-coniferous wood to small pieces which are subsequently cooked in a pressure vessel in the presence of sodium hydroxide cooking liquor (soda pulp) or a mixture of sodium hydroxide and sodium sulphite cooking liquor (sulphate pulp). The class includes bleached pulp.

[3]Figures are given in weight (air-dry = 10% moisture)

PULP[3]

Code Heading	Definition
1668 OTHER FIBRE PULP	Pulp of fibrous vegetable materials other than wood. Including straw, bamboo, bagasse, esparto, other reeds or grasses, cotton linters, flax, hemps, rags, other textile wastes. Used for the manufacture of paper, paperboard and fibreboard.
1669 WASTE PAPER	Paper and paperboard which has been used for its orginal purpose or residues from paper convertion, collected for re-use as a raw material for the manufacture of paper, paperboard, panels, moulded products, etc. and for wrapping, packing or other purposes, with or without further processing.

PAPER AND PAPERBOARD[4]

Code Heading	Definition
1876 PAPER + PAPERBOARD	The following commodities are included in this aggregate: Newsprint, printing and writing paper, other paper and paperboard.
1671 NEWSPRINT	Uncoated paper, unsized (or only slightly sized), containing at least 60% mechanical wood pulp (percent of fibrous content), usually weighting not less that 40 g/square m and generally not more than 60 g/square m of the type used mainly for the printing of newspapers.
1674 PRINTING + WRITING PAPER	Other printing and writing paper. Paper, except newsprint, suitable for printing and business purposes, writing, sketching, drawing, etc., made from a variety of pulp blends and with various finishes. Included are such papers as those used for books and magazines, wall paper base stock, box lining and covering calculator paper, rotonews, duplicating, tablet or block, label, lithograph, banknote, tabulating card stock, bible or imitation bible, stationary, manifold onionskin, typewriter, poster, etc.
1675 OTHER PAPER + PAPERBOARD	Includes construction paper and paperboard, household and sanitary paper, special thin paper, wrapping and packaging paper and paperboard and other paper and paperboard not elsewhere specified. Where detail is available statistics for four categories composing the above are given as follows:
1676 HOUSEHOLD + SANITARY PAPER	Household and sanitary paper; special thin paper. Household and sanitary paper includes absorbent paper, creped or uncreped, sometimes embossed, made from bleached or unbleached chemical wood pulp, sometimes with a mixture of pulp from waste paper and mechanical pulp. Included are towelling, napkin, facial tissue, toilet tissue, wadding disposable tissues.
1681 WRAPG + PACKG PAPER + BOARD	Wrapping and packaging paper and paperboard. Paper or paperboards included are the following: vegetable parchment, greaseproof and glassine paper. Papers made from pure chemical wood pulp or from mixture of chemical wood pulp, cotton fibre pulp, treated (e.g. highly hydrated or hard beaten) to render the resulting paper resistant to oil, grease and water. They are used primarily for packaging frozen, moist or greasy materials like butter, margarine, meat or fish, linerboard; paper or paperboard used as facing material on corrugated or solid paper or paperboard boxes and containers. Fluting medium: paper or paperboard used as medium when combining paper and paperboard for conversion into a corrugated board. Sack kraft paper: strong paper made from sulphate pulp and used in the manufacture of single, or multiwall, sacks. Other kraft wrapping paper: all other wrapping and packaging papers made principally from sulphate pulp. Folding boxboard: all types of paperboard used in the manufacture of folding boxes. Other wrapping and packaging paper and paperboard.

PAPER AND PAPERBOARD[4]

Code Heading	Definition
1683 PAPER + PAPERBOARD NS	Other paper and paperboard not elsewhere specified. Includes: Kraft papers for waxing, asphalting, water proofing, laminating, impregnating, spinning or twisting, gumming, etc., paper manufactured principally from furnishes other than sulphate pulp not included elsewhere, such as rope and jute paper, folder stock, blotting paper, filter paper, photographic sensitizing paper, etc. and paperboards not included elsewhere such as shoe board, gasket board, transformer board, press textile board, index pressboard, panel board (automative) trunk and suitcase board, matrix board. Construction paper and paperboard: Papers, paper felts and paper boards used in the construction of buildings and other structures for insulation, vapour real, roofing and flooring underlay, etc. They are made from fully refined material such as wood pulp, waste paper, other vegetable pulp and mineral fibre. Low thermal conductivity, moisture resistance, fire resistence permanency, insect and vermin resistance are desiderable characteristics of these materials (excluded are papers, felts or boards impregnated, satured laminated or further manufactured in any way and fibreboard or fibre building board, in the form of insulating board, medium hardboard and hardboard). Special thin paper: papers made for special purposes, their common characteristics being their relative thinness. They may be made from mechanical or chemical wood pulps, bleached or unbleached, but frequently from pulps containing flax, hemp or cotton fibre. Principal characteristics of some of these papers are: uniformity of surface and caliper, freedom from pinholes, strength close formation, opacity, low permeability, chemical purity - all related to special uses. Examples of types of paper included are: carbonizing tissue, condenser and capacitator paper, cigarette paper, lens tissue, pattern tissue, tea bag paper.

[4]Figures are given in weight

DATA COLLECTED

Heading	Definition
PRODUCTION	The total production of primary products is reported, even though a portion may immediately be consumed in the production of another commodity (e.g. wood pulp, which may immediately be converted into paper as part of a continuos process). An exception is made in the case of veneer production, which excludes veneer sheets used for plywood production within the country.
IMPORTS (Quantity) IMPORTS (Value)	Products for domestic consumption or processing shipped into the country. "In-transit" shipments are excluded; in certain instances, imports for re-export may be included. Value are normally c.i.f..
EXPORTS (Quantity) EXPORTS (Value)	All quantities of domestic origin or manufacture shipped out of the country. As indicated above under "Imports", re-exports may be included. "In-transit shipments are excluded. Value are normally f.o.b.

SPECIES

Heading	Definition
CONIFEROUS	All woods derived from trees classified botanically as Gymnospermae - e.g. fir (Abies), parana pine (Araucaria), deodar (Cedrus), ginkgo (Ginkgo), larch (Larix), spruce (Picea), pine, chir, kail (Pinus), etc. These are generally referred to as softwoods.
NON-CONIFEROUS	All wood derived from trees classified botanically as Angiospermae - e.g., maple (Acer), alder (Alnus), ebony (Diospyros), Beech (Fagus), lignum vitae (Guiaicum), poplar(Populus), oak (Quercus), sal (Shorea), teak (Tectona), casuarina (Casuarina), etc. These are generally referred to as broadleaved or hardwoods.

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CATEGORY	Unit x 1_____	Production Quantity	IMPORT Quantity	IMPORT Value	EXPORT Quantity	EXPORT Value
ROUNDWOOD	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
FUELWOOD + CHARCOAL	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
WOOD FOR CHARCOAL	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
FUELWOOD	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
INDUSTRIAL ROUNDWOOD	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
SAWLOGS + VENEER LOGS	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	_____	_____	_____	_____
Non-Coniferous	CUM	_____	_____	_____	_____	_____
PULPWOOD + PARTICLES	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
PULPWOOD (Round & Split)	CUM	XXXXX	_____	_____	_____	_____
CHIPS + PARTICLES	CUM	XXXXX	_____	_____	_____	_____
WOOD RESIDUES	CUM	XXXXX	_____	_____	_____	_____
OTHER INDUSTRIAL ROUNDWOOD	CUM	_____	_____	_____	_____	_____
Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX
Non-Coniferous	CUM	_____	XXXXX	XXXXX	XXXXX	XXXXX

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Processed wood and panels products	Unit x 1____	Production Quantity	IMPORT Quantity	IMPORT Value	EXPORT Quantity	EXPORT Value
CHARCOAL	MT					
SAWNWOOD + SLEEPERS	CUM					
Coniferous	CUM					
Non-Coniferous	CUM					
WOOD-BASED PANELS	CUM					
VENEER SHEETS	CUM					
PLYWOOD	CUM					
PARTICLEBOARD	CUM					
FIBREBOARD	CUM					
COMPRESSED	CUM					
NON-COMPRESSED	CUM					

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Pulp and paper products	Unit x 1____	Production Quantity	IMPORT Quantity	IMPORT Value	EXPORT Quantity	EXPORT Value
WOOD PULP	MT					
MECHANICAL	MT					
SEMI-CHEMICAL	MT					
CHEMICAL	MT					
SULPHATE UNBLEACHED	MT					
SULPHATE BLEACHED	MT					
SULPHITE UNBLEACHED	MT					
SULPHITE BLEACHED	MT					
DISSOLVING PULP	MT					
OTHER FIBRE PULP	MT					
WASTE PAPER	MT					
PAPER + PAPERBOARD	MT					
NEWSPRINT	MT					
PRINTING + WRITING PAPER	MT					
OTHER PAPER + PAPERBOARD	MT					
HOUSEHOLD AND SANITARY PAPER	MT					
WRAPG + PACKG PAPER + BOARD	MT					
PAPER + PAPERBOARD NES	MT					

CLASSIFICATIONS

Category	FAO Code	Harmonized System revised	SITC rev. 3	SITC rev. 2
ROUNDWOOD	1861			
Coniferous	1862			
Non-Coniferous	1863			
FUELWOOD + CHARCOAL	1864			
Coniferous				
Non-Coniferous				
WOOD FOR CHARCOAL				
Coniferous				
Non-Coniferous				
FUELWOOD	1629	4401.10	245.01	245.01
Coniferous	1627			
Non-Coniferous	1628			
INDUSTRIAL ROUNDWOOD	1865			
Coniferous	1866			
Non-Coniferous	1867			
SAWLOGS + VENEER LOGS	1868	Ex:44.03	Ex:247	
Coniferous	1601	4403.20	Ex:247.4	247.1
Non-Coniferous	1604	*4403.30, Ex: *4403.90	Ex:247.5	247.2
PULPWOOD + PARTICLES	1870			
Coniferous	1608			
Non-Coniferous	1611			
PULPWOOD (Round & Split)	1614	Ex:44.03	Ex:247	246.01
CHIPS + PARTICLES	1619	*4401.20	246.1	246.02
WOOD RESIDUES	1620	4401.30	246.2	246.03
OTHER INDUSTRIAL ROUNDWOOD	1871	Ex:4403 & 4404	Ex:247	247.9
Coniferous	1623			
Non-Coniferous	1626			
CHARCOAL	1630	4402.00	245.02	245.02
SAWNWOOD + SLEEPERS	1872	4407 & 4406	248	
Coniferous	1632	4407.10, ex:44.06	248.2	248.2/248.1Ex
Non-coniferous	1633	*4407.20, *4407.90	248.4, Ex248.1	248.3/248.1Ex
WOOD BASED PANELS	1873			
VENEER SHEETS	1634	44.08	634.1	634.1
PLYWOOD	1640	44.12	634.3/4	634.2, 634.41
PARTICLEBOARD	1646	44.10	634.2	634.32
FIBREBOARD	1874	44.11	634.5	641.6
COMPRESSED	1649	*4411.10 & *4411.20	634.51/52	641.61
NON-COMPRESSED	1650	*4411.30	634.53/59	641.62
WOOD PULP	1875			
MECHANICAL	1654	47.01	251.2	251.2
SEMI-CHEMICAL	1655	47.05	251.91	251.91
CHEMICAL	1656	47.03, 47.04		
SULPHATE UNBLEACHED	1662	*4703.10	251.4	251.71
SULPHATE BLEACHED	1663	*4703.20	251.5	251.72
SULPHITE UNBLEACHED	1660	*4704.10	251.61	251.81
SULPHITE BLEACHED	1661	*4704.20	251.62	251.82
DISSOLVING PULP	1667	47.02	251.3	251.6
OTHER FIBRE PULP	1668	47.06	251.92	251.92
WASTE PAPER	1669	47.07	251.1	251.1
PAPER + PAPERBOARD	1876			
NEWSPRINT	1671	48.01	641.1	641.1
PRINTING + WRITING PAPER	1674	48.02 + 48.09	641.2/3	641.2/7/94
OTHER PAPER + PAPERBOARD	1675	48.03 + 48.14	641.4/9	Ex:641
HOUSEHOLD AND SAN. PAPER	1676	48.03	641.63	641.72
WRAPG + PACKG PAPER + BOARD	1681	48.04+.05+.06+.08+Ex:.10	Ex:641.4/5/6/7	Ex:641
PAPER + PAPERBOARD NES	1683	48.07+Ex:.10+.11+.12+.14	Ex:641.3/7/9	Ex:641

Data collection, use and dissemination of forestry sector statistics (1 of 2)

Country	Hardware	Software	Applications
Botswana	None	None	None
Ghana	None	None	None
Kenya	IBM PC & Printer	Spreadsheet, Wordprocessing, Graphics packages	Programming, Regression analysis, Inventory and sales analysis, production & economic analys
Lesotho	IBM PC & AMSTRAD	Spreadsheet, Wordprocessing packages	Inventory, Research, Data processing
Liberia	AST PCs Epson & HP Printers	ACCPAC Windowing System Manager, LOTUS 123,dbase IV Wordstar Prof. 5.1	Payroll, Accounting, Statistical reports, Engineering, Mapping, Graphics, Documentary
Malawi	IBM, Olivetti,Burco	dBase III, LOTUS 123, Supercalc 4, SPSS pc, Word Perfect, Microsoft Word, LOTUS Manus.	Monitoring & Evaluation Research, SADCC data bank, Surveys analysis, Accounting, Planning, Reporting, Record Keep.
Mozambique	IBM compatibles	LOTUS 123, dBase, Word Perfect, Statgraphics, etc.	Data storage, Statisti cal analysis, Wordproc essing, Accounts, etc.
Nigeria	IBM PC & Compat.	LOTUS 123, dBase, SPSS, etc.	Monitoring & Evaluat., Management Inf. System, Forest Manag. tables, Sector Anal.& Strat.Pl, Accounting, Marketing
Sudan	IBM PC AT Toshiba 110 Epson Printers IBM PC	Spreadsheets, Wordprocessing, Utilities, Packag. Databases, etc..	Recording: Inventory and Management data, Data on personnel, Data on development project
Swaziland	Nil	Nil	Forest Management, Planning, Personnel Administration
Tanzania	None	None	None
Uganda	IBM PC & Compat.	MS DOS 4.1, LOTUS, dBASE III & IV, STATS, Wordproces sing, C compiler	Forestry Rehabilitation Project: analysis of inventory data, management. Forestry Statist.
Zambia	IBM PC XT, Epson Printer	Database,PCwrite, Wordstar,Wordperf. LOTUS 123, SYSTAT	Data collection, Data analysis, Report writing
Zimbabwe	IBM, Apple PC, Epson Printer	LOTUS 123, Wordperfect, Database	Inventory data and analysis, Accounting, Research data analysis, Wordprocessing

Data collection, use and dissemination of forestry sector statistics (2 of 2)

Country	Main data user	Computer Generated Publications	Forestry Publications and their issue
Botswana	None	None	None
Ghana	Ministry of Land and Natural Resources; Ministry of Finance and Economic Plan.	None	Forestry Department annual reports
Kenya	Forestry Department; Sawmill industry; Pulp industry	None	Annual reports; Sector review (2-4 years); Development Plans-5 yrs
Lesotho	Research section for Forestry Department Planning Units for Ministry of Agricul.	Progress reports	Annual Reports Data processing
Liberia	Financial Department Planning, Research & Statistics Departm. Forest Management & Forest Utiliz. Dep. Administration	None	None
Malawi	Forest Department; Ministry of Forestry & Natural Resources	Minutes of SADCC workshops & semin; Reports on: Man. & Eval.; Surveys; Projects. Others	Accounts Monthly; Man.&Eval. Quarterly & Annually; SADCC public. periodically
Mozambique	Ministries of: Agriculture & Forest; Energy; Planning & Trade. FAO and other International Organ.	Some unpublished issue.	Annual Statistics
Nigeria	All Forestry Departments; Forestry Research Institutes; Universities & Other Educational Inst.	None	None
Sudan	Planning & Inventory & Management Section and supporting staff of FAO project	Many reports by the FAO project (Fuelwood Development for Energy.	No periodicals but reports
Swaziland	Parent Ministry; Private Forest Industry; International Organizations	Nil	Annual Reports; Forest Nursery Manual; Forestry Extension Booklets; Forest Evaluatio Report
Tanzania	Agroforestry Resear. Unit and Forestry Department	None	Quarterly and Annual: Silviculture Research and Technical Notes
Uganda	FRP, Proj. Managem., Donor/Implementation Agencies, Forestry Depart., Government	Management/Working Plans for estates; FRP progress rep.; Annual Work programmes; Stat.Abstr.	General Progress Roport (semiannual, annual); Statistical Abstracts (annual)
Zambia	Forest Department (Management div.), Provincial forest offices	Forest Inventory & Forest Managements reports	Forest Dep. Annual Rep; Forest research bullet ins (occationally); Monthly prov. returns
Zimbabwe	Management and Planning Purposes	Nil	Annual Surveys: Roundwood processing

Organization of forestry statistics collection, processing and dissemination

Philip Wardle

The importance of forest products to the society through the supply of wood for energy, for construction and industry and trade means that a wide cross section of the people and the economy is involved way beyond the reach of a single ministry or of the forestry department. However the forestry ministry requires to have an overall view of the utilisation of the products and services in order to formulate sound policy and plands for the management of the forest resource.

To assemble the necessary information will require it to bring together forest production information, both of national forests and private, large and small, and trade information. Some of the information will be obtainable from routine records of state forest service and state enterprises. Some has to be collected through official enquiries or surveys. Some is collected through special returns by other departments such as industry or customs.

To get a comprehensive picture, the forest activity may have to carry out special surveys or gain access to the results of other departments' surveys. It may have to use both official information and "informal" information, for example from private associations or non mandatory enquiries.

The important requirement is that in order to get a comprehensive overview of the sector that the forest authority establishes a system to bring together data from all appropriate sources and to assemble it in a standard overview of the sector. This must extend beyond the narrow data coverage of the authority's direct operation to include the information necessary to build up comprehensive coverage of both state, private and communal operations in the sector. It must bring together formal records and estimates to create a sense of the whole activity and its magnitudes.

Part Two

COUNTRY BRIEFS

Presentation of country briefs

Country briefs were prepared by National particpants according to the following outline:

1. Introduction – background on the forestry sector
2. Forest sector statistics – statistical organization and its effectiveness
3. Informal sector products – fuelwood and charcoal, other forest products
4. Modern sector products – production and capacity of industrial roundwood, sawnwood, wood based panels and pulp and paper
5. Trade – imports and exports
6. Forest product prices
7. Summary, conclusions and recommendations

For each topic information was requested on:

- measurement units
- definitions
- method of survey
- coverage
- frequency
- offices responsible and
- publication

FAO statistics were provided to be checked for accuracy and for updating and completion where data are missing. At the end of each brief the data on production and trade updated to 1988 is attached.

The country brief and case study prepared for Tanzania examines the situation in depth in order to illustrate the range of problems associated with the collection, analysis and dissemination of statistics on the forestry sector.

Botswana

F. S. Alidi

INTRODUCTION

Botswana is one of the nine members of the Southern Africa Development Co-ordinating Conference SADCC. It occupies an area of about 580,000 Square Kilometres with a population of 11.3 million people of which 80% live in Eastern Botswana.

The average annual rainfall varies from 200 mm in the South Western Corner of the country to 700 mm in the North.

FOREST RESOURCES

The country has as Three Hand Tenure System - viz STATELAND which comprises about 24%, TRIBAL LAND comprising of about 70% and FREEHOLD LAND comprising of 6% of the land.

Of the total area of the country Gazetted Forestry occupies about 0.6%, 17% is occupied by the National Parks and Game Reserves which are administered by the Department of Wildlife, National Parks and Tourism under the Ministry of Commerce and Industry.

The Forest Reserves of the country are mostly located in the Northern part of the country namely the Chobe District. There are five Gazetted Forest Reserves.

1. Kasane Forest Reserve and the Kasane Extension Forest Reserve
2. The Chobe Forest Reserve
3. The Sibuyu Forest Reserve
4. The Kazuma Forest Reserve
5. The Maikaelelo Forest Reserve.

FOREST SECTOR STATISTICS

Statistical data in Botswana is mainly compiled by the Central Statistics Office in the Ministry of Finance and Development Planning. The Customs Office also under the Ministry of Finance and Development Planning collect statistical data with regards to Trade (Export and Import).

The Forestry Division which is under the Ministry of Agriculture compiles data on Production of Roundwood from the Forest. The four major sawmills in the country and wood-based industries and manufacturing companies also compile their own data.

The Forestry Division is being strengthened as of April, 1990 and the Ministry of Agriculture intends to establish a Forestry Planning and Economic Unit which will be responsible for Forestry Inventories and Collection of Forest Products Statistics. Currently, the Forestry Division relies on the Planning and Statistics Unit of the Ministry of Agriculture to carry out all its planning activities.

Statistical data available to the Forest Division is either collected by the foresters or is a result of Forest Projects -Reports such as Energy Resources Limited "Study of Energy Utilization and Requirements in Rural Sector of Botswana"-London, 1985, e.t.c.

INFORMAL SECTOR PRODUCTS

Fuelwood and Charcoal

Collection of statistical data on fuelwood and charcoal was first carried out in 1984-85 by Energy Resources Limited -Study of Energy Utilization and Requirements in Rural Sector of Botswana, commissioned by the Energy Unit of the Ministry of Mineral Resources and Water Affairs. Another study on energy consumption was carried out by the Norwegian Forestry Association - Odegaad, O and Seip, H.K. - Dukwe Forestry Project in 1985 -which was commissioned by the Office of the President. Currently, 1988 - 89. The World Bank are carrying out an Assessment of Biomass availability in areas of Botswana and Zambia (Reports to be available in 1990). Firewood Marketing in urban Botswana by D.L. Kgathi October, 1989 - commissioned by the World Bank and Ministry of Mineral Resources and Water Affairs -Botswana.

Botswana

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	870000	901000	934000	969000	1005000	1042000	1078000	1116000	1156000	1197000
INDUSTRIAL ROUNDWOOD	57000	59000	61000	64000	66000	68000	71000	73000	76000	79000
Import Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	6000	6000	6000	6000	6000	6000	8100	8100	8100	8100
PAPER AND PAPERBOARD	500	500	500	500	500	2800	7000	7000	7000	7000
Import Value (1000 US$)										
SAWNWOOD & SLEEPERS	1080	1080	1080	1080	1080	1080	1369	1369	1369	1369
PAPER AND PAPERBOARD	550	560	560	560	560	4747	8046	8046	8046	8046

Ghana

Robert T. Yayah

1. INTRODUCTION

1.1. Land use and forest production

The closed forest zone covering an area of some 82,258 km^2 of land or 34.50% of the land mass of Ghana makes a significant contribution to the national economy as it contains the country's present commercial timber wealth.

The remaining 65.50% or 156170.99 km^2 is made up of Savannah woodland which by contrast has little potential for timber production. This less productive zone has an important function in the production of building poles, fence posts, fuelwood, charcoal, food, fodder and medicinal plants.

1.2. Main functions of forest

The forests in Ghana play very important roles. The closed forests protect our water resources or catchment area to ensure permanent water supply for the local people. They also check soil erosion. The forests serve as wind breaks and also as natural habitats for the wild animals. They provide wood for constructional purposes and provide timber for export to earn foreign exchange for Ghana. Forests in Ghana create ideal micro climate.

The Savannah woodlands provide fodder for grazing animals.

1.3. Forestry in the economy

It is on record that Forest Products are second to cocoa in earning foreign exchange for Ghana. It is perhaps the wealth aspects of the forest resource that is most easily discernible as forest produce in one form or the other which appears as an object of commerce.

Forest Products exported to other countries in the form of logs, sawnwood or lumber, veneer, plywood and others earn significant foreign exchange for Ghana.

The wood-based industries set up all over the country provide job opportunities for Ghanaians in the rural areas where over 80 per cent of the people live.

Local demand for fuelwood and charcoal which provide source of energy for about 90% of Ghanaians also provide job openings for many individuals in the country.

Relative humidity is higher in the forests than in the open and has some bearing on the success of some agricultural crops especially cocoa whose success is considerably aided by the forest environment.

It is a fact that cocoa is the leading foreign exchange earner for this country.

This country was in some years back the world's leading cocoa producer but it is now ranked third due to depletion of some of our forests which created favourable climatic conditions of its growth.

In Ghana forestry plays significant role in the national economy since exploitation in the Forest Reserves is on sustainable basis, though there is to some degree a depreciation of capital stock. However, the unreserved forests are being exploited on non sustainable basis for fear that farmers might destroy the economic species available not taking into account the depreciation of capital stock.

The house and buildings in which we live and work, the furniture in them, the fuel for culinary purposes in most Ghanaian homes, the pestle and the mortar so essential for the popular fufu, canes for the rattan industry, boats which our fishermen use, bodies of mammy trucks and railway wagons, railways sleepers indispensable in transportation, the handles of many an agricultural implement, many pharmaceutical extracts vital for health, complex products such as veneer, plywood and by products like resins, latex, and essential oils are examples of forest produce that daily contribute to our wealth and general well-being.

2. FOREST SECTOR STATISTICS

Different institutions are involved in the activities of Forestry in Ghana. These comprise the Forestry Department, the National Energy Board, the Timber Export Development Board, the Forest Products Inspection Bureau, the Statistical Department, and the Customs, Exercise and Preventive Services (CEPS).

While the Forestry Department concerns itself with the measurement and counting of all trees felled in the Forest Reserves in the country, the Forest Products Inspection Bureau (FPIB) deals with the measurement and grading of all logs leaving the forests (reserved and

non reserved) for the sawmills and also for export. Plywood, Veneer, Sawnwood and other forest products are also measured and graded by the FPIB and certificates issued to cover them. Quality, is controlled by this institution.

The Timber Export Development Board (TEDB) deals with all timber being exported outside the country as regards levying of taxes on the face value of the product. For instance, the TEDB levies one percent on the face value of the product in foreign currency and two percent in local currency for the accounts of TEDB and FPIB. These two institutions are now performing the functions of the defunct Timber Marketing Board. It is the duty of the TEDB to find markets overseas for our lesser known species since our primary species are fast depreciating in stock.

The duties of these two institutions are regular (or say daily) and compile monthly reports to the Forestry Department, CEPS, Statistical Department, and Ministry of Trade for records.

3. INFORMAL SECTOR PRODUCTS

Statistics on charcoal and fuelwood are collected on monthly basis and embodied in the annual reports.

Surveys have been carried out by the National Energy Board and Statistical figures are based on estimation with regards to demand by the people. Data for 1989 are projections upon the previous years as given by the National Energy Board and the Annual Report of the Forestry Department.

Other important forests products in Ghana are canes for weaving, latex, resin and gum for which there are no consistent surveys and therefore no data.

4. MODERN SECTOR PRODUCTS

The main products in this sector, in Ghana are sawn timber, roundwood (logs), railway sleepers, plywood and veneer. Data are collected by the Forest Product Inspection Bureau.

Data for railway sleepers are obtained from the Ghana Railways Corporation Head Office.

The paper industry in this country is in its infancy. The Subri Industrial Plantations Ltd. is being funded by the African Development Bank (ADB) to establish plantations for the paper industry.

5. TRADE

Trade statistics on imports and exports are collected by the External Trade Section of the Department of Statistics. The Customs, Exercise and Preventive Services also collect some of these data. They are collected on monthly basis and the embodied in an annual report.

Products imported into this country are pulp and paper boards. Only some few data are available.

6. FOREST PRODUCT PRICES

The Statistics on the above are collected from the Department of Statistics and expect those of Fuelwood and charcoal which were collected from the National Energy Board and Forestry Department. The 1989 data for Logs, Sawnwood, Plywood and veneer are for January-August 1989. The fuelwood and Country charcoal figures for 1989 are projections up to the end of the year.

Royalties are recorded for 1976 - 1989.

7. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Since some of the National Statistics of the Forestry sector are not reliable, it is time the different organizations such as the National Energy Board, Forestry Department, Timber Export Development Board, Forest Products Inspection Bureau and the Department of Statistics came together to set up a strong Statistical Unit for data collection and data analysis.

The present Forestry Administration is seriously considering setting up a Statistical Unit within the department to deal with the situation.

Ghana

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	9462000	11951000	12440000	13535000	15253000	15430000	15459000	15483000	15724000	15924000
INDUSTRIAL ROUNDWOOD	1271000	981000	931000	791000	955000	984000	1081000	1101000	1101000	1101000
SAWNWOOD & SLEEPERS	345000	225000	225000	215000	275000	285000	345000	355000	455000	455000
CHARCOAL	0	384000	398000	431000	491000	507000	508000	509000	527000	529000
PANELS	62500	78500	73500	67500	49500	57500	65500	73500	78500	82500
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	198400	104900	54100	53200	61600	70000	129900	176700	318600	338900
SAWNWOOD & SLEEPERS	77600	69400	52900	39600	42600	56400	80300	102300	172900	169600
PANELS	7300	9000	7200	5600	9700	11700	14300	16800	22700	22300
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	18573	12398	4391	3469	4311	5140	9550	18440	39505	45420
SAWNWOOD & SLEEPERS	20508	23212	11974	6640	7686	10051	14077	18000	43636	45365
PANELS	2912	3330	2205	1075	1948	2593	2960	3082	8195	9288
Import Quantity (CUM/MT)										
PANELS	300	300	300	300	300	0	0	0	0	0
PAPER AND PAPERBOARD	8000	6700	10700	4000	6900	7800	9200	6800	7300	7300
Import Value (1000 US$)										
PANELS	194	194	194	194	194	0	0	0	0	0
PAPER AND PAPERBOARD	3205	2835	8435	2790	3829	4329	5329	4079	4344	4344

Kenya

C.D. Kahuki

1. INTRODUCTION

Kenya has a total area of approximately 582,646 sq. km of which approximately 2.187 million ha. is classified as forests, and consisting of 1.661 million ha. gazetted and 526,000 ha. ungazetted forests, privately owned forests are only 125,000 ha.

Of the total public reserves, 165,000 ha. are industrial plantations of mainly Pines (*P. patula, P. radiata*) and Cypress (*Cupressus lusitanica*). These plantations supply over 90 per cent of industrial wood currently being produced in the Country.

The annual industrial roundwood supply is about 480,000 m^3 Sawlogs, 320,000 m^3 pulpwood and 75,000^3 plywood and 5,000 m^3 fibreboard material, totaling approximately 880,000 m^3.

In recent years, environmental concern by the government has severely restricted harvesting in the natural forest and supplies from these forests are around 10,000 m^3 of hardwood sawlogs per year and this quantity is gradually declining.

It is estimated that fuelwood consumption in the Country is in the region of 32 million cubic metres. Estimates of supplies from reserved public forests is about 140,000 m^3 while the bulk comes from agricultural settlements and communal rangelands.

2. FOREST SECTOR STATISTICS

Organization

There is no specific central unit responsible for collection of the Sector Statistics. Each Departmental Section collects statistics which have relevance to the section such as Management Section collection data on forest areas, distribution and stocking, Economic Section collects economic and financial data while Marketing Section collects data, on timber sales.

The data collected is primarily on gazetted Central Government forest reserves which the Forest Department has direct control on.

Apart from fuelwood data coverage of other data is relatively comprehensive since most of the forests outside Central Government category such as Trust/ Local Government Forests are mainly protective and xploitation is minimal.

In case of fuelwood, even within gazetted Central Forests, there are areas and categories of fuelwood which are collected free (dead branches, twigs and logging residue) that is not recorded, hence no quantifying data. In some cases fuelwood is sold on a monthly licence that allows the holder to collect a headload per day and this is again difficult to quantify as there are not removal records.

3. INFORMAL SECTOR

Fuelwood and charcoal

Information on production and consumption of fuelwood and charcoal is extremely scanty and particularly as in case of production.

The Forest Department records only Commercial and Industrial fuelwood sold in stacks from forests under its jurisdiction, in which case domestic fuelwood collected from these forests by headloads and from outside these forests is not recorded by any authority. Forest Department data on fuelwood is reported in annual reports of the respective district and compiled in the Department annual reports.

Coverage is incomplete at the national level due to information gaps at different stages of compilation along the chain from the lower levels.

The Ministry of Energy has a fuelwood unit which co-ordinates fuelwood energy matters such as supply and consumption surveys and to some extent fuelwood plantation projects in the country.

Charcoal production and supply is wholly in the informal Sector and data is virtually non-existent.

4. THE MODERN SECTOR

Industry

The modern sector comprises of:

	1988 (EST)	Capacity (000)	Production (000)
Sawmills-approx	280	270 m^3	188 m^3
Plywoodmills	3	5	34
Fibreboard mills	1	8	6
Woodpulpmills	1	75 MT	64 MT
Particleboard (Plywood Integrated)	1	12	10

Forestry Department is almost the sole supplier of raw material and main source of statistics on this sector.

Trade

The Country's trade in forest products has been declining. Sawnwood export is restricted by Government and import is limited to hardwoods for furniture. Wood-based panels and pulp and paper produced is mainly consumed domestically and the domestic market for them expanding rapidly.

Internal trade statistics are collected by the Forest Department through questionnaires sent to producers such as the major sawmills, Plywood mills, fibreboard mill and Pulp and Paper producers.

The main problems in this collection is non-return of questionnaires and incomplete or incorrect returns where information is supplied by junior staff. The information received however if meticulously analyzed give a fair indication of the state of the market and trade trends. No reports are published by the Department.

The external trade statistics are supplied by the Ministry of Commerce which normally publishes Annual Trade Reports. The only shortcoming is that sometimes the Trade Reports are delayed in publication for long periods. Another problem is where some statistics indicate only the value and not physical quantities traded especially where some categories of items such as classes of papers are not *specified.*

External trade coding system used in Kenya currently is the SITC Rev. 3.

The Statistical Abstract contains a summary of Production and Trade figures.

Up to 1981 Kenya used to export sawntimber primarily plantation softwoods - Pines and Cypress, but then there was imposed a Government restriction and currently export is restricted only to special cases, hence very little. Importation of sawntimber has been limited to hardwoods for furniture and joinery hence also small quantities.

There is no restriction in import and export of Pulp, Paper and paper products as well as wood panels but trade is determined by domestic production and consumption.

Prices

Prices have been rising rapidly as a result of similar increases in royalty for logs and restriction in exploitation of natural forests.

Due to continued restriction on cutting timber in natural forests occasioning continued decline in supply of tropical timbers, their prices have been escalating. A virtual ban in exploitation of Mt. Kenya forests in 1985, the main forest supplier of these forests resulted in rocketing prices for Camphor (*Ocotea usambarensis*) and Meru Oak (*Vitex*). It had similar effect on prices of Australian Silkwood formerly considered inferior timber as an alternative hardwood (*Crevillea robusta*).

Mushavage (*Olea welwetschi*), Podo and Cedar (*Juniperus procera*), formerly popular timbers are virtually non-existent in the market for some years now due to existent in the market for some years now due to dwindling supplies in forests and government restriction in their exploitation, hence no prices given.

Prices of Cypress (*Cupressus lusitanica*) and Pine (mainly *Pinus patula* and some *P. radiata*) have been heavily influenced by government royalties which have always been increased annually (since 1975 to 1980 at 12% + inflation, 1980 - 1983/4 at 10% + inflation and since 1983/4 by the evaluated plantation replacement cost).

Since 1983/84 most of plantation timber sale has been on stumpage and this change from the traditional log ground scaling had an effect on the stumpage value charged per m^3 and resulted in sharp increases on a m^3 of sawnwood.

Kenya

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD & CHARCOAL	23948992	24908000	25914000	26972992	28088992	29258000	30483008	31778992	33135008	34564000
INDUSTRIAL ROUNDWOOD	1528000	1397000	1272000	1301000	1383000	1514000	1545000	1578000	1613000	1650000
SAWNWOOD & SLEEPERS	151000	181000	181000	181000	181000	181000	181000	181000	181000	181000
CHARCOAL	1472000F	1531000F	1593000F	1658000F	1727000F	1799000F	1874000F	1954000F	2037000F	2125000F
PANELS	19000	61000	52000	65000	59000	69000	69000	69000	69000	69000
WOOD PULP	47000	50000	52000	53000	53000	53000	53000	53000	53000	53000
PAPER AND PAPERBOARD	61000	62000	63000	61500	66000	69000	105000	105600	105700	105800
Export Quantity (CUM/MT)										
FUELWOOD AND CHARCOAL	46200	0	0	0	0	27600	0	0	0	0
INDUSTRIAL ROUNDWOOD	4600	3300	7000	6800	11100	6000	0	0	0	0
SAWNWOOD & SLEEPERS	5900	10300	5300	4100	1800	2700	1800	3400	3400	3400
CHARCOAL	7700	0	0	0	0	4600	0	0	0	0
PANELS	600	400	400	400	0	0	0	0	0	0
PAPER AND PAPERBOARD	19200	19300	19300	6700	3000	1700	1800	700	700	700
Export Value (1000 US$)										
FUELWOOD AND CHARCOAL	442	0	0	0	0	338	0	0	0	0
INDUSTRIAL ROUNDWOOD	506	439	1060	521	1073	579	0	0	0	0
SAWNWOOD & SLEEPERS	737	1975	814	419	170	347	171	329	329	329
CHARCOAL	442	0	0	0	0	338	0	0	0	0
PANELS	353	304	304	304	0	0	0	0	0	0
PAPER AND PAPERBOARD	10650	10674	10674	3867	1864	1275	1304	457	457	457
Import Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	100	0	0	0	0	0	0	0	0	0
PANELS	2300	2600	800	1700	1400	1300	7500	11500	300	300
PAPER AND PAPERBOARD	35800	28600	29200	19900	16000	11500	26500	32600	32600	32600
Import Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	19	0	0	0	0	0	0	0	0	0
PANELS	1874	1245	399	896	722	475	963	853	314	314
PAPER AND PAPERBOARD	28697	25377	25653	19569	17533	9898	17734	21941	21941	21941

Liberia

Albert B. Gbanya and James W. Doe

COUNTRY BACKGROUND

Liberia is a developing country with a population of 2.3 million people. The country is located on the West Coast of Africa and is bounded by Sierra Leone to the West, Ivory Coast to the East, Guinea to the North and the Atlantic Ocean to the South.

The Republic of Liberia covers a total land area of 111,369 square kilometers or 37,700 square miles, an equivalent of approximately 24.0 million acres. The climate is Tropical. The annual rainfall decreases from 4,500 mm to 2,200 mm along the Central and Northern parts of the Coast and the temperature varies from 21°c to 32°c.

ECONOMY

The Liberian economy is predominantly characterized by the free-enterprise system buttressed by the Government "Open Door Policy".

The Gross Domestic Product (GDP) in 1986 and 1987 were 906.5 and 922.5 million dollars respectively.

IMPORTANCE OF FORESTRY STATISTICS

Liberia is endowed with rich tropical forest resources which have manifold functions. In terms of economic contribution, these resources serve as source of timber, domestic energy (charcoal and fuelwood) and income, while at the same time fulfilling important social and environmental functions, e.g. keeping the air clean, stabilizing the water table, protecting against soil erosion, serving as wind break, maintaining watershed and providing homes for our wildlife and recreational facilities.

Forestry plays an important role in the socio-economic progress and growth of Liberia. Therefore, there is a dire need for rational planning of the forestry industry for its meaningful sustained contribution to the development of the nation.

There is no doubt that the primary basis for the rational planning of the industry largely depends on the availability of realistic statistics.

Such statistics required are collected, analyzed and processed through the interplay of data/information derived from the following sources:

a. Internal

Annual Coupe
Tally sheets
Monthly production summary
Waybills (export and local)
Export contracts
Bill of lading
Port manifest
Export and import statistical publications of the Ministry of Planning and Economic Affairs
Surveys and interviews

b. External

Publications of international organizations involved in the collection and compilation of forestry statistics:

- FAO Forest Product Statistics
- International Tropical Timber Organization (ITTO)
- African Timber Organization (ATO)

FOREST ESTATE

The forest resources (high forest area) of Liberia covers 4,790,000 hectares or 11,836,090 acres.

About 37,000 hectares or 1% of the total high forest area is lost annually to deforestation activities (e.g. shifting agriculture, road development, mining, human settlements and to a lesser extent logging operation).

Timber harvesting within the National Forest areas and other productive forest land is regulated on the basis of a 4% annual coupe which leads to a 25 years felling cycle.

SPECIES COMPOSITION

Species found in the forest are in excess of 250 and those of present day commercial value accout for about 75. The average growing stock of commercial size timber in the national forest is about 21.7 m^3/ha. The sustainable supply of commercial size timber on the basis of the felling cycle (4% annual coupe or 25 years felling cycle) is considered to be about 3.4 million cubic meter per annum, and the annual production reached the 1.0 million m^3 mark in 1988.

Geographical distribution of forest areas:

Sector	Million Hectares	Million Acres	%
South Eastern	2.727	6.736	57
North Western	1.205	2.977	25
Northern	0.059	0.147	1
Others	0.799	1.976	17
TOTAL	4.790	11.836	100

Composition of forest estate (million acres):

Types	Acres	Hectares	% Share
Undisturbed productive (protected)	4.2	1.70	35
Disturbed productive (unprotected)	5.4	2.18	45
TOTAL PRODUCTIVE	9.6	3.88	80
Disturbed unproductive (unprotected)	2.4	0.97	20
TOTAL	12.0	4.85	100

CONCESSION HOLDING (HA)

About 3.7 million hectares of forest land are presently under concession agreement.

Besides, the concession holdings a total of 0.6 million hectares of logged-over areas and privately owned land are granted to operators for extraction of standing commercial species under salvage permit.

PRODUCTION (1983-1988) (M^3)

Industrial round wood (saw and veneer logs) production for the last five years, 1983 - 1988 increased from 344,000 m^3 - 1,008,000 m^3 while actual export for the same period increased from 223 m^3 to 681 m^3.

Production (1983-1988) (m3)

Year	Production ($000m^3$)	Actual export ($000m^3$)	% of export to PRODUCTION
1983	344	223	65%
1984	317	183	58%
1985	410	258	63%
1986	540	358	66%
1987	810	444	55%
1988	1,008	681	68%

LOG PRODUCTION BY COMPANY AND SPECIES (JANUARY - DECEMBER 1988)

Forty-five registered logging companies harvested about thirty-eight species with the ever highest volume of 1,008,000 m^3 in the history of Liberia forestry.

Log production by species (January-December 1988)

Species	Volume (M^3)
SIPO/UTILE	22,833
MAKORE	15,783
SAPELE	6,627
KOSIPO	5,918
TIAMA/EDINAM	13,926
ACAJOU/KHAYA	7,680
DIBETOU/LOVOA	47,430
NIANGON	332,376
BOSSE/GUAREA	3,565
IROKO	23,140
BETE/MANSONIA	1,180
AMAZAKOUE	3,883
WAWA/OBECHE	25,033
FRAMIRE	53,697
ANIGRE	16,877
FRAKE/LIMBA	1,946
TALI	9,658
DANTA/KOTIBE	2,045
NAGA	12,063
ILOMBA	2,215
AFZELIA/DOUSSIE	194
SIKON/TETRA	129,637
MOVINQUI	5,634
KOTO	783
KUSIA/BILINGA	19,031
AIELE	16,476
AZOBE/EKKI	38,919
ABURA/BAHIA	52,808
LIMBALI	70,986
BOMBAX/KONDROTI	3,399
DAHOMA/DABEMA	4,285
SACLOGLOTTIS/OZOUGA	61
DANIELLIA/FARO	4,455
MAMMEA/OBOTO	333
CEIBA/FROMAGER	327
AVODIRE	10
ANTIARIS	4,572
DIDELOTIA	43,899
OTHERS	4,860
TOTAL	1,007,562

Log export by destination (January - December 1988)

Destination	Volume (M^3)	FOB (US$)
France	246,025.735	35,286,893.85
Germany	60,297.202	9,049,959.83
England	15,836.874	2,394,838.15
Spain	22,120.105	3,334,926.38
Holland	6,837.830	735,360.58
Italy	47,861.312	6,237,289.91
Thailand	11,929.580	1,101,997.40
India	53,536.774	4,855,866.79
Russia	3,338.772	532,846.00
Morocco	1,778.618	184,945.44
Portugal	128,403.483	15,671,017.37
Belgium	161.584	16,966.32
Israel	13,046.108	1,351,537.82
Greece	32,168.079	3,194,148.78
Austria	2,117.269	284,820.74
South Korea	14.791	1,331.19
Turkey	31,042.649	3,172,279.99
Brazil	4,511.148	367,138.32
TOTAL	681,027.883	87,774,164.86

NATIONAL REFORESTATION/AFFORESTATION

The National Reforestation Program started in 1971. Up to date 9,020.4 hectares of both exotics and indigenous species have been planted at fifteen sites.

LOG EXPORT BY DESTINATION AND SPECIES (JANUARY - DECEMBER 1988)

Logs during the last two years account for over ninety-five percent 95% of the export trade in wood products. In 1988, 861,000 m^3 were exported. The traditional market for Liberia's wood products is Europe (EEC Countries). This market however, has extended to the Middle East, Asia and South America.

CONTRIBUTION OF THE FORESTRY SECTOR

The forestry sector is export oriented in nature. In terms of foreign exchange earning logs and lumber occupy the third place among various export commodities, the first and record places being occupied by iron ore and rubber respectively.

Log export by species (January-December 1988)

Species	Average unit Volume(M^3)	FOB US$	Price(US$)
SIPO	16,752.798	3,226,432.17	193
TIAMA	8,488.464	1,231,883.94	145
KOSIPO	2,397.367	379,238.66	158
SAPELE	3,678.192	603,661.42	164
KHAYA	5,512.040	896,346.76	163
LOVOA	33,226.628	4,832,669.93	145
MAKORE	7,403.175	1,342,021.15	181
NINAGON	241,119.584	35,846,571.83	149
BOSSE	2,423.233	324,224.29	134
FRAMIRE	33,757.775	4,978,380.53	147
ANINGRE	12,820.568	2,413,150.90	188
MOVINQUE	3,435.872	492,485.49	143
AIELE	6,997.163	587,390.72	84
TETRA	121,605.358	11,717,122.55	96
KUSIA	7,886.602	896,404.29	114
LIMBALI	45,097.569	3,994,185.90	89
EKKI	23,507.649	2,224,942.66	95
DANTA	2,203.967	231,430.96	105
IROKO	11,270.341	1,680,465.83	149
LIMBA	658.956	74,236.60	113
BOMBAX	706.437	65,062.41	92
ETIMOE	338.818	39,518.53	117
AKATIO	418.633	61,959.79	148
TALI	4,581.676	401,718.90	88
NAGA	6,324.458	557,984.35	88
DIDELOTIA	26,081.062	2,304,658.94	88
ANTIARIS	574.990	42,079.10	73
FARO	1,048.678	87,643.46	84
WAWA	11,452.980	1,187,826.86	104
OBOTO	15.254	1,372.86	90
ABURA	35,187.446	4,548,616.45	129
DAHOMA	760.637	67,141.35	88
ILOMBA	347.475	33,605.13	97
AFZELIA	104.559	12,636.27	121
ANAPYXIS	14.294	1,110.85	78
CYNOM	166.177	14,955.93	90
KOTO	419.740	48,425.51	173
BODO	44.998	7,789.62	115
MANSONIA	806.581	120,094.83	149
AMAZAKOUE	1,278.097	184,935.00	145
FRAMGRE	35.583	3,914.13	110
KONDROTTI	76.009	7,868.01	104
TOTAL	681,027.883	87,774,164.86	

Major export 1983 - 1987 (US$)

Product/year	1983	1984	1985	1986	1987
Iron ore	267.3	279.0	279.4	248.4	217.8
Rubber	73.1	91.1	77.1	80.7	89.4
Logs & Timber	23.5	23.5	25.0	33.0	35.7
Diamond	17.2	10.9	4.7	6.4	11.0
Coffee	18.2	13.7	27.3	16.2	10.0
Cocoa	11.5	15.3	11.2	8.9	6.0
Other export	10.0	13.0	5.5	8.5	8.9
Re-export	6.8	5.4	5.2	6.2	3.5
Total export (FOB)	427.6	452.1	435.6	408.4	382.2
% of logs and Timber in Total FOB $	5%	5%	6%	8%	9%

The forestry industry contributed to the Gross Domestic Products (GDP) at current factor cost in 1983 and 1987 32.8 and 48.0 million US dollars respectively.

Year	% of forestry Total GDP (Current) (US$)	Forestry contribution (Absolute) (US$)	Sector in total GDP (US$)
1983	978.8	32.8	3
1984	967.2	34.8	4
1985	959.3	34.0	4
1986	936.2	42.0	4
1987	972.8	48.0	5

Employment in the forestry sector is put at 6,000 which according to industrial interpretation means over 30,000 persons are directly depending on forestry activities for their well-being.

Liberia

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	3824000	3978000	3726000	3880000	3594000	3738000	3898000	4608000	4674000	4734000
INDUSTRIAL ROUNDWOOD	866000	859000	569000	506000	469000	447000	544000	678000	953000	1155000
SAWNWOOD & SLEEPERS	166000	143000	199000	172000	161000	153000	169000	191000	411000	411000
CHARCOAL	254000F	263000F	271000F	280000F	289000F	298000F	308000F	318000F	329000F	339000F
PANELS	17000	9100	4400	3800	5000	5000	5000	5000	5000	5000
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	389000	474800	255400	230300	223000	183500	257700	370000	250500	681000
SAWNWOOD & SLEEPERS	68300	44700	24300	18300	10800	6200	6500	7700	4700	14300
PANELS	7700	4100	4000	3700	1900	1900	1900	200	200	5200
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	58000	84000	46213	37101	28022	22568	33369	48973	34587	87774
SAWNWOOD & SLEEPERS	16413	11413	7079	4115	2869	915	1518	2054	1369	4176
PANELS	1685	774	589	373	234	234	234	87	70	1779
Import Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	1400	46500	46500	14000	14000	5500	5500	0	0	0
PANELS	400	800	400	400	500	300	400	300	200	200
PAPER AND PAPERBOARD	2000	900	800	600	600	700	1000	2100	2100	2100
Import Value (1000 US$)										
SAWNWOOD & SLEEPERS	74	3900	3900	4475	4488	472	472	0	0	0
PANELS	388	774	400	400	601	465	519	363	294	294
PAPER AND PAPERBOARD	1978	1135	955	841	785	867	1335	1665	1648	1648

Malawi

EE.D. Misomali

1.0 INTRODUCTION

1.1 Background

Malawi is a small and landlocked country lying in the South-east African region between latitudes 32° and 36° East and longitudes 9° and 17° South. The total population in 1987, according to the 1987 population and housing census, was 7.9 million and is growing at 3.7 percent per annum.

Out of the total land area (119,140 square kilometers), 38% is classified as forest. Of this forest area, 11% is accounted for by national parks and game reserves, 10% by forest reserves, and protected hillslopes, and the remaining 17% by natural woodlands on customary land. The breakdown of forest land is as shown in Table 1.

TABLE 1

Malawi's forest area by type of management

	(Thousand hectares)
Forests on customary land	2700
National parks and game reserves	1000
Gazetted forest reserves	980
Timber plantations[a]	(80)*
Fuelwood plantations[b]	(76)*
TOTAL	4680

[a]Applies to timber and pulpwood plantations raised by Government.
[b]Includes Government as well as non-Government fuelwood plantations.
*Included in forest reserves and forest on customary lands.
Source: (Department of Forestry, 1989).

The natural forests consist mainly of the genus *Brachstegia* and *Isoberlinia* (Miombo woodlands) while the planted forests are dominated by Pines *(P. patula and kesiya)* for timber and Eucalyptus *(E. camaldulensis, tereticornis, saligna and grandis)* for fuelwood production.

1.2 Main functions of forests

Forests in Malawi play a vital role in both social and economic development in the country, providing over 90% of the nation's domestic and industrial requirements, a substantial volume of timber and significant environmental benefits. Table 2 presents the major consumers of wood.

TABLE 2

Estimated wood consumption, 1989

Consumer Category	Consumption (million m³)	Percentage (%)
Fuelwood:		
Rural Households	6.2	54.4
Urban Households	1.1	9.6
Tobacco and Tea Estates	1.9	16.7
Small scale industries	1.0	8.8
Urban Services and industries	0.2	1.8
Sub-total	10.4	91.0
Building Poles	0.8	7.0
Wood-processing	0.2	1.9
Total	11.4	100.0

Source: Estimates by the Author.

More than 90% of the rural and 84% of the urban population use fuelwood for cooking, boiling water and space heating and per capita consumption is estimated at 0.8 m^3 and 1.4 m^3 per annum by rural and urban population, respectively. The tobacco and tea industries, which represent Malawi's chief sources of foreign exchange earnings, are critically dependent on large supplies of fuelwood for curing and barn construction. In addition, small-scale industries use wood for a variety of purposes including beer brewing, lime burning, brick burning, and smoking fish and meat.

The forest continues to play a vital role in the supply of timber to the wood-using industries. Sawmilling is the main wood processing activity in the country. The large sawmills are owned by three private companies: Wood Industries Cooperation (WICO), International Timbers Limited (ITL) and the newly established Viphya Plywood and Allied Products (VIPLY). Other companies include Lakeland Company which is only involved in production of plywood and blockboard on small-scale and the match company. In addition to factory sawmilling, there are a number of pitsawyers operating on licence in both natural woodlands and plantations.

Forests also play an important function in environmental protection and stabilization. For instance, in certain areas, forest cover is particularly important in the protection of steep slopes and upper river catchments

from effects of soil erosion, river siltation, flash flooding and low rain infiltration of soil. While no studies have been conducted to quantify the benefits of forests in protecting the environment, studies carried out by the Ministry of Agriculture on soil erosion indicated that losses of soil and nutrients on deforestated and poorly farmed areas are ten times higher than on well managed and conserved area.

In addition to providing domestic and industrial energy requirements, timber and environmental protection, forests in national parks and game reserves offer an unrivalled variety of scenery, fauna and flora and are a great attraction to recreationists and tourists. Considerable foreign exchange is realized from the tourists who visit the forests.

2.0 FOREST SECTOR STATISTICS

Forestry statistics in Malawi are collected and disseminated by the Forestry Department, Ministry of Trade, Industry and Tourism, National Statistical Office and Wood-using Industries. In Forestry Department, the sections involved in collection of statistics are as follows:

- Management and Planning Unit: responsible for collection and dissemination of growth and yield statistics through inventory studies.
- Energy Studies Unit: responsible for collection and dissemination of wood consumption and other wood-energy related statistics through special surveys.
- Monitoring and Evaluation Unit: responsible for collection and dissemination of all information pertaining to the Second Wood Energy Project.
- Forest Plantation Stations: responsible for collection and dissemination of planted area statements.
- Forest Research Institute of Malawi: responsible for collection and dissemination of plantation management statistics.

Flow of information or statistics within Forestry Department is from the field to the Department Headquarters then to Ministry Headquarters, see Chart on the next page. Information is disseminated in form of written reports from the field level up the administrative hierachy. At Department level, the statistics are compiled into an annual report which is disseminated to forestry offices and to the Ministry. Within the Ministry, there is a Planning and Statistical Unit which is responsible for aggregation and dissemination of the information at Ministry level. The

Information flow chart

Level	Office (r)	Frequency
National	Ministry Hqs. (Permanent Secretary)	Quarterly
National	Department Hqs. (Chief Forestry Officer)	Quarterly
National	Regional Office (Regional Forestry Officer)	Monthly
District	District Office (District Forestry Officer)	Monthly
Area control Unit or extension Planning area	no office (Forestry Assistant, Forest Guards, Nurserymen, and Patrol men)	

TABLE 3

Area of forest plantations in Malawi ('000 Ha)

	1985	1986	1987	1988	1989
Government:	89.3	90.8	91.6	95.7	97.5
Viphya	53.1	53.2	53.2	53.2	53.2
Timber	20.8	21.9	22.4	24.4	24.5
Research Fuelwood &	2.0	2.1	2.2	2.2	2.2
Poles	13.4	13.6	13.8	15.9	17.6
Non-Government:*	26.5	32.1	39.3	47.8	58.1
Private & Local Authority Estates	15.6	18.0	21.1	24.3	26.9
Schools, Missions, Farmers, etc.	10.9	14.1	18.2	23.5	31.2
Total	115.9	122.9	130.9	143.5	155.6

*Figures calculated from the numbers of seedlings bought by various organizations through the National Tree Planting Programme and assumed a planting rate of 2,500 seedlings per Hectare, i.e. 2m x 2m spacing.

Source: Forestry Department planting returns/calculations by the Author.

statistics collected and disseminated this way are mainly resource, management and production statistics collected during the course of routine work.

The wood-using industries collect and maintain their own forest products statistics on production and trade. The statistics are contained in company's management reports which are specifically for internal use. The Ministry of Trade, Industry and Tourism as well as National Statistical Office collect and maintain forest industries statistics particularly pertaining to exports and imports. The statistics are published in monthly statistical bulletins.

Reliable statistics are available on Government forest plantations, local authority forest plantations and Government protected areas (Tables 3, 4 and Annex I). Only rough estimates currently exist on private forest plantations and forests on customary land. The Forestry Department has however planned a nationwide biomass

inventory which should provide more reliable data than what is presently available on indigenous forests.

3.0 INFORMAL SECTOR PRODUCTS

3.1 Fuelwood and charcoal

Collection of statistics on fuelwood and charcoal started in 1981 with the establishment of Energy Studies Unit (ESU) in the Department of Forestry, Ministry of Forestry and Natural Resources. The Energy Studies Unit was created as a component of the Wood Energy Project Phase I and its (ESU) main function was to conduct studies/surveys on tree planting, energy use patterns, wood-saving devices and other wood-energy related socio-economic issues.

During the first five-years of its existence, Energy Studies Unit conducted a total of four large- scale (nationwide) household and agro-industry surveys, viz:

(i) Malawi Rural Energy Survey, 1981 (and 1985)
(ii) Malawi Smallholder Tree Planting Survey, 1982
(iii) Malawi Urban Energy Survey, 1983
(iv) Malawi Flue-Cured Tobacco Energy Use Survey, 1984 (and 1988).

To compliment efforts of the ESU, a Monitoring and Evaluation Unit (M & EU) was set up in 1987 as part of the Second Phase of the Wood Energy Project. The Monitoring and Evaluation Unit, while dealing mainly with specific issues related to Wood Energy Project II, is also involved in conducting surveys. The Unit conducted its first survey in 1988 on establishment and management practices of farmer woodlots.

In addition to surveys carried out by the ESU and M & EU, the Department of Economic Planning and Development (DEPD) commissioned a study on the position of Biomass sector in Malawi in 1988.

All surveys conducted so far by the ESU and M & EU are nationwide household or agro-industry sample surveys. Principles of statistical data collection techniques have been applied as much as possible though in some cases the sample size has been too small to develop a statistically sound data-base. This weakness has been corrected by repeating the survey in question with a view to confirming the initial results and at the same time developing time trends. Up until 1988, the Forestry Department did not possess its own computers for data processing (data was either being processed manually or commissioned to other Department/ Ministries such as Data Processing Department and Ministry of Agriculture, which had computer facilities). The Forestry Department has since then acquired a total of seven personal computers and the constraint has now been removed.

While additional surveys are still required, (e.g. a Biomass Inventory and Management study, Energy Pricing Study and repeat of the Rural and Urban Energy use surveys) there is available quite comprehensive base-line statistics on tree planting practices, rural and urban energy use patterns, and tobacco industry consumption levels. (Annex II provides a full listing of special surveys of production and consumption of fuelwood and charcoal and Annex III provides a brief definition of fuelwood and charcoal).

3.2 Data collection methodologies

The following brief explanations have been provided in order to demonstrate methodologies used in household and agroindustry sample surveys.

3.2.1 Malawi rural energy survey

The survey was administered twice in 1981, at the end of the rains and at the end of the dry season in order to find out how energy use varies from season to season. It was one of the ten surveys being administered as part of the National sample Survey of Agriculture 1980/81 (NASA), which was being coordinated by the National Statistical Office (NSO). A national total of 2,408 households were interviewed.

Since the survey was primarily interested in the household chores of cooking, firewood collection and water collection, the questions were asked of the central woman in each household. The completed questionnaires were verified and processed by computer. In 1985, the survey was repeated in order to update the initial findings. Annex XV, Abstract A summarizes the 1981 survey results.

3.2.2 Malawi urban energy survey

The survey was carried out in 1982/83 in Malawi's four major cities: Blantyre, Lilongwe, Zomba and Mzuzu. Together, these cities accounted for 79% of all people classified as "urban" in the 1977 national census. The main objective was to determine the energy use pattern and consumption levels in urban areas. Interviews were conducted with the central women in 1,941 urban households. Although emphasis was on wood fuels, background information was gathered on other sources of energy as well. The completed questionnaires were processed manually using paramount cards.

3.2.3 Malawi flue-cured tobacco energy use survey

The survey was carried out in 1984. Information was collected on the existing barn design and condition, energy use, curing techniques, and tree planting activities. Out of a total of 304 tobacco estates, a random representative sample of 77 estates was selected and visited. The completed questionnaires were verified and processed by computer.

3.3 Fuelwood and charcoal production statistics

Fuelwood and Charcoal are supplied from the indigenous forests on customary land and forest reserves and Government and Private plantations. Table 5 shows estimates of wood production from 1984 to 1988 and Table 6 shows estimated wood consumption. The wood production and consumption figures indicate a growing wood deficit (Table 7).

TABLE 5
Estimated wood production[a]

	MAI[b] (m³/Ha/a)	Million m³ 1985	1986	1987	1988	1989
Govt. timber plantations	15	1.14	1.16	1.17	1.20	1.20
Govt. fuelwood plantations	5	0.07	0.07	0.07	0.08	0.08
Private plantations	10	0.27	0.32	0.39	0.48	0.58
Customary land forests	1.0	2.67	2.67	2.66	2.65	2.64
Forest reserves	1.2	0.80	0.80	0.80	0.80	0.80
TOTAL	4.95	5.02	5.09	5.21	5.30	

[a]Estimates are on based location and accessibility.
[b]MAIs for Plantations are based on growth yield studies done by the Forestry Department, whereas those for customary land forests and Forest Reserves are rough estimates.
Source: Calculations by the Author.

TABLE 6
Wood consumption statistics, 1984 to 1989
(million m³)

	Estimated[a] 1984	1985	1986	1987	1988	1989
Fuelwood: Rural	5.1	5.3	5.5	5.7	6.0	6.2
Urban	1.0	1.1	1.1	1.2	1.1	1.1
Estates[b]	2.0	2.0	2.0	2.0	2.0	1.9
Small-scale industry	0.4	0.5	0.6	0.7	0.8	1.0
Urban Services & Industry	0.1	0.1	0.1	0.2	0.2	0.2
Sub-total	8.6	9.0	9.3	9.8	10.1	10.4
Poles	0.7	0.7	0.7	0.7	0.8	0.8
Wood-processing	0.1	0.1	0.1	0.1	0.1	0.2
Grand Total	9.4	9.8	10.1	10.6	11.0	11.4

[a]Annual consumption by rural population is estimated with increase of 3% between 1984 and 1987 then 3.7% after 1987 (due to influx of displaced persons from Mozambique). The consumption by urban population is estimated at an increase of 6% and takes into account the introduction of fuel efficient charcoal stoves and Government restrictions on sale of indigenous woodfuel, both in 1987.
[b]Assumes that with introduction of improved barn technology (by the Tobacco Industry Energy Efficiency project) and the gradual switch to curing with pine charcoal (trials by Malawi Charcoal project), annual consumption by estates has been kept constant and is now falling at 5%.
Source: ESU, 1984/Calculations by the Author.

TABLE 7
Estimated wood deficit, 1985 to 1989 (million m³)

	1985	1986	1987	1988	1989
Consumption	9.80	10.1	10.6	11.0	11.4
Production	4.95	5.02	5.09	5.21	5.30
Deficit	4.85	5.08	5.51	5.79	6.10

4.1 Production statistics on major products

Annual production of industrial roundwood is currently in the region of 83,000 m³ and a production capacity in the region of 115,000 m³ (Pitsawn wood production is estimated to be in the region of 7,000 m³ per annum).

While the large Viphya plantation was established with the sole objective of pulp and paper production, the pulpmill which was intended to produce 180,000 tonnes of bleached sulphate pulp per annum has not been established yet. Hence, Malawi does not currently produce any pulp and paper.

5.0 TRADE

The bulk of the forest resource in Malawi is used for supplying fuelwood, charcoal and building poles and these products are mainly obtained free of charge from forests on customary land or land under freehold or leasehold. Only a small portion of wood (2%) goes into wood-using industries for manufacturing of forest products that are traded. Imports and exports of forest products are very negligible since there are only few wood-using industries in Malawi and due to the fact that not all of them deal in international trade.

The Match Company imports about 400 tonnes of match sticks per annum and in occasional instances, when local supply has been inadequate, veneer sheets have been imported by ITL in the past. For instance, in 1988, ITL had to import 30,000 veneer sheets costing MK 200,000 for face material. ITL however indicated that it will not import any more this year because there is now a ready supply from within the country. Table 8 shows a summary of forest products import statistics for 1983 and Table 9 shows local and export figures for Viply for 1988. Annex VIII presents the major forest products that are traded. The international coding system adopted in national trade statistics is Standard International Trade Classification (SITC) Rev. 1.

TABLE 8

Statistics on forest product imports (1983)

	Quantity	Value (MK)
Sawnwood	553 m^3	299,553
Veneer	2,727 m^3	68,926
Plywood	290,758 m^3	693,646
Blockboard	217,348 m^3	439,455
Fibreboard	9,358 m^3	44,071

Source:Draft Report by FAO Project Formulation Mission in Malawi, 1983)

TABLE 9

Local and export trade statistics (VIPLY) (1988)

	Export		Local	
	Quantity (m^3)	Value (MK)	Quantity (m^3)	Value (MK)
Sawnwood	1,300	620,000	980	296,000
Plywood	540	570,000	360	398,000
Blockboard	250	205,000	242	205,000

Source: Figures supplied by VIPLY, July 1989.

6.0 FOREST PRODUCT PRICES

Statistics on forest product prices are available on fuelwood, charcoal, logs, transmission poles, sawntimber and various sawmill and plymill products.

Fuelwood prices are determined by Government and have recently been revised (Table 10).

TABLE 10

Government stumpage fees for fuelwood

	Before April 1989		Since April 1989	
	MK/sm^3	(MK/m^3)*	MK/sm^3	(MK/m^3)*
Planted fuelwood, cut and stacked by by the purchaser	2.25	(4.09)	2.25	(4.09)
Planted fuelwood, ready stacked	3.15	(5.73)	3.15	(5.73)
Unplanted fuelwood, cut and stacked by the purchaser	2.70	(4.91)	4.50	(8.18)
Unplanted fuelwood, ready-stacked	3.60	(6.55)	5.10	(9.27)

*The stumpage fees are gazetted in MK per stacked m^3. The figures in brackets are in MK per solid m^3 converted using a factor stacked/solid of 0.55.
Source: Forestry Department.

Fuelwood produced by Government under the First Wood Energy Project is estimated at MK 21.9 per stacked cubic metre in 1986/87 prices (against the then prevailing fuelwood price of MK 2.70 per cubic metre). As a result of this discrepancy and in order to make wood production financially attractive, World Bank proposed gradual price increases as shown in Table 11.

TABLE 11

Projected real increases in stumpage fees for fuelwood

Year	March 1986 Prices MK/sm^3	Nominal Prices* MK/sm^3
1986	2.7	2.7
1987	3.1	3.5
1988	3.6	4.6
1989	4.1	6.1
1990	4.7	7.9
1991	5.4	10.4
1992	6.2	13.6
1993	7.2	18.0
1994	8.3	23.6
1995	9.5	30.9
1996	10.7	39.7

*14% annual inflation rate assumed
Source: World Bank, Staff Appraisal Report, 1986.

Log pricing is also the responsibility of the Department of Forestry and all sales of logs on Government timber

plantations are based the "Metric Log Volume and Price Table".

Market prices for fuelwood and charcoal are collected through occasional surveys and studies such as the Urban Energy Use Survey which was conducted by ESU in 1983 and the Marketing Price Study for Fuelwood and Poles done by Blantyre City Fuelwood Project in 1988.

Pricing of sawmill or plymill products is done by the wood-using industries themselves. The private companies normally produce their own price series of the products available for sale.

Prices of sawnwood and transmission poles (controlled market) remained constant from 1985 to 1988. In contrast, prices for fuelwood and charcoal (free market) in 1988 were almost double those in 1984.

Royalties for standing timber from Government owned plant-ations are determined by the Department of Forestry. The wood-using industries, almost all of which do not possess their own plantations, have to negotiate with Forestry Department on the rate they (industries) would pay to Government for the timber. The figures provided by WICO shows royalties of MK29/m^3 and MK21/m^3 for Pine and Eucalyptus respectively, since 1985.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Collection and dissemination of forestry statistics in Malawi is primarily the responsibility of the Forestry Department with the exception of production and trade statistics for wood industries. Wood industries statistics are collected and maintained by the industries themselves but are aggregated by the National Statistical Office and the Ministry of Trade and Industry particularly with regards to exports.

While statistics on Government forest plantations, forest reserves and national parks and game reserves are reasonably well documented, there are no reliable data on private plantations and indigenous forests on customary land. The Forestry Department has however planned to conduct a nationwide biomass inventory which should provide more reliable data than what is currently available. In addition to the biomass inventory, the Department intends to repeat the urban and rural wood consumption surveys and also to do an energy pricing study under the auspices of the Economic Planning and Development. These studies are expected to provide the much needed data-base for forestry policy formulation, planning and management.

7.2 Major priorities for development

The following have been identified as priorities for development:

(a) Collection and dissemination of statistics on indigenous forests on customary land and private plantations.

(b) Development of a reliable data base on production, consumption, trade and prices of major forest products through special studies and surveys so as to facilitate policy formulation, planning and management of the forestry sector.

(c) Strengthening of forestry staff capability in data processing using computers through training in computer science and applications.

(d) Strengthening of the Management and Planning Branch at Forestry Department Headquarters in order to enhance collection, analysis, storage and dissemination of forestry statistics in the Department.

7.3 Recommendations

(a) In order to develop the reliable data base for policy formulation, planning and management, the following studies should be conducted by the Forestry Department:
  (i) A nationwide assessment of the forest resource and classification of all forest types.
  (ii) Forest products trade and pricing study.
  (iii) Supply and demand study on major forest products including fuelwood and charcoal.

(b) Development of standard guidelines on collection and analysis of forestry data in general and classification and definition of various forest products.

(c) Coupled with (b) above, development of a simple to use computer programme for analysing production and consumption forestry statistics.

(d) Formulation of a national body with members from both the public and private sectors which would co-ordinate and promote collection and dissemination of forestry statistics in the country.

(e) In line with (d) above, introduction of an annual publication, e.g. Journal of Forestry Statistics in Malawi, to which interested parties could submit articles on forestry statistics.

(f) Training of forestry personnel in forestry statistics; programme/project appraisal, monitoring and evaluation; sectoral planning and management.

Malawi

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	5280000	5442000	5612000	5790000	5983000	6177000	6378000	6587000	6820000	7070000
INDUSTRIAL ROUNDWOOD	301000	366000	360000	334000	315000	300000	310000	318000	327000	337000
SAWNWOOD & SLEEPERS	46000	48000	43000	38000	23000	16000	19000	23000	30000	31000
CHARCOAL	5000F	5000F	5000F	5000F	6000F	6000F	6000F	6000F	8500	12500
PANELS	5100	8600	9700	8300	6000	3700	4100	4900	5700	6200
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	200	0	0	0	0	0	0	0	0	0
PANELS	0	0	1600	1600	1600	1600	0	0	0	0
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	50	0	0	0	0	0	0	0	0	0
PANELS	0	0	594	600	600	600	0	0	0	0
Import Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	5200	6500	400	1200	1200	700	500	200	0	0
PANELS	7200	4000	3000	3300	3300	3300	1500	1200	800	800
PAPER AND PAPERBOARD	7500	25700	11500	9900	10200	7000	12100	8700	9500	9500
Import Value (1000 US$)										
SAWNWOOD & SLEEPERS	934	1403	110	331	331	275	144	65	0	0
PANELS	2724	1966	1586	1817	1827	1827	479	474	202	202
PAPER AND PAPERBOARD	6936	23669	13984	9253	9275	5110	7595	6168	7393	7393

People's Republic of Mozambique

Samuel H. Santos

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1) The raw material for sawnwood production is in many cases measured in sawmills or estimated from the measurement of final product by using an average conversion factor.

There are not convenient places for log storage where it would be possible to calculate and to register the amount of logs in volume on a systematic basis.

2) The volume and value of wood material which are produced and commercialized for several purposes including fuelwood and charcoal are not usually recorded. Provincial Departments which have this task are not able to control the production due to lack of qualified personnel, vehicles and other equipment.

3) Lack of suitable information systems in the reforestation projects as well as in the forest enterprises and provincial departments that control the forest activity, makes it difficult to obtain accurate information to be sent to the central data bank localized in Maputo city.

4) Questionnaires have been drawn up for formal answers and are designed to be filled in by provincial departments, wood production enterprises and reforestation projects for the purpose of obtaining relevant data concerning production, evolution of prices, consumptions and other statistics. These are usually either incorrectly filled in (they omit some important information) or simply rejected as they regarded rather complicated by the local field technicians. Sometimes this questionnaire is inadequate to the patterns which guide these sectors in terms of their INPUT and OUTPUT.

5) It is quite obvious that good management at leadership level is not enough to solve the problem when in the provinces where production is carried out management is rather bad. In fact it is now possible to find well equipped computers with suitable "software" for filing and processing of statistic data at the National Directorate, but in the provinces elementary difficulties still exist.

6) Lack of financial resources and personnel also makes it difficult for the National Directorate of forest sector to supervise the country's activities.

7) The few existing technicians at the leadershiplevel are required to perform several tasks at the same time and because of this situation they are not able to support forest activity in the provinces adequately.

Recommendations

1) To rehabilitate those sectors which controls the consumption of wood materials at the provincial level and provide them with a reasonable number of technicians and relevant equipment. This would probably make it easier to obtain accurate figures of expenditures and the volume of wood material has been extracted in each province of the country.

This figure may also be used to manage native forest, to ensure rational use of forest products and to reach a sustainable exploitation of the existing resource. This item is particularly important because tropical forests are now facing the threat of destruction with harmful consequences which are well known by the humanity.

2) To organize the wood production sectors (enterprises and projects) providing them with adequate means for the collection, storage and processing of data related to forest production. So they will be able to send accurate figures to the departments concerned where they should be available to meet either national or international requests.

Short term training courses on methodologies of management monitored by recognized personalities should be made regularly available which would take candidates involved in forest production.

3) To provide the National Directorate with equipment and enough personnel so that it may open data sub-stations and systems of control by areas of forest activity (ex. South, Centre and Northern areas). Field data can so be sent to correspondent sectorial data bank concerning each group of provinces.

The provincial sub-stations would be able to check up and update the information to be sent to the central data bank in Maputo. This would ensure availability of more reliable information, enabling relevant corrections be

made with less difficulty, particularly those which require that technicians travel to the countryside.

This kind of organization seems to be more adequate for the promotion of a rather balanced development of the forest sector in the country in terms of geographic coverage.

INTRODUCTION

1. General information

The People's Republic of Mozambique is an East Coast African country bounded by five SADCC member States (Swaziland, Zimbabwe, Zambia, Malawi and Tanzania) and by South Africa on the Southernmost border.

Mozambique has 801,590 Km2 of land area and its population is about 14.5 million growing at 2.6% annually. The major cities of the country, Maputo, Beira and Nampula have respectively 150,000, 261,500 and 177,555 inhabitants growing at 5% anually in Maputo and 2.5% in the others*. The structure of the whole population is shown in table 1.

TABLE 1

Age (years)	Inhabitants	%
0 - 4	2 523 700	17.8
5 - 9	2 270 500	16.0
10 - 14	1 784 100	12.6
15 - 29	3 389 000	24.0
30 - 59	3 426 300	24.2
- 60	780 700	5.2
Total	14 174 300	100.0

1.1 Background on the forest sector

The forest resource in Mozambique consists of natural broadleaved forest and plantations of several species divided in 3 main types which are:

a) Dense forest which occupies a little area in the highest zones of Sofala, Manica, Zambezia, Nampula and Cabo Delgado provinces.

b) Open forest, and

c) Savanna

Along the coast there are small areas of Mangrove vegetation.

These three types of forest cover an area of about 19 126 000 ha but with a rate of degration estimated in 45 000 ha/year due to uncontrolled exploitation, fires and encroachment by agriculture.**

Plantations include eucalyptus, pine, casuarina and other species covering 42,624 ha. with an annual rate of replanting estimated at 5%***.

1.1.1 Productive forest

In 1972 areas described as forest land was covering 56 million of ha. accounting for 71% of the country's surface. That area was in that time distributed in the following manner according to FAO study done by J. Malleux (see table 2).

TABLE 2

Potential forest of Mozambique in 1972

Forest Type	Area (1000 ha)
Productive Forest	
– forest of high productivity	600
– forest of medium productivity	4 000
– forest of low productivity	14 500
TOTAL	19 100
Thicket with forest or agro-forest potential	20 000
Savanna with agro-sil-past-potential	17 000
TOTAL	37 000
Total potential forest area	56 100

Source: Jorge Malleux, Avaliacao dos Recursos Florestais da Republica Popular de Mozambique.

According to the annual degration rate of 45 000 ha/year, by the end of 1983 the forest composition has become as is seen in table 3.

TABLE 3

Forest area, end 1983

Forest type	Area 1000 ha
1. High productive	596
2. Medium productive	3 544
3. Low productive	14 906
TOTAL	19 046

Source: A. Kir Field Document 6, FO MOZ 82 009

* Source: Instituto Nacional de Planeamento Fisico

** Source: FAO, Forest Resources of Tropical Africa, Rome 1981.

*** Source: Estimativas de A. KARLBERG e E. MANSUR, DNFFB, 1986 (Plano Nacional de Reflorestamento)

TABLE 4
Forest growing stock

Forest Type	Volume (1000 m3) DBH 25 + cm	DBH 40 + cm
1	20 943	12 384
2	106 107	59 326
3	196 013	90 330
TOTAL	323 063	162 040

As reported in the same document the total growing stock on the three types of productive forest are the following:

The actual functions of the natural forest are:

1. To supply by fuelwood, charcoal and building materials to the rural population as well as to the suburban population with lack of alternative sources of energy.
2. To expand industrial wood production in order to provide required raw materials for development activities as well as to contribute to the country's foreign exchange earning through wood and wood products export.
3. Protection of natural environment and ecosystem, hunting and others.

Further to these designated functions, forest land is also used for agriculture purpose.

Taking account of all forest roles the annual wood harvest amounts to an estimated 15 million m^3 of which only 3% is industrial roundwood. There is no quantitative control of harvesting in the forest and log production is usually measured on arrival in sawmills or is estimated from the final product by using an average conversion factor.

People have free access to the forest for fuelwood and small wood for building.

Production level is determined by local requirement irrespective of the resource capacity. Forest management and rigorous legislation do not exist for the forest products utilization.

There are on the other hand significant clearing for agriculture and uncontrolled fires which reduce the forest productive capacity.

The situation of deforestation is particularly harmful around the urban centres because families are forced to leave their homes and drift to the towns in search of work and security against the war, accounting for about 3 million persons displaced from their homelands to towns.

1.1.2 Plantations

Initiation of the establishment of forest plantation in Mozambique dates back to 1920s. Early plantations of *Casuarina equisetifolia* were carried out mainly for sand dunes fixation whose area reached about 2 800 ha. by 1950.

In 1979 a sizeable annual programmes of plantations began involving pines and eucalyptus species and now covering about 42 624 ha of area.

Main concentration is found in Manica province and accounts for more than 50% of total area already planted. The plantations of Manica province are mainly designed to supply the local market for processed wood.

Recent development in reforestation policy also gives a high emphasis on the establishment of fuelwood plantations to secure wood supply for major urban centres for their energy needs. With this regards 46% of current plantations programmes aims at fuelwood growing and is mainly located around three major cities (Maputo, Beira and Nampula).

The remaining plantation on small scale is undertaken by provincial institutions and through forestry extension programmes.

The output obtained from that plantations is still small compared with 15 millions of m3 of wood material annually extracted from the natural forest by the population of the country. The plantations are far from being sufficient to cover the demand of fuelwood and charcoal in the near future.

So it is possible to stop the natural forest devastation by planning exotic species without using alternative sources of energy such as petroleum, gas, electricity and others.

2. FOREST SECTOR STATISTICS

The National Directorate of Forestry and Wildlife (D.N.F.F.B.), an organ through which the Ministry of Agriculture controls forest production in the country, has two sectors which among other activities collect and prepare statistical data on forestry activity throughout the country.

These sectors are the National Programme of Reforestation (PNR), and the Department of Economy and Forest Industry (DEIF) and have been operating for approximately six years. The PNR is responsible for production of fuelwood charcoal and poles and the DEIF, for industrial wood production.

As production of wood related-energy in the country is carried out by projects of reforestation, as is stated above, PNR supervises the activities of these projects and gives them technical recommendations on how to make production plans and how to forecast consumption and demand for fuelwood and charcoal.

With regard to industrial production DEIF supports such production including internal and external commercialization of timber and provides technical advice on the basis of studies undertaken by them.

Another sector equally operates at D.N.F.F.B.. It controls and oversees all activities undertaken by the Provincial Directorates on matters concerning the natural forest production of timber as well as fuelwood (See sketch 1 on annexes).

Statistic data which are usually organized with a questionnaire are then sent to the Departments concerned, together with periodic reports. Sometimes these data are brought by technicians of these sectors who travel regularly to various sites of forest activity throughout the country.

The estimation of consumptions, price rises, future demands of the populations and other statistic analysis normally results from special studies undertaken by foreign technicians requested by the local authorities from other developed countries or from international organisms devoted to support the poor countries.

These technicians are normally accompanied by local technicians with several levels of academic education.

Lack of qualified personnel compels local technicians to devote themselves to another areas of activity besides the role on which they received training from foreign technicians. This situation does not contribute to keeping the knowledge acquired from the international cooperation.

This fact associated with lack of an institutionalized sector of statistics at D.N.F.F.B., makes it difficult to undertake collection of data and data processing of forest production on permanent basis and with complete coverage.

Some problems related to statistical coverage are due to difficulty of field personnel to tour because of security problems. This situation is most sensitive in relation to fuelwood and charcoal production.

3. INFORMAL SECTOR PRODUCTS

Almost all the rural population in Mozambique are using fuelwood and/or charcoal as the main source of energy. Studies carried out by Geography Department of the local University, are showing fuelwood consumption of about 0.8 m3/person/year for the whole country. According the same studies the consumption of fuelwood was calculated as 10/kg/family/day in the rural areas.

National population census done in 1980 indicates a medium of 5 persons by family.

The urban fuelwood supply is guaranteed by private trade activity bringing fuelwood and/or charcoal from surrounding rural areas and selling it in the urban market places.

Almost 100% of the product is from the natural forest in the increasing area of about 90 km radius of the city (Estimates by KARLBERG and MANSUR: Levantamento do Abastecimento de Carvao e Lenha a Cidade do Maputo 1986).

Statistical coverage adequate to forecast consumption and demands of fuelwood and charcoal is mainly confined to Maputo city. Studies were carried out to estimate the number of Maputo consumers and amounts of fuelwood and charcoal needed to supply the town population in the near future.

Similar studies are expected to be done in other major cities (Beira and Nampula) next and after that it should be possible to extend the coverage to the whole country. The demand for energy is becoming so important due of the increasing population.

In the table 4 is shown the population for major cities (1980 and 1986).

TABLE 4

Population of major cities (1980 - 1986)

City	Population1980*	Population 1986**
Maputo	739 077	990 500
Beira	214 613	248 900
Nampula	145 722	169 000
Nacala	75 038	87 000
Chimoio	68 125	79 000
Quelimane	60 151	69 800
Inhambane	56 439	65 500
Tete	45 119	52 300
Pemba	41 116	47 700
Lichinga	39 009	45 200
Chockwe	10 871	12 600

**Source*: Population census 1980, INPF
***Source*: Estimations considering growth rate as follows: 5% per year for Maputo city and 2.5% for the other.

According to the KARLBERG, MANSUR and BUNSTER's studies, 70% of the Maputo city inhabitants are using fuelwood and/or charcoal as a only source of energy. The annual consumption of fuelwood amounts to 142 000 Ton and for charcoal is about 14 300 Ton. The caloric power of that quantity is equivalent to 53.3

Tcal which is only 62% of the demand of energy for Maputo city.

Situation of scarcity compels people to reduce their consumption and in some cases it has become more difficult to get fuelwood than food further increasing the problem of country hunger.

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Mozambique

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	11590000	12306000	12668000	13512000	13870000	14070000	14270000	14643000	15022000	15022000
INDUSTRIAL ROUNDWOOD	911000	939000	1030000	930600	922000	941000	946000	948000	951000	980000
SAWNWOOD & SLEEPERS	66200	65300	65400	42300	37800	36600	34600	39100	41700	35750
CHARCOAL	65000	71000	78000	102000	95000	95000	95000	98000	100000	100000F
PANELS	2300	2000	4300	2800	1600	6400	6800	7500	9250	4900
PAPER AND PAPERBOARD	1500	3000	2000	1800	1800	1400	2000	2000	2000	2000
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	10200	11400	8200	4800	700	2200	1300	2300	3400	6200
SAWNWOOD & SLEEPERS	143800	19800	14200	6800	1100	600	400	100	100	100
PANELS	0	0	0	1500	2600	1300	1600	1600	1600	1600
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	1825	3286	2659	1680	257	1130	643	1100	1300	2600
SAWNWOOD & SLEEPERS	11393	5386	3882	2172	403	220	176	38	38	38
PANELS	0	0	0	785	1400	550	480	480	480	480
Import Quantity (CUM/MT)										
PANELS	3800	4400	4400	4400	4400	0	0	0	0	0
PAPER AND PAPERBOARD	16800	16800	8600	12200	12200	1600	500	500	500	500
Import Value (1000 US$)										
PANELS	409	480	480	480	480	0	0	0	0	0
PAPER AND PAPERBOARD	9580	10420	6550	9400	9400	1150	396	396	396	396

Federal Republic of Nigeria

R.O. Aruofor

1.0 INTRODUCTION

1.01 Forest resources of nigeria

Nigeria occupies a total land area of 924,000 square kilometers between latitudes 4° 15'N (Southern tip of the Niger delta, on the Atlantic) and 13° 55'N (North Western frontier with Niger) and between longitudes 2° 45'E (Southern frontier with Benin) and 14° 40'E (Northern frontier with Cameroon).

The vegetation of Nigeria is determined by climate, particularly by the rains and dry season but also largely by farming, fires and soil. The main vegetation zones are distinguished to include the Forest, Derived Savanna and Savannas, in succession from the south to the north. However, the large human population which is over 110 million by 1989, has impacted adversely on the natural vegetation with the result that more than four fifth of the land is now occupied by an impoverished savanna woodland, while the remains is essentially forest but predominantly of mosaics of farmland and forest.

The forest estate of the country is made up of an area of 9.6 million hectares that have been legally set aside for forestry purposes. This amounts to about 10% of the total land area and distributed as follows: (See Table 1)

TABLE 1

Forest estate of Nigeria

Formation	Area (mill.ha)	%
Grassland	1.54	16.0
Shrub/woodlands	5.42	56.2
Forest	1.56	16.2
Farmland/woodland/ forest mosaic	0.98	10.2
Forest Plantation	0.14	1.4
Total	9.64	100.0

About 78% of the forest reserves lie in the savanna zones which produce mainly fuelwood and poles and make no contribution to the supply of sawlogs. The production of sawlogs is mainly from the forests within and outside forest reserves which are proving to be progressively undependable because of agricultural pressure and overcutting. The dwindling supply of commercial timber from the forest has led to increased emphasis on forest plantation establishment since the 1960's. By 1976, about 115,000 ha. of plantation had been established. It is estimated that to date the figure should have risen to about 240,000 hectares of mixed tropical hardwood species.

1.02 Environmental conservation

Forestry practice in Nigeria is gradually shifting emphasis from production to the protection of environment. The persistent wood deficit in the Northern States of Nigeria has resulted in the overexploitation of the savanna woodlands for fuelwood. The prolonged effect of this practice coupled with the farming systems and over grazing by livestock has resulted in a large scale desertification of the arid north of Nigeria. Also water erosion has posed a grave concern in the south of Nigeria with the agricultural base of some of the states affected being threatened adversely. These two phenomena have, therefore, been accorded a national disaster status with various measures being adopted to try and arrest the menace. The second World Bank forestry project with a massive afforestation programme is one of such measures.

All areas north of latitude 12°N of Nigeria are classified as Arid Zone though the menace of desertification has since spread southwards beyond this limit.

1.02.1 Wildlife conservation

Wildlife conservation in Nigeria is carried out by the forestry departments and is managed for the dual purpose of sustained bush meat production as well as providing recreational opportunities. Wildlife poaching continued to remain the greatest bane of successful conservation. The promulgation of the Endangered species (International Trade and Traffic) Decree No. 11 of 20th April 1985, has provided some of the necessary leverage for a more effective wildlife conservation and management strategy.

Nigeria has about 36 game reserves spread all over the country, one National park, several zoological/parks/ gardens and over 9 zoos. Kainji Lake National Park

which was created in 1975 has a total area of about 525,000 ha. Yankari game reserve in Bauchi State is the most prominent of the game reserves and covers 225,000 ha. approximately.

1.03 Forest administration

The institutional make up of Nigerian forestry fall under three main factions; viz - Administration and policy; research and training; and management and control. To this effect there are the following forestry institutions and establishments in Nigeria.

(i) The Federal Department of Forestry which was set up in 1971 under the Federal Ministry of Agriculture, Water Resources and Rural Development. It co-ordinates forestry activities throughout the country. Its main functions are in the areas of administration policy and liaison services between the federal and state forestry services as well as international organization and agencies. It is also supposed to assist with planning and development within the forestry sector of Nigeria. Ideally, forest sector statistics should be the responsibility of the Federal Department of Forestry. The Department has established field offices in all states of the Federation in addition to various specialized project units.

(ii) The Forest Research Institute of Nigeria (FRIN) was established in 1954 and is currently under the Federal Ministry of Science and Technology. It has its headquarters at Ibadan with substations at the Savanna Forest Research Station, Samaru, Zaria (SFRS); the Shelterbelt Research Station, Kano; the Eastern Research Station, Umuahia and the Moist Forest Research Station, Sapoba. FRIN is officially responsible for all forest research in Nigeria as well as for technical level training. FRIN runs schools of Forestry at Ibadan and Jos as well as the School of Wildlife Management in New Bussa. It also operates an establishment in Kaduna for training in forest mechanization. Essentially it is not directly connected with the responsibility of forest sector statistics in Nigeria, but is a significant consumer. However professional traning is provided at University level. At present over six universities provide forestry training as part of their curricula. They are also major consumers of forestry statistics.

(iii) Finally, there are twenty-two other forestry departments corresponding to twenty-one state forestry services and a federal capital territory. These state forestry departments function as a division under the appropriate Ministry of Agriculture, responsible for administering the forest estate of the state.

Each of the departments and institute mentioned above is headed by a Director, who reports to a Director-General and thus to a Minister in the federal set up and a commission in a state set-up. The state forestry departments should ideally constitute the folcrum of data collection in the respective states. The states are responsible for management and control. The autonomy of the various forestry sub-units does not provide the right environment for a co-ordinated approach to forestry statistics, collection, processing and dissemination.

4.04 Forestry industry

Available statistics reveal that forest industries development in Nigeria had been on the upward trend since 1974. This has largely been due to rapidly rising domestic demand for wood coupled with the attendant ban on log and wood product export in 1976. The forest industry in Nigeria is, therefore, dominated by the sawmilling industry which is characterised by a preponderence of privately owned units most of which are small to medium sized and frequently unintegrated. The investment in the sawmilling industry requiring little comparative capital and yielding substantial and quick returns, has been by far the most convenient and attractive to the Nigerian businessman. There are however a few large and integrated sawmills in existence numbering about 23 in 1980. However FAO/FDF survey in 1981 estimated the total sawmills in Nigeria by 1980 to be 1,300 of which only 942 were duly licensed; with small mills comprising about 81%. There were also about seven plywood mills with installed output capacity of well over 100,000 m3 and two particle board mills with an output of about 55,000 m^3. Most of the above were integrated with large sawmills.

Two pulp and paper mills are currently operating in Nigeria producing newsprint and industrial paper respectively.

The individual capacties are 100,000 mt and 65,000 mt of newsprint and kraft paper respectively. A third mill with anticipated capacity of 100,000 mt of printing and writing paper has not been commissioned as yet having suffered a hugh cost overrun which has impeded its completion.

1.05 Developmental focus

The developmental focus of the forestry departments over the last decade had been geared towards resource development, conservation and utilization of forests and wildlife. Also education, research and training were emphasized to varying degrees. The developmental focus has been manifested in various schemes and projects including plantation establishment for production of either timber, poles, fuelwood or fruits of for protection of water catchments, erodible lands and arid and marginal lands. The current trends tend to be emphasizing environmental protection in greater detail.

2.0 FOREST SECTOR STATISTICS

2.0.1 Present status

The present state of forestry statistics in Nigeria is not well developed or formalized and is far from being well organized. Most of the available data on forestry are the result of various ad-hoc studies carried out by various authors. A lot of information are therefore scattered in files, and various other publications. There is an apparent lack of co-ordination between the data generating institutions on the one hand and producers and users of forestry information on the other hand. The result is that much effort is dissipated with very little result to show for it.

2.01.1 Federal Office of Statistics

At present, the Federal Office of Statistics (FOS) is given the full mandate by the Federal Government of Nigeria to collect and publish all statistics relating to the Nigerian Economy. To this effect, the office is responsible for the national accounts, trade statistics as well as production including agricultural and manufacturing statistics. The production of social statistics is also covered under the schedule of the FOS.

To fulfil the above roles, the Federal Office of Statistics maintains several independent units in Lagos which is its headquarters and has regional offices in each of the twenty-one state headquarters of the Federation including Abuja, the Federal Capital Territory. In addition, it also operates some sub-offices in enumeration areas as classified in the 1973 census.

Among its usual publications are:

(i) The Annual Abstract of Statistics
(ii) Digest of Statistics
(iii) Nigerian Trade Summary
(iv) Review of External Trade
(v) National Integrated Survey of Households
(vi) Social Statistics in Nigeria
(vii) Facts and Figures about Nigeria

Forest Sector Statistics are also published in part and are incorporated under the following standard Industrial Classifications as follows:

(i) 3311, 3312 sawmill, planing mill, wooden and cane containers.
(ii) 3319, 3320 wood products, furniture non metal.
(iii) 3411, 3412 pulp, paper paperboard container and boxes of paper.
(iv) 3419 paper and paperboards. Articles not elsewhere classified.
(v) 3420 printing and publishing. Other commodity codes include those for fuelwood, charcoal, sawlogs and roundwood classified according to species etc. are covered under the standard International Trade Classification (S.I.T.C.).

These series of code range from 241.10.0 to 243.39.0. Essentially the forest statistics published by the Federal Office of Statistics are not comprehensive enough especially with reference to domestic production and trade. The level of aggregation adopted in some of the series obscures rather than clarifying and sometimes published series are disjointed. Domestic oriented forest sector statistics as published by the Federal Office of Statistics leaves much to be desired in terms of content and scope.

2.0.12 Federal Department of Forestry

The need for Federal Department of Forestry to superintend the collection and publication of forest sector statistics in Nigeria has been mooted in Government Circles. In fact there had been dialogue between the Federal Office of Statistics and the Federal Department of Forestry on the issue of forest sector statistics but what had remained unresolved is who should take responsibility and the source of funds.

Forest Sector Statistic collection and publication at the Federal Department of Forestry level had been purely on ad-hoc basis. The boldest step to publish forestry based statistics was taken in 1983 when the first volume of the Nigerian Forestry Statistics (Khalique-Ur-Reham and Rex Oforitse Aruofor edition) was published by the Forestry Projects Monitoring and Evaluation Unit. The volume apart from publishing project based data tried to collate and summarize existing forest sector statistics from various sources. The effort was continued in 1984 but could not be sustained due to operational and institutional constraints and related factors.

The Federal Department of Forestry had tried to transfer the role of forest sector data collection to a planning unitconceived within its ambit but with no positive result.

At present, Federal Department of Forestry does not appear well posed and ready for the important function of forest sector statistics collection and publication in terms of correctly trained manpower, institutionalization and resource requirements.

The wide spread opinion that generation and publication of statistics is the full preserve and responsibility of the Federal Office of Statistics and more over that anything that has to do with wood based mills belong to the Federal Ministry of Industry does not augur well for a well executed forestry data collection and dissemination. Such compartmentalization will at Nigeria (6) best hinder planning and development within the Nigerian economy.

At present no organization is effective in terms of forest sector statistics, collection and publication.

3.0 INFORMAL SECTOR PRODUCTS

3.01 Fuelwood and charcoal

Nigeria has no domestic series on these wood products. The Federal Office of Statistic carries out household surveys every year since 1980. The only mention of the above products is in connection with the utilization of type of fuels by sector in Nigeria. The 1984/85 household survey revealed that 80% of the fuel most commonly used in rural areas was fuelwood and less than 1% was charcoal. In urban areas however about 36% of households used wood.

Fuelwood is very widely in demand in Nigeria and used mainly for domestic cooking and industrial bakery. Flourishing markets exist for fuelwood in most of the northern and middle belt states of Nigeria where huge piles and stacks abound in roadside trading in rural areas. There are no established records on these products at the moment nor are there any indications of organized surveys aimed at generating the required records in the future. One consultancy was instituted by the Federal Department of Forestry to study the prospects for wood for energy but that was as rare as interest on the above products went.

Prices of fuelwood vary from state to state and no formal and well designed surveys have been carried out so far to determine firewood prices.

Some attempts were made by Forestry Management Evaluation and Co-ordinating Unit (FORMECU) Ibadan, to survey fuelwood demand and prices in 1988. The results were only indicative though not conclusive. The survey method left a lot to be desired and did not lend itself to statistical analysis. A subjective but extensively cited assumption is that fuelwood production in Nigeria accounts for about 90% of total roundwood production.

3.01.1 Review of production statistics of fuelwood and charcoal (FAO)

The only available estimates of production of the above products for Nigeria are the FAO estimates. Fuelwood production in Nigeria was estimated at about 54.8 million cubic meters in 1974 reaching over 79.7 million cubic meters in 1985. This has meant an annual growth rate of 3.46% per annum. Charcoal production on the other hand was estimated at 903,000 metric tons in 1974 and over 1.3 million mt in 1985 signifying a growth rate of 3.40% per annum. Sincere there are no available domestic records a comparative analyses is not feasible.

3.02 Other product

Gum arabic production has assumed economic dimension in recent years especially because of the favourable world market prices but thus far no conscious effort has been made to quantify production by any organization in the country. In 1987, about 6,840,485 kg. of Gum arabic was exported by the country according to Federal Office of Statistics.

4.0 MODERN SECTOR PRODUCTS

The modern sector products in Nigeria include industrial roundwood, sawnwood, plywood, veneer, particleboard and pulp and paper. No fibreboard is being produced as of now and no indication exist for the future.

4.01 Present status

The FOS statistics are presented in annex 1.0. Only the value of production are published even though elaborate information is supposed to be collected on quantities and output. The FOS carries out the following surveys viz:

i) National census of industries and businesses;
ii) Survey of manufacturing industries and
iii) Survey of industrial production.

In each of the above cases very detailed questionnaires are administered to the selected industries and collected back yearly. As can be seen from the annex 1.0, the product classification is too broad and so tends to obscure the facts and secondly such a publication that

does not incorporate quantities is very limited in term of its usefulness especially with respect to sectoral planning.

From the investigation made for the preparation of this report, it appears that the population of forest industries assumed by the FOS severely under-states the true population of forest industries in Nigeria eventhough they claim to survey only establishments employing more than 10 workers.

4.0.2 FAO published statistics

FAO published statistics for production in the modern sector are still the most dependable to date. Industrial roundwood production 1974 was 4.9 million cubic meters and grew at an annual growth rate of 7.0% to reach 10.2 million m3 in 1985. Sawnwood production was 0.8 million m^3 in 1974 and 2.7 million m^3 in 1985 a growth rate of 11.8% per annum. Plywood production was 60,000 m3 in 1974 and reached 151,000 m^3 in 1985; a growth rate of 8.8% per annum. Plywood production is estimated at 175,000 m3 by 1987. Particle board production was 35,000 m3 in 1976 and reached 55,000 m^3 in 1985 a growth rate of 5.2% per annum.

The following table 2 provides a comparative analysis between FAO estimate and domestic estimate of modern sector production based on the works of Alviar (1983)

The FAO estimates as can be seen is reliable except that of sawnwood which is understated by about 5%.

5.0 TRADE

The trade statistics in forest products in Nigeria are

TABLE 2

Comparison of production statistics in forest industries1980 (FAO: Alviar 1983)

Wood Products	FAO m^3	Alviar (1983)* m^3	FAO/Alviar %
Sawnwood	2,782,000	2,669,000	95
Plywood	68,000	68,000	100
Particleboard	45,000	45,000	100

*Alviar, G.O. (1983): Development of Forest Management Capability: Report on Forest Industries in Nigeria. Working Document No. 12A, FOR:NIR/77/008, Federal Department of Forestry, Lagos.

fairly effective and covers most of the forest sector products classified according to Standard International Trade Classification (S.I.T.C.). Bills of entry are classified and collated at all the ports in the country and these are collected regularly by staffs of the FOS and form the basis for the statistics published in the Nigerian Trade Summary as well as the review of external trade.

The main product imported is paper and paper product whose value rose from Naira 78,115.00 in 1975 to Naira 469,700,000 in 1987 a growth rate of 16.12%. Plywood export is significant among the wood products export through the series appear disjointed. The FOS trade statistics is presented in annex 2.0. The disjointed nature of Nigerian trade statistics is very apparent in the above annex. However Annex 3.0 presents in greater detail the trade statistics on forest products in 1982 and 1987. The 1987 is the most recent figures published by the Federal Office of Statistics.

5.01 Review of FAO trade statistics

As very comprensive trade statistics are not available domestically the comparative analysis, Table 3, has been restricted to 1982 and 1987 for which some information are available from FOS.

TABLE 3

Comparative analysis of forest products trade statistics - 1982 and 1987

Wood products	FAO: FOS (%) 1982	1987
Sawnwood (export)	531	0.07
Veneer (import)	-	0.94
Plywood (import)	-	0.42
Fibre board (import)	552	307.50
Newsprint (import)	129	1,218.70
Printing and writing (import)	63	76.8
Other paper & paperboard (import)	198	117.9
Particle board (import)	341.7	190.4

The FAO trade statistics did not include export for most of the forest products as is obvious from the FOS trade statistics of 1987. However the FAO estimate of sawnwood export is a severe understatement of the actual magnitude. Veener and plywood imports are also severely understated by FAO in 1987, while fibreboard and Newsprint imports were very much overstated relative to FOS figures in both 1982 and 1987. While printing and writing paper import was only understated by FAO by about 30% on the average, other paper and paperboard and particleboard imports were all overstated by FAO statistics and more so for particle board in 1982.

Annex 3.0 should provide greater details on forest products trade.

6.0 FOREST PRODUCT PRICES

There are no national statistics on forest product prices in Nigeria. The first real attempt at publishing comprehensive prices on wood products is by Omoluabi, A.C. and Onwuka, S.O., both of Forest Management, Evaluation and Co-ordinating Unit (FORMECU), Federal Department of Forestry, Ibadan. The publication Nigeria Forest Products Prices 1988 is yet to be sent to the press. This publication covers all the major wood products and are classified according to states of the Federation.

Highlights are as follows:

(i) Fuelwood price range from a low of Naira 36.25/m^3 in Benin in Bendel State to a high of Naira 181.25/m^3 in Sokoto in Sokoto State in 1988.

(ii) Charcoal prices range from Naira 200.00/mt. in most of the southwestern states of Nigeria to Naira 700.00/mt. in Jos in Plateau State.

(iii) Sawnwood prices were categorized into Mahogany, other redwoods and white wood. Mahogany sold for naira 630.00/m^3 in Akure in Ondo State reaching a peak of Naira 985.00/m^3 in Sokoto and Enugu in Anambra State. Other red woods ranged from Naira 455.00/m to Naira 700.00/m^3 Nigeria (10) while white wood ranged from Naira 210.00 per m^3 to Naira 455.00/m^3.

(iv) Plywood prices were categorized into brown and white types. Brown types ranged from Naira 1,487.00/m3 (18 mm) to Naira 2,625.00/m^3 in the furniture grade while the white type ranged from naira 1,435.00/m^3 to Naira 2,450.00/m^3. Construction grade ranged from Naira 1,435.00/m^3 to Naira 1,575.00/m^3 for the brown type and from Naira 1,400.00/$m^3$to 1,575.00/m^3 for the white type.

(v) Particle board prices ranged from Naira 869.65/m^3 for the 18mm standard grade in the South of Nigeria to Naira 3,193.75/m^3 in the North of Nigeria.

(vi) Fibre board ranged from Naira 1,200.00/m^3 for soft board to Naira 3,456.00/m^3 for hard board.

(vii) Newsprint ranged from Naira 3,250/mt to Naira 4,500.00/mt. Kraft paper from Naira 5,000.00/mt to Naira 7,000.00/mt. Printing and writing from Naira 7,000.00/mt. to Naira 8,000.00/mt.

All the above price were retail prices. Even though some average prices were given in the publication all prices were weighted equally. Quantity weights would have been more appropriate where they available. There is no indication that this price survey will be a continuous exercise.

7.0 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The state of forest sector statistics in Nigeria is largely uncoordinated and thus not effective. A general apathy still exists with respect to a conscious and systematic collection of forestry statistics and it is not certain whose responsibility it is to collect and publish such statistics and more importantly who should fund such an exercise.

Secondly, the attitude of the general public toward providing survey information leaves much to be desired. The general finding is that response from the public is usually not encouraging and it is more so with urban than rural; with literates than otherwise and with big establishments than the reverse.

When the above seem to be pointing to is the need for more government concern in the provision of sectoral statistics and the need to make it mandatory for the public to release information on request to government agent.

For forest sector statistics in Nigeria to become effective, there is the need to formalize a statistical unit within the Federal Department of Forestry that is well staffed with the correctly trained manpower. This unit should be well funded and provided with the necessary resources and mandate that can enable it to implement a meaningful forest sector data collection programme on a continuing basis.

ANNEX 1.0

Values of gross output in manufacturing Naira

(000.00)

Year	Wood and wood Products	Paper and paper Products
1978	142,753	210,228
1979	-	-
1980	528,917	239,798
1981	445,023	469,622
1982	322,300	154,033
1983	484,697	137,981
1984	174,935	443,636

Source: Annual Abstract of Statistics 1987 edition, FOS, Lagos.

ANNEX 2.0
Value of import - Naira
('000.00)

Year	Paper products
1975	78,115
1976	108,572
1977	134,639
1978	152,032
1979	110,165
1980	172,100
1981	215,100
1982	171,657
1983	144,788
1984	125,009
1985	204,970
1986	156,324
1987	469,700

Source: (i) Annual Abstract of Statistics, FOS, Lagos
(ii) Digest of Statistics, FOS, Lagos
(iii) Review of external trade, FOS, Lagos.

Export of Timber and Plywood

Year	Quantity '000 m^3	Value Naira '000.00
1971	223	7,000
1972	232	8,100
1973	370	14,300
1974	305	14,000
1975	107	4,800
1976*	Ban on export.	
1983	-	Negligible
1984	Negligible	"
1985	-	-
1986	4.5	0.7
1987	36.0	12.3

Review of External Trade - 1987, FOS, Lagos

Nigeria

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	71590000	74115008	76699008	79334000	82031008	84779008	87587008	90591008	93729008	97013008
INDUSTRIAL ROUNDWOOD	6107000	7360000	8507000	7884000	7325000	7557000	7869000	7868000	7868000	7868000
SAWNWOOD & SLEEPERS	2012000	2794000	2962000	2667000	2402000	2512000	2712000	2712000	2712000	2712000
CHARCOAL	1073000F	1111000F	1150000F	1189000F	1230000F	1271000F	1313000F	1358000F	1405000F	1455000F
PANELS	126900	116000	209000	209000	209000	209000	203000	233000	233000	233000
WOOD PULP	0	0	0	0	0	2000	13600	16600	16600	16600
PAPER AND PAPERBOARD	17500	17500	17500	17500	17500	15000	40500	76000	76000	95000
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	9600	9600	25700	101300	50400	59800	59800	59800	59800	59800
SAWNWOOD & SLEEPERS	1500	1500	1000	1100	1100	1100	600	600	600	600
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	720	770	2053	8107	5200	5981	5981	5981	5981	5981
SAWNWOOD & SLEEPERS	240	250	170	200	200	200	110	110	110	110
Import Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	0	0	0	0	900	1000	1000	1000	1000	1000
SAWNWOOD & SLEEPERS	0	0	2400	700	700	700	100	100	100	100
PANELS	118200	168500	157500	129500	117000	23100	23100	23100	23100	23100
WOOD PULP	5100	4700	4700	4700	5100	3200	3200	3200	3200	3200
PAPER AND PAPERBOARD	131800	123100	261300	172700	172300	124400	122800	58600	58600	58600
Import Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	0	0	0	0	164	207	207	207	207	207
SAWNWOOD & SLEEPERS	0	0	500	100	100	100	15	15	15	15
PANELS	58724	89938	82738	63038	52664	9605	9605	9605	9605	9605
WOOD PULP	4268	4836	4836	4836	3795	3109	3109	3109	3109	3109
PAPER AND PAPERBOARD	141592	153558	339100	229800	229496	146962	153480	86810	86810	86810

Republic of the Sudan

Hisham Mohyeldin Mohamed Tahir

1. INTRODUCTION

1.1 Land use and forest production

- Table (1) shows the types and areas of forests based on land use classification.
- Under irrigated agriculture natural forest is completely replaced by vegetation of domesticated plants, except for the important date palms.
- Under rainfed agriculture the production rate of natural forest is also significantly affected, not only during the cultivation periods but also by longterm effects of cultivation on the soil which supports the forest vegetation in fallow periods. In this connection the uncontrolled fires which frequently spread after the grass-burning which is part of most forms of shifting cultivation, have serious effects on the survival of young trees.
- Under the mechanized schemes as long as land is cultivated more or less continuously there is just no production of natural forests because once the land is eventually abandoned, natural regeneration is seriously hampered by the lack of seeds left in the ground.
- When the animal stocking rate is high the browsing habits of goats and camels and even cattle serve to reduce the survival chances of geminating seeds.
- The pastoralists practice of burning perennial grasses at the beginning of the dry season in order to get a new sprout of green grasses often leads to uncontrolled grass fires which destroy young trees.

1.2 Main functions of forests

Forests play an important role in the Sudan. They provide wood for different construction purposes and for fuel. They protect the soil from erosion and they stabilize moving sands. They are the natural habitat for wild animals and they offer grazing and browsing opportunities for domestic animals. They ameliorate the climate and prevent bank erosion of rivers and water courses.

1.3 Forestry in the economy

Conventional national accounting methodology underestimates the contribution that forests make towards the national economy. This methodology indicates that the contribution of forests is about one per cent, mostly in the form of timber production from government forest reserves. Such forest reserves only constitute about two per cent of the total forest area of the Sudan.

A large portion of forestry related activities is not part of the monetary economy. However, a significant percentage of the unrecorded fuel trade is monitized. The undervaluation of the contribution of forestry has resulted in the consistent bias of development towards activities that have had deleterious effects on forestry. Another shortcoming in national accounting methodology has been that forest output is measured solely as income, and it does not take into account depreciation of capital stock where the forests are being exploited on a non-sustainable basis. Most forests product output comes from common land or forests and not from Forest Reserves. Zero or very low stumpage rates are charged on the majority of the exploited woodland. Since the final market price includes only a very small amount for stumpage, royalties or tax and the costs of harvesting, transport and marketing account for most of the market value, by not including the drawdown of capital stock, national accounts tend to undervalue even the forest products that are included in the statistics. Furthermore, wood harvested for home use is often ignored in national accounts.

Downstream activities dependending on forestry include the charcoal industry, and transport and commerce of all forest products. Usually these other activities are measured and the contribution of forestry is not disaggregated from them. In terms of measured economic activity in the Sudan, timber output from Forest Reserves represents a very small proportion of forestry activities. Other timber, such as building poles not from forest reserves, represents a much greater volume than officially transacted (and therefore measured) timber.

Wood used as fuel amounts to between 25-35 million M3 solid volume per year. The energy value of the wood amounts to between six and nine million TOE. As discussed above, not all of the wood is bought and sold,

but such a consumption is an important part of the livelihood of all Sudanese households. Other forest products include gum arabic, medicines, fencing for animals, fruit nuts and berries, honey, natural fertilizers etc.. The role of forests as gene pools and habitats for wild flora and fauna is not represented in statistics, but still may be of considerable economic value.

Forestry and trees are an integral part of traditional rainfed farming systems in the Sudan. The fallow system uses Aca*cia senegal* and other tree species as a key element of an agricultural rotation system. An an indication of the value of the trees, the loss has a destroying impact on traditional agriculture in certain areas, such that the land can no longer be used for farming. Woodlands and plantations can provide protection for both irrigated and rainfed farmland, preserve watersheds, and slow down the siltation of dams. Abandoned farmland and village settlements in the Geziera Scheme have been recovered through the use of shelterbelts. Woodlands are also an essential component of transhumant animal husbandry, ensuring that browsing is available during the dry season.

The main component of industrial forestry in the Sudan is sawmilling.

This industry depends on local timber for the production of railway sleeper, sawlogs for buildings and other purposes. This industry is practiced by the public and the private sectors. There are also other small industries including joinery, particle board industry and manufacture of local furniture and tool handles.

(Reference UNDP/World Bank Sudan Forestry Project, 1987).

2. FOREST SECTOR STATISTICS

There are different institutions involved in the activities of forestry in the Sudan. These include the University of Khartoum, the Central Forests Administration, the National Energy Administration, different non-governmental Organizations and the Department of Statistics of the Sudan. None of these institutions has an organized unit of forestry statistics. Forestry data are collected by these institutions irregularly. They are collected on the basis of need or certain purposes during a certain period therefore, these statistics are not complete in coverage.

As far as the Forests Administration is concerned, the system for recording the quantities of all forest products which are produced throughout the country had been established for many years. It was based on the tabulation of all royalty and revenue receipts issued by each Forest Ranger station (Forest Circle) which was then presented each month to the Provincial Office. The Provincial returns were then published by the Regional Headquarters in their annual reports.

Because of the de-centralization of the Forests Administration 1979, and the serious short-comings of transportation, resource, and local staff, these valuable statistics are incomplete and what is recorded rarely reaches the Central Forests Administration Headquarters in Khartoum.

(Reference: A.P. Padon, Wood Energy Research and Development - GCP/SUD/033/NFT/FAO 1989).

3. INFORMAL SECTOR PRODUCTS

As it was mentioned earlier in point (2), (Forest sector statistics), statistics on charcoal and fuelwood were collected on monthly basis and presented in the annual report of the Central Forests Administration (CFA). After the decentralization of the CFA this practice stopped. Nevertheless there is some data available now which is the effort of different organizations working in the field of forestry in the Sudan.

Another important forest product in the Sudan is gum arabic. There are no surveys concerning this product but there are some data on trade which will be discussed in the appropriate chapter.

4. MODERN SECTOR PRODUCTS

The main products in this sector are railway sleepers, sawn timber, saw logs, round wood. Unfortunately there are no recent surveys in this concern. The latest statistics available are for the years 1975/76 - 1976/77 which are presented in the annual report of the CFA for the year 1977-1978. This report was the last one to be issued by the CFA before the decentralization.

As far as paper industry is concerned there are some small factories producing card board, folding boxes, solid board sheets, etc.. All of these factories depend on imported raw material like kraft paper and waste paper used in the manufacture of fluted paper. Table (2) gives some data collected from these factories by the author.

5. TRADE

Trade statistics on imports and exports are collected by the Foreign Trade Statistics Section of the Department of Statistics. Data are collected on monthly basis and

issued in an annual report. There is also another annual report issued by the Bank of Sudan.

The main products imported are round wood or roughly squared, wood shaped simple worked, pulp waste paper, plywood, artificial wood, etc. (See table (3)). The main products exported are gum arabic, senna pods, bees wax (See table 4).

The international coding system for national trade statistics is: Standard International Trade Classification, revised (SITC, R).

6. FOREST PRODUCT PRICES

The only statistics on forest product prices available are on gum arabic and charcoal which were collected by special occasional surveys.

7. SUMMARY CONCLUSIONS AND RECOMMENDATIONS

National statistics of the forestry sector are almost lacking. Therefore, it is highly recommended to coordinate the efforts of different organizations involved in forestry to set a strong statistical base for data collection and data analysis. The Central Forests Administration is being transformed into a National Forests Corporation and it is planned to build a strong division of forest statistics to abridge the gap.

TABLE 1

Forest types and areas

Forest Type	Area (km2)
Evergreen Tropical Rain Forest	3859
Montane Evergreen Tropical Rain Forest	1150
Semi-Deciduous High Woodland Savanna, with some Closed Forest	59989
Deciduous High Woodland Savanna	48062
Tropical Rain Forest or High Woodland Savanna with Shifting Cultivation	130897
Total	243957

Source: Land Use in Sudan by: J.H.G. Lebon, 1965. Sudan (6)

TABLE 2

Production of paperboard/Packaging factories (Metric Tonnes/Year)

Product Factory	Corrugated cardboard carton paper	Folding boxes Toilet	Plastic sacks sheets	Tissue and	Solid board	Fluted paper
Khartoum Kuwaiti Packing Company	3.000	-	-	-	-	-
Khartoum Packing Company	1.500	-	-	-	-	-
Blue Nile Packing Company	2.500	200	100	50	1160	-
Packing House	1.080	648	-	-	-	-
Apex	-	-	-	-	-	1000
TOTAL	8.080	848	100	50	1160	1000

Source: Survey made by the author, April 1989.

TABLE 3

Values of imports of forest products (1985) (In Sudanese Pounds)

Product	Value
Wood round or roughly shaped	999
Wood shaped simple worked	189,009,821
Pulp and waste paper	616,160
Plywood	1,601,928
Artificial wood	311,150
Wood Manufactures	88,390
Paper in rolls sheets	20,387,091
Articles made of pulp, paper, paperboard	9,233,905

Source: Foreign Trade Statistics Annual Report, 1985. Sudan (7)

TABLE 4

Exports of gum and other minor forest products (Quantity (Q) in metric tonne value (V) in Ls. 000's

Year	1985		1986		1987	
Product	Q	V	Q	V	Q	V
Hashab Gum	14179	4764	17071	122305	19749	254902
Talh Gum	13225	18400	2070	19405	1838	12224
Senna pods	1699	4174	1444	3141	16584	9169
Henna	-	-	-	-	7118	3201
Bees Wax	14	110	13	65	-	-

Source: Foreign Trade Statistics Annual Report (1987).

Sudan

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	14852000	15327000	15818000	16321000	16838992	17372992	17900992	18446000	18998000	19550992
INDUSTRIAL ROUNDWOOD	1552000	1600000	1650000	1702000	1754000	1808000	1862000	1918000	1974000	2030000
SAWNWOOD & SLEEPERS	9800	6400	6400	6400	12500	12500	12500	12500	12500	12500
CHARCOAL	1719000F	1774000F	1831000F	1889000F	1949000F	2011000F	2072000F	2135000F	2199000F	2263000F
PANELS	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
PAPER AND PAPERBOARD	6600	9000	9000	9000	9000	9000	9000	9000	10000	10000
Import Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	30900	15100	80300	49600	21000	21000	55800	55800	55800	55800
PANELS	4100	4300	12000	12000	6500	6500	6500	6500	6500	6500
PAPER AND PAPERBOARD	11500	11300	20200	12300	17800	18800	16100	13400	13400	13400
Import Value (1000 US$)										
SAWNWOOD & SLEEPERS	7144	4482	24219	9130	6261	6261	16600	16600	16600	16600
PANELS	2191	2277	5666	5666	2743	2743	2743	2743	2743	2743
PAPER AND PAPERBOARD	6266	6179	18315	10200	13214	13752	11547	10247	10247	10247

Swaziland

D.A. Gwaitta-Magumba

1. GENERAL INFORMATION ABOUT SWAZILAND

a) Area and Location

The Kingdom of Swaziland covers an area of 17,364 km^2 and is situated on the South eastern side of Africa (See Fig. 1). Swaziland is geographically land locked between the Republic of South Africa and the Republic of Mozambique. Its capital, Mbabane, lies 220 km from the nearest seaport, Maputo.

b) Relief and Climate

In spite of Swaziland being a small country, it is divided into four well-defined ecological regions. They are from West to East, the Highveld, the Middleveld, the Lowveld and the Lubombo Plateau.

The Highveld has an average altitude of 1000 - 1300 m and the Lowveld, 200-500 m. The altitudinal range and its southerly location gives Swaziland two distinct seasons, summer and winter.

The Highveld receives an annual rainfall of 1000 - 1500 mm and is of almost temperate climate. The Lowveld gets 600 -750 mm, and is of a subtropical climate. About 85% of the total rainfall in Swaziland is received during summer season.

c) Land Tenure and Land Use

There are two distinct systems of land tenure in Swaziland: the Swazi Nation Land (SNL) which is communally owned and occupies 57% of the total land area, and the Individual Tenure Farms (ITF) which can be bought and sold freely by the Swazi citizens.

On SNL, subsistence agriculture is practiced, though there is an emerging tendency to grow more cash crops, particularly under Rural Development Area (RDA) Programme.

Livestock plays a very important role in traditional Swazi society, both economically and socially. However, increased population of livestock has led to overgrazing, causing soil erosion in some areas of the country.

Individual Tenure Farms and estates produce sugar cane, citrus, pineappleas and timber for external markets. Here, the efficiency of land use is very high and irrigation is used to supplement natural rainfall, particularly in sugar cane growing area.

d) Population

Provisional population census results of 1986 indicate that Swaziland has a total residence population of 676,000 a growth rate of 3.2% over the 1976 enumeration and a density of 35 persons/km^2.

e) Employment

A substantial number of Swazi labour force is absorbed by South African gold and coal mining industries, representing 15% of the Swazi male Labour force in 1986.

Miner's remittance constitute about 11% of Swaziland's GNP.

Employment in traditional sector is mainly in agriculture with 55% of the total farm population being unpaid family members.

f) Economic Factors

i) ***Resources***

Swaziland has a mixed economy with substantial agriculture and mining resources. Mixed farming is based on maize, tobacco, cotton, citrus fruits and rice, in the Middleveld.

The most dominant crop, sugarcane is grown in the Lowveld under irrigation.

Commercial forests for production of woodpulp and saw timber abound in the Highveld.

Mining, a relatively important activity is mainly based on asbestos in the Highveld and coal in the Lowveld.

ii) ***Gross domestic product***

With an estimated per capita income of US$ 800 in 1984, Swaziland was among the countries with the highest economic growth in the sub-Saharan Africa. In 1980, sugar and wood pulp industries together accounted for over 45% of the total Agricultural and Industrial GPD.

By 1982, however, economic growth had slumped down and the economy essentially stagnated until 1986. This was due to worldwide recession which

was felt particularly severely in the Southern African Region.

iii) ***External dependence***

The proximity to the Republic of South Africa has heavily influenced the development of Swaziland. Almost 90% of the Swaziland's export originate in South Africa, although only 20% of the Swaziland's exports are sold to the Republic.

iv)***Exports***

Swaziland's exports are dominated by sugar which averaged between 35% and 45% during the 1980 - 1986 period.

v) ***Imports***

Energy, machinery, transport equipment, and miscellaneous manufacturers dominate imports. In 1986/87, food constituted a large part of Swaziland's imports (9.3%), due to the draught years.

vi)***Prices and exchange rate***

Swaziland has faced inflation in the past due to the sharp decline in 1984 - 85 of the South African Rand to which the Swazi Lilangeni[1] (Plural Emalangeni (E)) is closely tied.

2. STATUS OF FORESTRY DEVELOPMENT IN SWAZILAND

2.1 Forest Policy

The Forest Policy of the kingdom of Swaziland is:

a) to encourage the attainment of optimum productivity of the forest resource;

b) to manage, protect and conserve forest resources, having due regard to the immediate and long term economic and social benefits;

c) to provide extension services to farmers by establishing woodlots for firewood, building poles, control of soil erosion and income generating;

d) to co-ordinate timber harvesting, wildlife management, water, out-door recreation, and other natural resources, in consultation with other ministries, departments, agencies and private sectors;

e) to encourage a vigorous and efficient timber processing industry in the kingdom, and assert the financial interest of the nation in the forest resources in a systematic and equitable manner, and

f) to pursue an applied research programme in Forestry and Agroforestry etc.

2.2 Three year forestry sector development plan (1988-92)

The Commercial exploitation of forestry for wood pulp accounts for a significant proportion of Swaziland's exports but this exploitation is predominantly located on large plantations operated by the private sector. The role of the Forestry Section within the Ministry is to ensure that the country's forestry resources are managed and conserved optimally, so any exploit-ation does not have harmful environmental consequences. This entails the continued monitoring of rates of deforestation, the provision of extension services to advise farmers on appropriate forestry practices and the undertaking of research on propagation of both indigenous and exotic tree species.

Specific programmes and projects to be implemented in the plan period are:

a)To carry out a nation-wide inventory of indigenous forests in conjuction with Fuel and Energy Sectoral Programme which will provide sufficient data for proper regeneration practices, forest management planning, forest utilization and environmental protection. As a follow-up from this inventory, forest-reserves will be demarcated.

b) To introduce four new forest nurseries in firewood deficit areas, and to improve and maintain the existing five nurseries. These nurseries are used for propagation of both indigenous and exotic tree species covering 1000 ha to derive suitable tree species for firewood, building material and conservation of the soil.

c) Demarcation programmes on forest management will be launched by forestry extension officers to encourage farmers on SNL to convert wattle jungles into managed plantations for the production of timber, building poles, wattle bark and charcoal.

3. FORESTRY AND FOREST INDUSTRY

3.1 Forest Area and Primary Wood Products

The total area covered by forests in Swaziland is 106,810 ha, about 6% of the total area of Swaziland (See Table 1); man-made forests account for 103,021 ha and are mostly planted on ITF. This figure, however, excludes timber plantations and naturally regenerating black wattle on SNL, small holdings under ITF, as well as areas used for forest servicing. Although the area under indigenous woodlands is given as 1717 ha in Table 1 this appears to be a gross under estimate. The actual area will be known after the ongoing inventory

[1] 1 Lilangeni is currently equivalent to US$ 0.38.

of indigenous woodlands and black wattle forests on SNL is completed.

Coniferous trees accounted for about 75% of the total plantation area in 1983 forest census. About 19% of the forest land was under Eucalyptus, predominantly E. grandis/saligna. (See Table 2).

Approximately 308 900 m3 of roundwood excluding wattle bark was extracted from forest plantations in 1984 (See Table 3) in 1985 the value of sales of processed wood products was

E 102,339,000 (See Table 4).

Primary wood processing is the first stage of wood processing after the wood has been removed from the forest. Forest operations before the mill stage are excluded, and so are the later stages of processing such as carpentry and joinery.

There are 10 companies know to be engaged in wood processing. These are as follows:

Sawmilling	5
Manufacture of mining timber	1
Oil Manufacturing	1
Treating poles	4
Manufacturing panel products	1
Manufacture of woodpulp	1
Laminating	1

Some companies cited more than one activity each.

3.2 Timber Statistics in Swaziland

The first comprehensive Annual Report on Swaziland Timber Industry was compiled in 1970 by the Department of Economic Planning and Statistics of the Prime Minister's Office. From that year until 1983, this report gave the results of two censuses, one for timber plantations and the other for primary wood processing establishments.

The Government of Swaziland is currently reviewing the structure of the Forestry Section with a view to upgranding it to Department level so that it can compile forestry statistics and later send it to the Department of Statistics and Economic Planning for compiling the overall national statistics.

The Census of timber plantations was intended to cover all timber growers on ITF as well as Government departments known to have timber plantations. The census does not include small patches and wattle forests growing on SNL. It was however decided in 1985 that timber growing on SNL and its use would be covered separately, particularly after the inventory of indigeous and wattle forests.

Two types of farms are mailed out in the middle of December for the year to which the census refers, to all timber growers and processors.

Timber growers are sent a larger form if they are known to be selling over E 5,000 per annum, and a simpler form of one sheet if they sold less than E 5,000 worth of timber during that year.

Respondents are required to report the year's activities as evaluated at 31st December.

Statistics from commercial growers and processors selling E 10,000 per annum are collected on a monthly basis. These are further revised upon receipt of the annual census forms.

Most of the non-responses are attributed to various factors, such as:

- most holders ageing or simply going out of farming;
- some farms being left idle or sold to local farmers whose interests are usually different;
- addresses of the new holders are usually not registered.

SWAZILAND CENSUS OF AGRICULTURE # 1983-1994

Individual tenure farms and large estates

TABLE 1

Timber plantations: area by land-use and by ownership type

31st December 1983

Land-Use Category	Swaziland		Individual Or Partnership		Registered Companies		Other Growers	
	Area ha	% of total	Area ha	% of total	Area ha	% of total	Area ha	% of total
Forests of which	106810	62.2	7809	28.3	97517	72.1	1484	16.7
Man-made forests	103021	60.0	7547	27.3	94484	69.8	990	11.1
Natural forests	1717	1.0	146	0.5	1314	1.0	257	2.9
Open wood land temporarily unplanted	2072	1.2	116	0.4	1719	1.3	237	2.7
Forest Serving	14049	8.2	423	1.5	13726	10.1		
All other land including cultivated grazing or unused land	50825	29.6	19391	70.2	24035	17.8	7398	83.3
Total Area covered by the Census	171784	100.0	27623	100.0	135278	100.0	8882	100.0

Including educational and religious institutions.
Source: Central Statistics Office, Mbabane.Swaziland (8)

SWAZILAND CENSUS OF AGRICULTURE # 1983 - 1984

Individual tenure farms and large estates

TABLE 2

Man-made forest area by species

31 December 1983

Species	Area Hectares		% of Total Man-made Forest Area		% of Total Area of Swaziland	
	1982	1983	1982	1983	1982	1983
Coniferous Species	75 737	77 646	75.1	74.7	4.36	4.47
Saligna/ grandis	19 856	19 347	19.7	18.6	1.14	1.11
Other gums	2 469	1 705	2.4	1.6	0.14	0.10
Wattle	2 657	2 657	2.6	2.6	0.16	0.15
Other non coniferous species	197	2 453	0.2	2.5	0.01	0.15
Total	100 916	103 898	100.0	100.0	5.81	5.98

Source: Central Statistics Office, Mbabane.

SWAZILAND CENSUS OF AGRICULTURE
1983 - 1984
Individual tenure farms and large estates

TABLE 3
Quantity of roundwood sold or transferred out from plantations in 1984

Use	Unit	Whether Exported	Coniferous Species	Eucalyptus (Gums)	Other Gums	Tan Wattle
Sawlogs	c.m.	not exported	187 912	-		
		exported	-	1 880	-	-
		Total	187 912	1 880	-	-
Poles and	c.m.	not exported	-	51	-	-
		exported	-	15 671	-	-
		Total	-	15 722	-	-
Mining timber	Mton	not exported	-	393	-	-
		exported	-	25 981	-	900
		Total	-	26 374	-	900
Pulpwood for paper products	Mton	not exported	55 524	299	-	-
		exported	5 716	3 034	-	-
		Total	61 240	3 333	-	
Pulpwood Mtons for other products		not exported	8 717	-	-	
		exported	-	-	-	3 000
		Total	8 717	-	-	3 000
Firewood	Mtons	not exported	-	-	-	-
		exported	-	-	-	-
		Total	-	-	-	-
Wattle bark	Mtons	not exported	xxxx	xxxxx	xxxxx	
		exported	xxxx	xxxxx	xxxxx	900
		Total	xxxx	xxxxx	xxxxx	900
Other Purposes	Mtons	not exported	-	-	-	-
		exported	-	-	-	-
		Total	-	-	-	-

Source: Central Statistical Office, Mbabane.

SWAZILAND CENSUS OF AGRICULTRE # 1983 - 1984
Individual tenure farms and large estates

TABLE 4
Sales of processed wood products by commodity group in 1985 value E'000

Commodify group	Unit	Total sales		Sales in Swaziland		Exports TORSA		Exports to Other countries	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
A. Sawn timber	c.m.	55 847	10 202	10 816	1 878	31 143	5 502	13 888	2 822
B. Sleepers	M ton	-	-	-	-	-	-	-	-
C. Treated poles	c.m.	833	36	833	136	-	-		
D. Mining timber	c.m.	4 160	266	-	-	4 160	266	-	-
E. Panel products	c.m.	376 838	3 278	5 457	53	371 381	3 225	-	-
F. Woodpulp		+	87 940	-	-	+	34 744	+	53 196
G. Eucalyptus oil	M ton	60	517	-	-	-	-	60	517
H. Wattle + Other	c.m.	-	-	-	-	-	-	-	-
Total		N/A	102 339	N/A	2 067	N/A	43 737	N/A	56 535

Notes: +:No figures of volume are published by agreement with the company conceme
N/A: Not applicable
Sales in Swaziland are valued at millsite values, exports at free-at-border values
Source: Central Statistical Office, Mbabane.

Swaziland

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	527000	543000	560000	560000	560000	560000	560000	560000	560000	560000
INDUSTRIAL ROUNDWOOD	1410000	1611400	1663400	1663400	1663400	1663400	1663400	1663400	1663400	1663400
SAWNWOOD & SLEEPERS	120000	121000	136000	136000	136000	136000	136000	136000	136000	136000
PANELS	3000	4900	4500	8000	8000	8000	8000	8000	8000	8000
WOOD PULP	161000	156000	157000	157000	175000	178000	174000	180000	180000	178000
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	244200	164700	270500	270500	270100	270100	270100	270100	270100	270100
SAWNWOOD & SLEEPERS	112900	96800	89400	76400	76400	76400	76400	76400	76400	76400
PANELS	3300	3100	4500	8000	8000	8000	8000	8000	8000	8000
WOOD PULP	161300	156200	156700	126000	126000	178000	174000	174000	174000	174000
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	3476	2532	3820	3820	3801	3801	3801	3801	3801	3801
SAWNWOOD & SLEEPERS	10439	12612	11440	8536	8536	8536	8536	8536	8536	8536
PANELS	1091	958	1610	2087	2087	2087	2087	2087	2087	2087
WOOD PULP	33971	47353	53267	42928	42928	70000	69000	69000	69000	69000
Import Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	0	41300	72100	72100	72100	72100	72100	72100	72100	72100
SAWNWOOD & SLEEPERS	0	5000	5000	0	0	0	0	0	0	0
Import Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	0	861	730	730	730	730	730	730	730	730
SAWNWOOD & SLEEPERS	0	678	678	0	0	0	0	0	0	0

Tanzania

G.S. Kowero and S.G. Mathias

1. INTRODUCTION

The role of statistics in planning and control, among several other uses, cannot be overemphasized. Forestry, like many other undertakings, requires reliable and adequate statistics on various parameters to facilitate planning and execution of its development plans.

In Tanzania statistics on various forestry related parameters are available in varying degrees of abundance and accuracy. There is for example, very scanty information in form of estimates or "guesses" on non-traded products especially those available and consumed in villages like poles for building purposes and firewood. More information is available on products with well established modern commercial systems. This includes data on plantation forest produce and on secondary forestry production. In this category more reliable data is obtained about produce emanating from public institutions as opposed to that originating from the private sector. This is largely due to an element of information confidentiality built into the private sector to suit various objectives.

These variations notwithstanding, plans for the forestry sector require data from both public and private sectors. This paper seeks to examine how such data is organized in Tanzania.

2. ORGANIZATION OF FORESTRY STATISTICS

In Tanzania there is no single institution or organization with all data on the forestry sector. Several production, teaching and research institutions within and outside forestry collect, process and store forestry related information for various purposes. Such institutions include the Bureau of Statistics, Forest and Beekeping Division, Tanzania Wood Industry Corporation and its subsidiary companies, various forest project offices, district and regional forest offices, Customs and Sales Tax Department, Faculty of Forestry at Sokoine University of Agriculture and Tanzania Forest Research Institute.

The Bureau of Statistics is in principle the custodian of statistical information from various sectors of the economy. However the amount and quality of data from this source will very much depend on what type of data the Bureau is supplied with from the various sectors of the economy. The Bureau periodically publishes statistical abstracts for the whole country. The forestry sector is included in such publications to the level of detail expected from a single document covering all sectors of the economy.

The Forest and Beekeeping Divison of the Ministry of Lands, Natural Resources and Tourism is in principle responsible for all forestry matters in the country since it is the custodian of the country's forest policy and regulations/ordinances and is responsible for their implementation. Consequently one would naturally expect its library to be the depository of all forestry related information on primary and secondary forestry production; in addition it is the source of information available at the Bureau of Statistics of the Ministry of Finance, Planning and Economic Affairs.

In addition the following organizations are involved in information on the sector:

Tanzania Wood Industries Corporation (TWICO)

- responsible for information on public and private wood based industries related to input and output capacities. Publishes progress report available in their industries, and TWICO office
- keep record on export of wood.

Forests Projects Offices

- used as source of information of Forest production in Forest Plantation in the Forest and Beekeeping Division.

Districts and Regional Forest Officer

- source of information on forest especially natural forest under the Prime Minister's Office, and Catchment forest under Forest and Beekeeping Division where some statistical information on inventory data harvested volume and revenue collection are available. Publishes quarterly and annual progress reports.

Customs and Sales Tax Department

- organization publishes an Annual Trade Report of Tanzania and is the source of various reports/ information on forestry products exportation and importation

- this department keeps information on quality and quantity of wood exported and their destination. Therefore is the most reliable source on International Trade Statistics for many institutions like the Bureau of Statistics.

Faculty of Forest at Sokoine University of Agriculture

- source of various statistical information related to academic or research objectives. Publishes annual report and Journals.

Tanzania Forestry Research Institute

- compiles data on Silvicultural and Utilization of different tree species
- publishes in: Annual Reports, Silvicultural and Technical notes also in International Journals.

Energy Planning

- Collects information on woodfuel consumption for Energy Planning. Publishes in Annual Reports, Seminar Papers.

The multiplex organization structure of forest and forestry related activities in the country to a large extent affects the availability, storage, and level of analysis of related data. The following sub-chapters evaluate the status of such data within the framework of this multiplex organization set-up.

2.1 Forest Resources

Out of 88.6 million hectares that make up mainland Tanzania, about 39.5 million hectares are considered arable rainfed conditions and only 6 (six) million hectares (16%) of the potential is under cultivation. Land under irrigation is estimated to be 15% of 0.9 million ha which can be irrigated.

Grazing land amounts to 44 million hectares, most of which is only marginally used for pasture overlapping with Miombo and savanna woodlands.

Forests and Woodland occupy about 44 million hectare or 50% of Tanzania's Land area. This estimate may be up to 15% too high because of the unrecorded area lost mainly due to shifting cultivation and fires. The total forested area is distributed into the following categories. (TFAP 1989).

Type of forest

(1) Forests	1,400,000 ha
(2) Mangroves forests	80,800 ha
(3) Woodlands	42,891,000 ha

Use of Forest Land

• "Net Productive" area	34,626,000 ha
• "Un-Productive" area	974,500 ha

Legal status:

• Forest Reserves	13,024,000 ha
• Forest/Woodlands within National Parks etc.	2,000,000 ha
• Public Forest land	23,347,000 ha

Woodlands can further include some 150,000 ha plantation Forests (within forest reserves about 80,000 ha) representing only about 0.3% of the total area of forests and woodlands (TFAP 1989).

Most of forest reserves have been set aside mainly for production purposes and the rest in catchment areas.

The average growing stock is estimated at 41 m^3/ha representing a total wood volume of about 1.8 billion m^3. The potential sustained yield from the net productive area could be 24.3 million m^3 per year of 0.7 m^3/ha/year. All the available estimates on forest areas stock and yield are shaky and based on mostly unrevised inventories. This is discussed in the following sections.

2.1.1 Natural Forests

These are productive/commercial and protective forests. The commercial forests are managed by foresters at district and regional levels and since district and regional administrations are under the Prime Minister's office, statistics on these forests are found in aggregated or condensed form at Prime Minister's office. However these officers also supply statistics to the Forest and Beekeeping Division. The catchment forests are managed by the Forest and Beekeeping Divison and statistics on them are relatively easier to obtain.

A central information system broke down with the decentralization move of the early 1970s when the Prime Minister's office assumed responsibilities of the commercial natural forests from the then Forest Division. The Forest and Beekeeping Division has some statistics on these forests and on such aspects as areas, inventory data, harvested volumes and revenues realized. The district forest authorities are the ones who issue licences for any harvesting in these forests and are required to submit monthly records of such activities on especially prepared forms to the Forest and Beekeeping Divison headquarters. On the basis of such records, it will then be possible to keep track of harvesting levels, their compatibility with existing stock (based on inventory data) and wood processing capacity, forestry-related developments in each district, tree species mix in harvests and their distribution in the forests. This and other types of information is useful for planning and control of activities in these forests.

This is certainly an ideal picture. The reality is that despite this elaborate set-up, the district and regional forestry authorities are not duty-bound to the Forest and Beekeeping Division, consequently these forms are not filled and submitted as required, and there is no penalty for defaulting. A serious consequence of this is that there is not sufficient and reliable data to support meaningful plans for these forest types. For example the size of Tanzania's forest estates largely remains elusive as exhibited by table 1. The figure of 440,000 km^2 as the area of Tanzania's forest estate has been used since 1972 despite the fact that this area has been reduced over the years through deforestation which has been estimated to range from 300,000 to 400,000 hectares per year (Forest and Beekeeping Division, 1988).

TABLE 1
Total forest area of Tanzania

Source	% of total Area (km^2)	land area
Jorgensen (1977)	297,500	34
FAO (1969)	315,000	36
IBRD (1974)	376,250	43
Morgan (1969)	385,000	44
Kessy (1982)	420,000	48
ODA (1987)	427,800	48
Forest Division (1972)	440,000	50

Adapted from Forest and Beekeeping Division (1988)

Similar discrepancies occur when one examines statistics on the distribution of various forest reserves as shown in table 2.

The Forest reserves number 540 and vary in size from 3 ha (Kwembogo Forest Reserve in Lushoto District of Tamba region) to 680,000 ha (Nyanjambaga Forest Reserve in Tabora District of Tabora Region). The average size is about 25,000 hectares. These forest reserves represent about 30% of the total area classified as forest land. They have been gazetted and are under government management. The rest of the forest land, with the exception of plantation forests, are public forest lands i.e. are open for free use by the people.

The forest reserves have been gazetted mainly for production (i.e. for timber, poles and firewood production) and protective proposes. The protection forests are largely for water and soil protection purposes. Again there are several estimates of the distribution of the forest reserve areas between these two forest types as shown in table 3.

The last major inventory of a large portion of the natural forests is one carried out by CIDA in 1971 - 1973.

Therefore the basis for the disparities in the statistics on the area of the forest estate and its constituents is very questionable and calls for serious efforts to establish the actual size of the forest estate, its composition, and growth parameters of its various tree species so as to assist plans to further the development of this sector.

2.1.2 Public forest land

The Forest and Beekeeping Divison (FDB) has the mandate of overseeing activities in public forest lands which occupy about 31.1 million hectares. In principle this is in line with the requirements of the forest policy but in practice FBD does not have the resources for such an enourmous exercise. Consequently there is no reliable information on the state and development of these public lands. This is very unfortunate because such lands support considerable livestock rearing, provide fuelwood to a large proportion of the population in addition to poles and withies for building purposes.

TABLE 2
Forest reserves of Tanzania

Area	Closed %	Woodlands forest	Grassland	Mangrove	Total	Source
Hectares	883,900	11,481,000	355,600	79,200	12,796,700	Procto (1969)
% of land area	1.01	13.12	4.10	0.09	14.62	
Hectares	927,100	10,783,600	313,400	79,900	12,104,000	Tanzania Govt. (1976)
% of land area	1.06	12.32	3.60	0.09	13.83	
Hectares	951,900	11,375,600	945,700	81,700	13,355,100	Maagi (1979)
area	1.09	13.00	10.80	0.09	15.26	
Hectares	850,760	12,142,614	334,785	79,875	13,407,785	Forest Division (1982)
% of land area	1.00	13.50	4.3	0.09	16.00	

Adapted from Forest and Beekeeping Division (1988)

TABLE 3
Productive and protective forest reserves of Tanzania (million hectares)

Productive	Protective	Source
11.8	1.6	Forest Division Annual Reports
10.8	2.6	Maagi, Mkude and Mlowe (1979)
10.4	3.0	Maagi, Mkude and Williams (1982)

Adapted from Forest and Beekeeping Division (1988)

To plan for the future availability of these and other commodities from the forested public land, one would definitely need data on its various forest parameters.

2.1.3 Plantation forests

Tanzania has eighteen industrial plantations and one fuelwood plantation. The industrial plantations occupy an area of 79,300 hectares and comprise of 68,700 hectares of softwood and 10,600 hectares of hardwoods. The fuelwood plantation has an area of 633 hectares.

The Forest and Beekeeping Division is responsible for establishing and managing these plantations. Each plantation forest project maintains job cards for all its daily operations. These together with other documents are used to compile the history of each compartment which is recorded in a compartment history book. Each forest project compiles monthly, quarterly, and annual reports on their operations which are submitted to FBD head office. The monthly and quarterly reports are more detailed than the annual reports.

This arrangement enables the FBD to monitor activities in its plantation forest projects. However the reliability of such reports is in some cases questionable depending on the accuracy of the information in the basic or primary records like job cards, machine books and weekly reports. However the plantation forestry statistics could be the most accurate and reliable statistics on the whole primary forest production phase.

2.1.4 Village/community forests/woodlots

Villages are under the Prime Minister's office. With the recently formed Ministry of Local Government, Cooperatives and Marketing, many village matters will also be handled by this ministry. The village governments are not well-staffed; consequently the development of a strong information system within the villages has not materialized. Although there has been a village afforestation programme since 1967, reliable statistics on coverage, plant survival rates and future plans and targets are not easily available. In fact the afforested village acreage has been crudly estimated on the basis of number of seedlings issued to villagers and planting espacement. The absence of a follow-up on field survival of the planted seedlings adds doubts on the estimated acreage of about 100,000 hectares so far afforested in Tanzanian villages since 1967.

Since development efforts in the country are targeted at villages, reliable and sufficient data on forestry related parameters are necessary in order to effectively plan for such village requirements like fuelwood, poles, withies and fodder for animals, in addition to conserving village water supplies and soils.

2.1.5 Other forest areas

Some local government authorities like town councils, municipalities and city councils own and manage some forest areas within their localities. These forests are mainly for fuelwood purposes and are fairly small. They are managed with assistance from officials of the Forest and Beekeeping Division. Statistics on these forests are readily available from such authorities.

2.2 SECONDARY FORESTRY PRODUCTION

In this text secondary forestry production deals with the utilization of primary forest produce, whether further processed or consumed raw.

For convenience, such produce is divided into "informal sector products" comprising of firewood, charcoal and other forest related products like resins, gums and fruits. "Modern sector products" include industrial roundwood, sawntimber, wood based panel products, and pulp and paper.

2.2.1 Informal sector products

The products considered in this section are firewood and charcoal which comprise the bulk of energy requirements for the majority of the people in Tanzania. A brief qualitative assessment of forest related products like resins, gums and fruits will also be made.

There are several statistics on informal sector products of firewood and charcoal. Some are based on actual surveys and several are educated guesses. At the national level statistics on these products are very questionable mainly because there are not national surveys which adequately represent the various ecological zones. Surveys made so far are only spot ones and not continuous surveys. This has a strong bearing on consumption of these products which vary with seasons,

their availability, cooking stoves, habits, and presence of alternative sources of energy and their prices.

Most of the surveys carried out have been limited to certain ecological zones, districts and regions and this could be mainly due to lack of funds and manpower for more extensive surveys and on a continuous basis. Most of the surveys have been carried out by foreign financed institutions or individuals. There are hardly any surveys carried out and financed by the government.

The following are some of the important surveys carried out in the 1970's and 1980's.

1. Openshaw, K. 1971. Present consumption and future requirements of wood in Tanzania. Technical report no. 3 FAO, Rome.
2. Fleurent, P. and A. Fleurent, 1978. Fuelwood use in a peasant community: A Tanzania case study. Journal of Development Areas 12: 315-322.
3. Nkonoki, S.R. 1981. The poor man's energy crisis. A report of the Tanzania rural energy consumption survey. Institute of Development Studies, University of Dar es Salaam.
4. Skutsch, M.C. 1983. Why people do not plant trees. The social-economic impacts of existing woodfuel programmes: Village case studies, Tanzania. Resources for the Future. Washington D.C.
5. FAO, 1984. Tanzania: fuelwood consumption and supply in semi-arid areas. FAO/SIDA Forestry for local community development programme. FAO, Rome.
6. Eklot, J.A. and H. Pettersson, 1984. A study on energy use and afforestation in Tabora, Tanzania. Statistics Sweden Stockholm.
7. Chchage, C.S. and A.A.K. Nvungi, 1988. Village participation survey. Department of Sociology, University of Dar es Salaam.

None of these surveys have been repeated, they are therefore spot surveys.

Coverage and woodfuel consumption statistics reported by some of the surveys and some other reports are summarized in table 4.

TABLE 4
Wood energy consumption data for Tanzania

Author	Location	Amount (Range) m³/capita	Comments
National estimates			
Openshaw 1971		2.3	2.1 households, 0.2 other
Mnzava 1980		2.0	
Nkonoki 1981		2.5	
Kaale 1983		2.0	
Kikula 1983		2.0	
UNDP/World Bank 1984		2.04	1.78 households 0.26 other
MEM 1988		2.7*	households only, 1986 energy balance
Sawe and Leach 1989		1.0	
Rural Surveys (Village Averages)			
Fleurent & Fleurent 1978	Lushoto	4.0	
Gulluisson	Shinyanga	0.71	(0.41-1.5) Depends on wood abundance
Persson	Mwanza		Collection distance
Nilsson 1983	N. regions	0.86 (.04-1.5)	15 villages:dryseason
"	"	1.4 (0.6-2.4)	15 villages: wet season (depends on distance)
Oklot & Petterson 1984	Tabora	1.7	
FAO 1984	Semi-arid	1.2* (0.63-1.86)	15 villages
"	"	1.73* (1.36-1.86)	1500 m altitude
"	"	1.43* (1.34-1.80)	1000-1500 m
"	"	0.93* (0.63-1.60)	1000 m
Asman & Kayumbo 1980	Dodoma	0.77 (0.66-3.0)	11 villages
Skutsch 1983	Dodoma & Morogoro	1.47* (0.41-1.20)	11 villages 1000m
		0.93* (0.49-1.59)	7 villages 1000m

Notes: *Domestic use includes beer brewing. For FAO 1984 Survey, beer brewing used an average 0.05 m³/capita in high altitude villages and 0.13 - 0.16 m³/capita in others. For Skutsch 1983, beer brewing was 0.27 - 0.30 m³/capita.
All data are solid wood equivalent, including wood for charcoal production.
Original data given by weight is converted to volume at 1.4 m³ per tonne.

Source: TFAP, BLOENERGY (1989)

The wide variations are most probably explained by accuracy, timing and locality of survey. For example Lushoto district surveyed by P. Fleurent and A. Fleurent has a very cold season which necessitates use of firewood for heating purposes as compared to the hot semi-arid areas surveyed by M.C. Skutsch which also harbour poorer communities as compared to Lushoto residents. The latter can afford to cook more meals per day than the former.

All these surveys have almost exclusively confined themselves to wood fuel energy consumption. There is almost no information on consumption of other forest related products like poles for building purposes, fruits and resins. Also industrial consumption of these products especially firewood and charcoal is partially covered. The main reason could be the great attention the fuelwood energy problem has been receiving and its impact on the rural poor.

As regards production statistics on fuelwood and charcoal there are no reliable and accurate data on these products. The estimates supplied by FAO (1988) have been accepted as provisional data on these products pending the publication of the Tanzania Tropical Forestry Action Plan later this year. Hopefully this publication will contain some more recent and reliable estimates. Tables 5 to 7 which were extracted from "Joint UNDP/World Bank Energy Sector Management Assistance Program (1988) Tanzania : Woodfuel/ Forestry Project: Main Report and Annexes".

TABLE 5
Woodfuel consumption estimates for Tanzania: 1987 and 2000 (million m³)

Sector	1987 Total	1987 %	2000 Total	2000 %
Household (urban)	5.4	13	10.7	17
Household (rural)	31.5	74	45.7	71
Tobacco curing	0.5	1	0.5	1
Other	5.0	12	7.3	11
Total	42.4		64.2	

Source: UNDP/World Bank (1988)

As a conclusion, there is some information on informal sector products of firewood and charcoal. The information originates from various sources based on varied coverage, accuracy and methodologies, as such estimates of national averages also vary.

There is no information on consumption and availability of other products like poles, fruits, gums and resins. These are very important to local communities as rural houses are constructed using poles as a significant component. These are products also need increased attention so as to assure their sustained availability.

TABLE 6
Wood Supply estimates for Tanzania

	Gross Area	Reserved Area	Unreserved Area	Growing Stock	Gross Annual allowable cut	Annual allowable cut
	million ha			million m³		
Woodlands*	84.2	11.4	44.5	3,100	72.0	61.0
Villages	0.8	-	0.8	24	0.6	0.5
Total	85.0	11.4	45.03	3,124	72.6	61.5

Source: UNDP/World Bank (1988)
*Includes bushland and thickets.

2.3.2 Modern sector products

2.3.2.1 ***Sawn wood***

(a) Available statistics

The production of sawnwood in Tanzania is by both public and private sectors. In the public sector the Tanzania Wood Industry Corporation (TWICO), a parastatal organization in the Ministry of Lands, Natural Resources and Tourism, has 40% of the installed sawn hardwood capacity. This implies that TWICO has a sawmill capacity of about 35,000 m³ of log intake per year.

Most of the big sawmills are owned by TWICO. The private sector and a few district development corporations own the remaining 60% which is equivalent to 52,000 m³ of log intake per year. The private sector is characterized by many small sawmills, each with a capacity averaging 2,000 m³ of log intake per year.

With respect to softwood sawn timber production, TWICO owns 74% of the installed capacity which is equivalent to 161,000 m³ of log intake per year. The private sector has an installed capacity of about 55,000 m³ of log intake per year which is equivalent to 26% of the total installed softwood sawn timber capacity.

In addition to sawmills, pit sawyers contribute about 40% of the total sawn wood consumed in Tanzania. However their production which is confined to natural forests only is very difficult, if not impossible, to monitor as it takes place in relatively remote areas and is largely unrecorded. Consequently one has to adjust production from public and private sector sawmills by

TABLE 7

Aggregate energy balance for Tanzania, 1986

Million tonnes of oil equivalent (MTOE)

	Crude Oil	Petrol. Prods	Coal	Hydro	Elec.	wood	coal	Char biomass	Other Total
Total Requiment	.51	.38	.02	.09	0	16.90	0	.71	18.61
Conversion	-.51	.39	0	0	.07	-5.59* 1.11	0	4.61	
Final use	0	.77	.02	0	.07	11.31	1.11	.71	14.00

Notes on conversions:
Petroleum products: 0.38 MTOE petroleum white products is imported directly and 0.39 MTOE is obtained from refining crude oil. The conversion loss from crude oil (0.51 MTOE) to refined products (0.39 MTOE) includes some re-export of fuel oil as well as refinery operating losses.
**Wood*: 5.59 MTOE of wood is converted to 1.11 MTOE of charcoal, mostly by traditional earth kilns.Tanzania (14)

Cont'd

Woodfuels only: million solid m³ wood equivalent

	Wood	Char coal	Other biomass	Total
Total requirement	63.1	0	2.7	65.8
(Wood to make charcoal)	(20.1)			
Total final consumption	42.3	4.1	2.7	49.1
Of which:				
Rural households (incl. beer brewing)	37.3	2.0	2.7	42.0
Urban households	0.1	2.1	0	2.2
Agriculture (tobacco, fish, etc)	2.2	2.2		
Industry (bricks, pottery, etc,)	0.4	0.4		
Other commercial institutions	2.3	2.3		
Including wood to make charcoal:				
Rural households	50.1			
Urban households	10.8			
Other	4.9			

Tonne oil equivalent (TOE) = 42.6 GJ (gigajoules)
Solid m³ wood - 11.4 GJ (16 GJ/tonne, 714 kg/m³, 1.4 m³/tonne)

this factor in order to arrive at an estimate of national sawn wood production.

Additionally, the private sector records are not easily available to researchers and other interested people, so the production from this sector is largely an estimate. In this report production from the private sector has been estimated based on a list of private sector sawmills and their installed capacities compiled on basis of data available from TWICO and the Forest and Beekeeping Division. It was assumed that since the public and private sector sawmills have been operating under the same economic environment and facing similar problems like lack of spare parts and skilled manpower, they have most probably been operating at the same level of efficiency. Table 8 summarizes the production statistics of sawn timber for the 1980's.

b) Organization of statistics

The quality of data from public sector sawmill is satisfactory. Data on production are compiled by the mills on a daily basis and thereafter assembled on weekly, monthly, quarterly and yearly basis. Monthly, quarterly and yearly statistics are submitted to TWICO headquarters in Dar es Salaam to enable the holding company to monitor activities in its subsidiary companies.

The same pattern of compilation of data is pursued by the private sector but the information is not easily available to outside parties.

According to established procedures, which are currently not pursued vigorously each sawmiller, whether private or public, is required to fill "Monthly Sawmill Return" form which contains information like his input and output volumes by tree species. One form is submitted to the sawmillers' district forest officer and another is sent to the Forest and Beekeeping Division headquarters.

The district forest officers compile all monthly sawmill return forms in their districts on two forms which constitute "Monthly Production Return" forms for the districts.

TABLE 8

Production of sawntimber in Tanzania ('000 m³)

Product/Year	1980	1981	1982	1983	1984	1985	1986	1987
A. Hardwood sawntimber								
TWICO sawmills	11.7	8.7	7.2	9.0	8.3	9.6	13.3	12.1
Other sawmills	29.3	21.8	18.2	22.5	20.8	24.0	33.3	30.3
Pit sawyers	27.3	20.3	16.8	21.0	19.4	22.4	31.1	28.3
Sub-total	68.3	50.8	42.0	52.5	48.5	56.0	77.7	70.7
B. Softwood sawntimber								
TWICO sawmills	39.7	32.4	32.8	27.6	39.3	39.0	56.4	63.0
Other sawmills	13.9	11.4	11.5	9.7	13.8	13.7	19.8	22.1
Sub-total	53.6	43.8	44.3	37.3	53.1	52.7	76.2	85.1
Grand Total	121.9	94.6	86.3	89.8	101.6	108.7	153.9	155.8

Source: Various reports form TWICO and own estimates.

Since district forest officers are the ones who issue licences for harvesting in natural forests, these two forms also record production by licenced pit sawyers. However many pit sawyers operate illegally in these forests and it is therefore difficult to monitor their production.

If these forms were filled as required it would have been relatively easy to get correct statistics on actual removals from the forest and production by various wood based industries.

2.2.2.2 ***Wood based panel products***

(a) Available statistics

All the wood based panel mills in Tanzania are owned by TWICO. There are two plywood mills, one hardboard mill, and a particleboard mill. All of them are integrated with sawmill production lines. The hardboard and particleboard mills are based on softwood raw material and can use wastes like offcuts and slabs from the sawmills as raw material. The plywood mills use hardwood logs from natural forests.

The recovery percentages on conversion are about 30%, 50% and 70% for plywood, hardboard and particleboard production respectively.

The production of these panels in Tanzania in the 1980's is summarized in table 9.

(b) Organization of statistics

Like TWICO sawmills, the wood based panel mills have

production statistics on a daily basis. This forms a basis for compiling weekly, monthly, quarterly and yearly reports on mill activities. The latter three are submitted to TWICO headquarters in Dar es Salaam.

On the whole, these reports if compiled properly and at the required intervals, once can get a lot of information about the mills under TWICO in Dar es Salaam. All mills adhere to this procedure although one may find some exceptions.

Additionally these mills can also fill in the same

forms filled by sawmills by just altering the title of the forms. This could enable such information to be monitored right from the districts in which the mills are located.

2.2.2.3 ***Pulp and paper products.*** There are three mills producing pulp and paper in the country: the largest is the Southern Paper Mills, a public sector mill under the parastatal National Development Corporation. It produces pulp and paper from industrial round wood. Kibo Pulp and Paperboard mill is a private one also producing pulp and paperboard products from industrial roundwood. Kibo paper Industries Ltd produces corrugated boxes, multiwall bags and paper board products based on pulp, waste paper, sack kraft paper and duplex boards as raw materials. It therefore does not use industrial round wood as an input.

No data was obtained from Kibo Pulp and Paperboard

factory. Table 10 summarizes the productions by Southern Paper Mills and Kibo Paper Industries Ltd for the 1980's.

TABLE 9

Production of wood based panels in Tanzania (m^3)

Production/Year	1980	1981	1982	1983	1984	1985	1986	1987
Plywood	1,676	1,693	1,853	1,062	1,378	1,587	1,996	1,571
Hardboards	2,510	2,590	1,589	2,817	4,810	3,535	5,347	4,974
Particleboards	1,822	2,748	2,189	1,020	2,688	2,370	3,863	3,576
Total	6,008	7,031	5,631	4,899	8,876	7,492	11,206	10,121

Source: Various reports from TWICO

TABLE 10

Production of pulp and paper in Tanzania (metric tonnes)

Product/Year	1980	1981	1982	1983	1984	1985	1986	1987
Newsprint	-	-	-	-	-	-	4,194	6,467
Mechanical printing	-	-	-	-	-	-	2,193	2,865
MF white printing	-	-	-	-	-	-	1,157	1,425
Duplicating paper	-	-	-	-	-	-	203	498
WF white printing	-	-	-	-	-	-	107	585
Coloured printing	-	-	-	-	-	-	276	593
Other printing paper*	2,180	1,750	1,700	1,300	900	770	700	500
Coverboard white (manilla)	-	-	-	-	-	-	15	235
Computer paper	-	-	-	-	-	-	-	-
Tea Yellow	-	-	-	-	-	-	15	135
Bag/Sack kraft	-	-	-	-	-	-	2,991	5,315
Kraft liner	-	-	-	-	-	-	2,188	9,490
Corrugated medium	-	-	-	-	-	-	914	774
Corrugated boxes*	4,400	4,300	4,500	2,900	3,800	2,000	1,900	1,800
Tanzania (19) Multiwall bags*	3,600	2,500	2,400	2,600	2,300	2,300	2,200	2,900
Other paperboard*	3,600	2,000	1,400	3,300	2,200	2,200	2,200	2,200
Bleached kraft pulp	-	-	-	-	-	-	253	151
Unbleached kraft pulp	-	-	-	-	-	-	766	862
Total	13,780	11,050	10,000	10,100	9,200	7,200	22,272	36,795

Source: Southern Paper Mills and Kibo Paper Industries Ltd reports.
*Production by Kibo Paper Industries Ltd.Tanzania (20)

(b) Organization of statistics

Like in other wood processing mills, these pulp and paper mills have their production statistics recorded on a daily basis. This forms a basis for constructing monthly, quarterly and yearly reports.

If available, the statistics are very reliable. Annex IV contains additional statistics on this industry while Annex VI (d) summarizes these statistical organizational aspects.

2.2.2.4 ***Industrial roundwood.*** Based on the productions from the various mills as detailed tables 1 through 3 and also based on estimates on production of matches and transmission poles according to Ahlback (1986), table 11 summarizes estimates of the volumes of industrial round wood consumed in the 1980's.

Ideally this information should be made available from

the district forest offices through monthly mill return forms copies of which are also required to be sent to the head office of Forest and Beekeeping Division. In practice this is not the case.

The information can alternatively be obtained from the the individual mills and forest areas supplying them with wood raw material. For TWICO mills the information can also be extracted from reports sent to TWICO head office.

2.3 INTERNATIONAL TRADE IN FOREST PRODUCTS

In 1985, export trade in forest products was deconfined from Tanzania Wood Industry Corporation, which had been monopolizing such trade.

TABLE 11
Industrial round wood consumption in Tanzania ('000 m³)

	1980	1981	1982	1983	1984	1985	1986	1987
A. Hardwood								
Sawn timber	136.6	101.6	84.0	105.0	97.0	112.0	155.4	141.4
Plywood	5.6	5.6	6.2	3.5	4.6	5.3	6.7	5.2
Sub-total	142.2	107.2	90.2	108.5	101.6	117.3	162.1	146.6
B. Softwood								
Sawntimber	107.2	87.6	88.6	74.6	106.2	105.4	152.4	170.2
Hardboard	5.0	5.2	3.2	5.6	9.6	7.0	10.6	10.0
Particleboard	2.6	3.9	3.0	1.4	3.9	3.4	5.6	5.1
Pulp and paper	n.a.	n.a.	10.0	12.0	14.0	15.0	97.9	179.9
Matches	n.a.	n.a.	10.0	12.0	15.0	16.0	17.0	18.0
Poles	n.a.	n.a.	n.a.	n.a.	1.6	1.6	2.5	14.8
Sub-total	115.8	96.7	114.8	105.6	150.3	148.4	286.0	398.0
C. Total (A+B)	258.0	203.9	205.0	212.1	251.9	265.7	448.1	544.6

Source: Various mill reports, Ahlback (1986), and own estimates.

TABLE 12
Main products exported in 1986 and 1987

Product	Unit of Quality	1986 Quality	1986 Value	1987 Quality	1987 Value
Sawlogs + veneer logs (C)	MT	18	10,806	116	164,009
Sawlogs + veneer logs (NC)	MT	20	64,264	196	185,339
Subtotal	38	75,070	312	349,348	
Mangrove poles	no	127,800	27,643	10,500	40,621
Poles, pilings and posts	no	300,233	58,934	420,372	109,936
Subtotal	428,033	86,577	430,872	150,557	
Sawnwood (C)	m^3	397	488,209	925	364,917
Sawnwood (NC)	m^3	3,425	308,465	12,562	1,364,674
Subtotal	3,849	796,674	13,487	1,729,591	
Paper	MT	3,518	940,244	8,709	2,121,403
Paper and paperboard	MT	5,807	651,921	11,641	3,203,024
Subtotal	9,325	1,592,165	20,350	5,324,427	
Wattle extract	MT	3,439	2,191,354	4,985	3,974,185
Total	4,741,840	11,528,108			

Source: Tanzania Customs and Sales Tax Department reports.

Since then other public and private institutions, in addition to individuals, have been allowed to export forest products. Exporters have been given the incentive of retaining up to fifty percent of the foreign currency earned on exports. This is in line with the current economic recovery programme which aims at, among other things, assisting export oriented firms with foreign currency to facilitate their production and export trade. The recent introduction of preferential trade area (PTA) arrangements with several countries in the eastern, central and southern African region also facilitates international trade.

In response to both the economic recovery programme and PTA arrangements the private and public sectors have diversified and increased the volume and value of exports of forest products since 1986 as compared with the preceeding years when such arrangements were non-existent. Table 12 presents statistics on exports of major forest products.

It is noteworthy that while wattle extract (tannin) is regarded as a minor forest product, in export trade it ranked first and second in terms of value in 1986 and 1987 respectively. Therefore it deserves more attention than is presently accorded.

It is also important to note that the export diversity and value of paper and paperboard products increased in 1986 and 1987 mainly because the Southern Paper Mills, who are the main pulp and paper producers in the country, became operational in 1985.

Also the ban of export of sawlogs appears to have been lifted since 1985 and there were considerable sawlog exports in 1987.

With respect to imports, the diversity of imports of forest products did not change significantly with the introduction of the economic recovery programme and PTA arrangements. However with the coming into operation of Southern Paper Mills the quantities of paper and paperboard products imported have declined. There is also decline in the import volumes of sawn timber. However, with respect to wood based panel products of plywood, particleboard and fibreboard the imported quantities have increased considerably during this economic recovery period characterized by liberalization of trade policies.

The international coding system adopted in national trade statistics is the Standard International Trade Classification, Revision Two i.e. SITC. Rev. 2.

2.4 FOREST PRODUCT PRICES

Statistics on prices of forest products present a number of problems. Modern sector products and especially those emanating from public and fairly large and organized private sector producers have their prices published in form of price lists available from their sales offices. However prices have been changing even on an annual basis and it is also difficult to trace price lists for previous years. Additionally to derive correct average prices of such produce one needs to know sales volumes corresponding to each price list so as to arrive at a weighted average price. No records are kept for such sales volume regimes. Another complication arises when one wants to determine national average prices. Prices of the same products vary all over the country. Additionally prices of similar products, e.g. softwood sawntimber of given dimensions, vary from one producer to another even in the same locality. As a consequence it is not possible to establish fair national average prices without the assistance of market surveys. The same is true of the informal sector products.

This sub-chapter intends to shed more light on this subject by examining prices of both industrial and non-industrial forest products.

2.4.1 Industrial products

The industrial products considered are industrial roundwood, sawnwood, pulp and paper, plywood, particleboard and fibreboard.

2.4.1.1 ***Industrial roundwood.*** The Forest and Beekeeping Division (FBD) is responsible for pricing roundwood from both its plantation and natural forests. These prices are released to the public through the government gazette as legal prices. The prices are not only available from forestry offices but from a large number of offices all over the country because the government gazette has a very wide circulation.

The FBD first classifies the various tree species from natural forests into six classes based on the market demand of timber from such tree species. FBD then issues royalty charges on group basis.

Plantation industrial roundwood is also classified. The softwoods raised are those of cypress and pines and are grouped together and segragated into five diameter at breast height (overbark) classes. These guide setting of stumpage/royalty rates. For the years 1981-87, royalties on softwood thinnings have been charged as a percentage of the specified clearfelling rates of 50%, 20% and 10% for 1st, 2nd and 3rd thinnings for each diameter class.

Plantation hardwoods, with the exception of eucalypts, are not mature yet and are sold as thinnings some of which are suitable as sawlogs. The hardwoods are classified into four classes and FBD issues group prices.

Forest plantation produce is sold standing whereas produce from natural forests is measured for sale after being harvested.

2.4.1.2 ***Sawnwood.*** There are many sawmills operating in both softwood plantations and natural forests. Sawnwood is available all over the country in varying prices for similar wood and same quantity. In the absence of market surveys, which will have probably yielded fairly accurate data for 1988 only due to limited memory of respondents, the sales value of sawntimber from TWICO mills has been divided into the sales volumes for the corresponding years to give estimates of the prices of sawnwood. TWICO owns all the big softwood sawmills enabling it to control 74% of the country's sofwood sawmill installed capacity. TWICO also owns all of the big hardwood sawmills and therefore has control over 40% of the installed hardwood capacity. It is therefore reasonable to expect TWICO to be a price leader in the market.

Sales from TWICO mills take place at mill sites and various sales branches all over the country. Consequently sales information obtained from TWICO is implicit of market survey information. The mills, in addition to a cost plus pricing system, price their products with an eye on other similar producers.

2.4.2.3 ***Wood based panel products.*** The panel products of plywood, hardboard, and particleboard are

confined to TWICO mills and their pricing is done as for sawnwood because a similar argument exists for their sale.

2.4.2.4 ***Pulp and paper products.*** The prices of pulp and paper products are based on price lists obtained from Southern Paper Mills.

2.4.2.5 ***Non-industrial products.*** The non industrial products considered are charcoal, firewood and poles from natural forests. These are consumed by the majority of the population. FBD is responsible for their pricing.

3. CONCLUSIONS AND RECOMMENDATIONS

In order to make improvements on the collection, storage, analysis, publication of forestry sector statistics, a review of the current major problem areas is necessary.

3.1 Problem sources and areas

The relatively unsatisfactory state of national forestry statistics in Tanzania is a result of the following:

(a) Multiplex organization structure of the forestry sector without effective central coordination. This has resulted in a reduction of account ability in some areas, like for example the non-submission of monthly production return reports from the districts and regions to FBD head office.

(b) The planning section/unit of FBD is relatively weak. It needs additional trained manpower and the present manpower still need further training. Additionally it needs more equipment especially for data handling. These measures, if undertaken, would enable the unit to collect, assemble and analyse data more efficiently with the resultant of better forest sector plans.

(c) Lack of awareness, by some forestry officials at all levels, of the importance of collecting, storing and transmitting/publishing data from their work areas.

This could be due to general laxity on the issue of forestry statistics and inadequate academic training on matters.

(d) A few offices, especially in the private sector, would not want to release some statistics, especially those related to their finances, for reasons better known to themselves.

(e) Some operations, like a good proportion of pitsawing, are carried out illegally making it impossible for forest personnel to get statistics on them.

(f) A societal lack of record keeping culture on some aspects like consumption of firewood and charcoal. This makes it impossible to obtain past yearly series of data on these aspects. Data generated through interviews are limited to the immediate past and with some inaccuracies.

(g) A large portion of the forested land is not under direct control of FBD and therefore it becomes difficult to monitor what is happening in such freely used public areas.

(h) The Tanzania Forest Research Institute (TAFORI) which has been in existence for about nine years and which could have assisted, if not pioneered efforts in collecting, storage, analysis of data and publication of eventual results, has been constrained by lack of trained staff and equipment.

(i) Lack of funds has resulted in limited data generation and collection on some forestry aspects. For example, fuelwood consumption surveys have been limited to spot surveys for limited geographical areas very well knowing that continuous surveys over a more representative area would have yielded better results.

3.2 Priorities for development and areas of action

Based on these problems behind the current state of forestry statistics, the following are some of the areas needing action or rectification.

(a) On forestry policy

The present forest policy dates back to 1953. At the time of its formulation priorities and the administrative structure for the policy implementation were very different from present day key forestry pressing areas and the government structure. Since 1984 efforts have been made to revise the policy and there exists a 1986 draft forest policy which is relevant to present circumstances. Among the revisions suggested is the requirement that forest officers in district and regional offices, in addition to those presently under FBD, should be answerable to the Director of Forestry. This will facilitate accountability and enforcement of reporting procedures which may include reporting data on the areas managed by these officers to a central office. It will also facilitate coordination of the forest sector.

(b) On planning section/unit of FBD

There is a need to strengthen the planning section/unit of FBD with more funds allocation. trained and enough manpower, and equipment. It is recommended that the section should maintain a data bank for the forestry sector.

(c) On Tanzania Forest Research Institute (TAFORI)
TAFORI needs to be activated by providing it with organization staff and equipment and sufficient funds.

(d) On training
There is a need to create an awareness among all of forestry statistics and how to collect, store, analyse and publish results for dissemination. This could be done through seminars, workshops and training courses for the practicing foresters. Additionally for future foresters emphasis on this aspect can be made by teaching institutions forestry.

(e) On standardization
There are some good standard formats for collecting data on same or similar forestry aspects. However there is a need to adhere to specific or standard formats and where they do not exist institute them to facilitate a uniform way of reporting information on similar or same aspects. Localized aspects can always be reported separately or within the same format as additional comments.

(f) On analysis and dissemination of information
Some forestry offices have a considerable volume of raw data which has not been analyzed, while others have processed data (results) which require dissemination. For example, wood properties of many indigenous tree species have been determined but still remain unknown to the user public.

There is therefore a need to analyze stored data before it becomes obsolete. In addition, there is a need to publish results of the analyses and those stored in some offices/centres in publications which will be available to users of such information and wherever possible to the public at large.

All these recommendations can be implemented concurrently.

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Tanzania

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	21509008	22281008	23095008	23954000	24869008	25836000	26858000	27880000	28930000	30011008
INDUSTRIAL ROUNDWOOD	1054000	1186600	1168100	1205200	1253000	1330000	1386000	1612000	1910000	1943000
SAWNWOOD & SLEEPERS	97500	122000	95000	86000	91000	102000	109000	154000	156000	156000
CHARCOAL	107000F	111000F	115000F	119000F	124000F	129000F	134000F	139000F	144000F	150000F
PANELS	9200	6000	7000	5700	5000	9100	7500	11200	10200	10200
WOOD PULP	0	0	0	0	0	0	0	0	37000	35000
PAPER AND PAPERBOARD	0	0	0	0	0	0	0	0	29000	28000
Export Quantity (CUM/MT)										
FUELWOOD AND CHARCOAL	4800	4800	0	0	0	0	0	0	0	0
INDUSTRIAL ROUNDWOOD	1600	900	200	200	600	600	600	200	200	200
SAWNWOOD & SLEEPERS	3900	2800	1700	1600	1000	1000	8400	8100	4800	4800
CHARCOAL	800F	800F	0	0	0	0	0	0	0F	0
PANELS	300	300	900	600	430	430	430	430	500	500
Export Value (1000 US$)										
FUELWOOD AND CHARCOAL	72	72	0	0	0	0	0	0	0	0
INDUSTRIAL ROUNDWOOD	269	131	24	24	52	52	52	14	14	14
SAWNWOOD & SLEEPERS	1077	851	720	659	439	439	2667	1384	1421	1421
CHARCOAL	72F	72F	0	0	0	0	0	0	0F	0
PANELS	106	112	427	329	267	267	267	267	104	104
Import Quantity (CUM/MT)										
PAPER AND PAPERBOARD	20200	23500	23500	23500	23500	25700	21700	21700	21700	21700
Import Value (1000 US$)										
PAPER AND PAPERBOARD	14600	16600	16750	16900	16900	18600	15700	15700	15700	15700

Uganda

Hudson J. Andrua

BACKGROUND ON FORESTRY SECTOR

The forestry sector in the Ugandan economy has an important place and a vital role in influencing the micro-climate and soil conservation; supply of raw materials for household use, agricultural and industrial development as well as rural economics. The forests contributed substantially to tourist industry and the forest products contributed to government revenue through royalty and sales tax. This fact has long since been recognised and the forest policy embodies creation of a permanent forest estate enough to protect water supplies, preserve suitable climatic soil conditions for agriculture and to provide adequate forest produce to meet the needs of the people of the country and for export.

POLICY

The effective Forest Policy was revised and gazetted under general notice No. 3 dated 15th January 1988 and reads in full as follows:

To maintain and safeguard enough forest land so as to ensure that:

(i) sufficient supplies of timber, fuel, pulp, paper and poles and other forest products are available in the long-term for the needs of the country, and where feasible for export;

(ii) water supplies and soils are protected, plants and animals (including endangered ones) are conserved in natural ecosystems, and forests are also available for amenity and recreation.

To manage the forest so as to optimize economic and environmental benefits to the country by ensuring that:

(i) the conversion of the forest resource into timber, charcoal, fuelwood, poles, pulp and paper, and other products is carried out efficiently;

(ii) the forest estate is protected against encroachment, illegal tree cutting, pests, diseases and fires;

(iii) the harvesting of timber, charcoal, fuelwood, poles and other products applies appropriate silvicultural methods which ensures sustainable yield and preserves environmental services and biotic diversity;

(iv) research is undertaken to improve seed sources for planting stock and the silvicultural and protection methods needed to regenerate the forest and increase its growth and yield. Research is also carried out into new and existing forest products, including tourism and education with the object of maximizing their potential utilization. Research is undertaken to monitor and promote the preservation of environmental services and conservation of biotic diversity.

To promote an understanding of forests and trees by:

(i) establishing extension and research services aimed at helping farmers, organizations and individuals to grow and protect their own trees for timber, fuel and poles and to encourage agro-forestry practices;

(ii) publicizing the availability and suitability of various types of timber and wood products for domestic and industrial use and publicizing the importance of environmental services provided by forests;

(iii) holding open days at regular intervals in all districts to demonstrate working techniques and bring attention to the positive benefits of forestry.

(iv) promoting scientific research, environmental, tourism, education and related activities inside the forest estate.

ORGANIZATION

The Forest policy and management of the Forest sector is the responsibility of the Forest Department (FD) under the direction of the Ministry of Environment Protection formerly attached to the Ministry of Agriculture.

The Forest Department has control over large part of the country's forest resource but limited powers to supervise and direct private forestry activities. The main responsibilities of FD are for management, protection, extension and to formulate plans to develop the forest estate to achieve objectives of government for the forestry sector and to put the plans into action.

FOREST RESOURCES

The gazetted forest reserves (reserved forests) of the country total 1.5 million hectares constituting 7% of the total dry land area distributed as follows:

1. Natural High Forests	730,000 ha
Production Forest	540,000 ha
Protection Forest	190,000 ha
2. Savanna forest	768,000 ha
3. Plantations (Man-made forests)	24,300 ha
Peri-Urban (Fuel & Pole)	10,900 ha
Softwoods (Industrial)	13,000 ha

It is estimated that private forests amount to over 200,000 ha mostly natural forests. Approximately 10,000 ha and 500 ha are fuel plantations for tobacco and tea processing respectively.

The forests serve one or both of the primary purposes of timber production and main catchment as well as hill protection. However, gazetted forest reserves and protection forests on public lands have over the past two decades been subjected to severe pressure form cultivators, grazers, timber dealers, charcoal burners and fuelwood collectors.

MAIN FUNCTIONS OF FOREST

Wood production

The Natural high forests (NHF) concentrated mainly in western Uganda, around Lake Victoria in the South and Mt. Elgon in the East produce most of the timber in the country. It contains a wide variety of timber tree species among which are the highly valued mahoganies, ohlorophera, Lavoa and Elgon olive.

No recent inventory data is available to determine the actual volume of wood in this type of forest.

Softwood plantations planted with fast growing conifer tree species of C. *lusitanica*, *Pinus oocarpa*, *patula* and *caribbaea* in some areas reserved but not containing forests. The objective being to supplement the supply of wood from the NHF to meet increasing demands and to provide a base for the pulp and paper industry.

Generally, the plantations are underutilized source of timber and pulp. In some areas the trees are overmature.

It is estimated that yields from the plantations could reach 90,000 m^3 of sawntimber per year which by the year 2000 would constitute 50-70% of demand. This would relieve much of the pressure on the ecologically fragile NHF producing the hardwood timber.

Several plantations of eucalyptus species have been established by FD, private individuals and institutions all over the country to supply building poles and fuelwood for domestic and industrial usage in rural and urban areas. Eucalyptus sawntimber is increasingly being used in rural areas in housing and furniture businesses.

ENVIRONMENTAL CONSERVATION

Soil

Uganda's economy largely depends on agricultural production. Forestry has greatly contributed in maintaining favourable climatic conditions and conserving the soil for agriculture through protection forests and taungya or agroforestry practices which enhance the soil fertility.

Water

Protective forests are maintained in old catchment areas of main reservoirs to ensure sustained flow of streams and rivers. The catchments are either under forests privately owned or managed by FD. Water from these sources is very clean for domestic use especially in rural areas. The forest streams and rivers abound in fish which provide much needed animal protein to the people.

Wildlife

Game conservation occurs under four controls namely: National Parks, Game Reserves, Animal sanctuaries and Controlled Hunting Areas. These controls are frequently supplemented by forest reservation powers as they occur in gazetted forests. Such forests are not developed for production but devoted to wild animals and tourism. Approximately 16,500 km^2 is under game conservation regulations of which 6,500 km^2 are under forestry regulations. Many savanna woodland reserves fulfil game conservation roles and are therefore designated as controlled Hunting areas or Game sanctuaries.

The NHF carries rare flora and fauna and some endangered species of animals and unique ecological systems. Under an ongoing EEC-funded project, the FD is identifying and delineating such zones for nature conservation. Plans are also underway to convert productive forests or their parts into "Forest Parks" with objective of conserving the ecosystem and tourism.

FORESTRY IN THE ECONOMY

Subsistence

The rural sector has always benefited from employment opportunities accruing from departmental forest projects. People's participation in raising (private) nurseries and selling seedlings, poles, firewood offers

income to those involved in such programmes. Both direct employment in the forestry business and sales income from the forestry produce enhances the role of forestry in reducing the influx of people to urban areas in search of employment.

Forest industries continued also to offer employment through sawmilling, hand or pitsawing and charcoal burning. Sawmilling and pitsawing provided raw material for carpentry and joinery workshops as tertiary industries thereby illustrating the multiplier effect of forest industries. About 2000 people are still engaged in pitsawing and 3000 in charcoal burning using earth kilns.

Fuelwood is the main source of energy for domestic heating and about 96 per cent of the population depend on fuelwood. Poles are on demand for house construction. Estimated requirements are 14,000,000 m^3 of fuelwood and 1,000,000 m^3 of poles annually by the subsistence sector.

More effort has been made to create recreational facilities and attract people to visit forests thereby arousing interest and awareness of the role of forests. Educating people to understand and appreciate benefits from forests is considered the best approach toward conservation of this natural.

FORESTRY FOR INDUSTRIAL AND DOMESTIC ENERGY

Many industries including Tobacco, Sugar/Jaggery, Fish smoking, Bricks/Tiles depend on fuelwood for energy supply. Improvement in industrial activities has given rise to greater demands for fuelwood. There has been a 2 per cent rise per annum in woodfuel consumption and this may increase unless there are alternative source of energy.

In industrial energy supply, forestry contribution averaged 54.3 per cent in terms of woodfuel and 15.2 per cent as charcoal over the last ten years. For overall energy requirements, woodfuel and charcoal represent 96 per cent. This is because electricity is expensive leaving both woodfuel and charcoal as sources of energy in town and rural areas for household purposes.

INDUSTRIAL WOOD SUPPLY

Sawn timber production was the main activity of forest industries which together with plywood manufacturing constituted primary processing. Two new sawmills started operating while some old sawmills stopped functioning due to lack of spare and replacement parts. Twenty saw mills were in operation by the end of 1988. Pitsawing greatly alleviated the position of sawn timber supply on the local market. Roundwood harvested and taken slightly increased to 82,000 m^3 in 1988 compared to 77,000 m^3 in 1984.

The only paper factory in the country continued to operate using imported pulp from Scandinavian countries, particularly Sweden. Studies were made to establish an integrated pulp and paper plant with an annual capacity of 60 metric tonnes.

FOREST SECTOR STATISTICS

Organization of statistics

The Statistics Department of the Ministry of Planning & Economic Development (MPED) is the central authority which co-ordinates all the statistical activity in the country. From mid-1970's it has not played its role effectively. Sectoral Statistical systems became more or less autonomous. They, however, also suffered and were not very effective.

There is an ongoing World Bank/UNDP project to revitalize and operationalize the Statistical system in the Statistics Department. This project does not provide support to other sector statistical system.

The Biometrics section in the Planning Division of the FD is responsible for forestry sector statistics. The functions of this section largely involve forest inventory & survey work, preparation of volume and yield table, establishment and maintenance of computerized data bank, updating and maintenance of working plan records, preparation and editing of forest abstracts and attending to questionnaires for information on forestry.

In carrying out its work the Biometrics section liases with the Planning section and Forest Resources Management Divisions of the department, as well as Ministries of Finance, Energy and Planning and Economic Development (Statistics Department).

The Field Management Staff especially the District Forest Officers supply monthly and quarterly returns on forest products production e.g. roundwood, sawntimber, poles, firewood, charcoal and any other forest produce to the head office. This information is compiled by the Biometrics Section and reported for use by Planning Section and Forest Resources Management Division as well as to other sectors and organizations.

The newly created Ministry of Energy is responsible for fuelwood and charcoal statistics (production, demand and consumption); Statistics on external trade are obtained from the Customs Department of Ministry of Finance and the FD liases with statistics Department of

MPED on industrial production statistics that provides background to national budget.

Publications

The Forest Department used to publish its statistical information in the Forest abstract. Due to economic problems Uganda has faced over the past two decades publication was not possible and has not resumed to date.

The Central Statistics department which has also undergone similar difficulties produced its first Statistical Bulletin in June this year since the mid 1970's apart from backgrounds to the budget. Forest products trade statistics are published in the Annual trade reports of the Ministry of Finance which also ceased regular publication for several years creating information gaps.

Coverage

Coverage on industrial production statistics is comprehensive but there is a problem of timely submissions of data due to lack of logistics. Similarly this had led to inability to carry out adequate surveys on production demand and consumption of some forest products especially charcoal and fuelwood and other forest products. This category of products is mainly produced and consumed in the rural areas. There is also a problem in obtaining proper statistics on trade due to malpractices e.g. illegal pitsawing, smuggling, etc. For this matter where the actual information cannot be obtained through surveys or reports estimates have generally been used to provide basis for planning and decision making.

INFORMAL SECTOR STATISTICS

Fuelwood and charcoal

There is no accurate national data on fuelwood and charcoal production, demand and consumption. The data collection on fuelwood and charcoal by the Forest Department is generally limited to records of production from gazetted forests and the public lands under licence and fee. Various authorities have simply made their own estimations.

The largest proportion of fuelwood and charcoal production and consumption is in the subsistence sector and national surveys have been conducted to establish more reliable statistics. There is an ongoing pilot project in the newly created Ministry of Energy (1987) to find out woodfuel energy consumption of households in rural and urban areas. No reports have been produced as yet.

Other products

Gum arabic obtained from the tree Acacia senegal is important but its documented systematic production and trade by the Forest Department ceased in mid-seventies. No estimates of the current production by the subsistence sector is available.

Modern sector products

14 sawmills are in operation producing annually about

12 000 m^3. The production of pitsawyers is estimated at about

16 000 m^3. Sawlog consumption is put at 19,400 m^3 coniferous and non-coniferous 50,800 m^3. Plywood manufacture is currently 1 000 m^3 per year. A small plysawmill has limited production.

Trade

Statistics are available up to 1983.

Prices

Collection of price information was resumed in 1986.

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Major problems with the National statistics of the forestry sector.

Inadequate institutional framework. The existing Forest Department organization and procedures does not provide for a fully fledged sector statistical system. As such, statistical information on the Forestry sector is not adequately managed.

Inadequate Resources. The Biometrics section which is charged with Forest sector statistics laks statistical staff, operational funds, logistics - transport, office equipment, data storage facilities e.g. computers. The present staff handling statistical data are professional forest cadre and there is lack of statistical assistant. As a result of other commitments the statistical data management suffers.

Coverage. The existing forest sector statistics coverage emphasises more on government and large industry and tends and lays less emphasis on private sector, small-scale industries and households. As a result forest product statistics are inadequate and generally under estimated.

Linkage with other sectors

There is a very low level of integration and co-ordination between the Forest Department and other sectors involved in forestry statistics e.g. Statistics Department (Central), Ministry of Energy, Finance and the NGO's. This has led to duplication of work or omission of vital statistical information.

Major priorities for development

(1) A new section of statistics should be established in the Planning Division of the Forest Department with sole responsibility of managing the Forestry sector statistical system. The staff to manage the system should be identified and trained and the necessary logistics provided and adequate financial support provided. To strengthen at field level some of the trained staff should be posted at Regional and district offices.

(2) Legislation for obligatory supply of forestry statistics to ensure better coverage and reliability of statistics and the department through its extension network should emphasize the importance of providing the forest sector statistics.

(3) The Forest Statistics system should link closely with National statistics system and other related sectors to ensure efficiency in management of the forest sector statistics.

Areas of Action

(1) Establishment and operationalizing the proposed statistics section in the Planning Division.

(2) Development of resources:
   (a)Training of staff
   (b)Provision of logistics
   (c)Funding.

(3) Establishment of legal and administrative mechanism for obtaining adequate and reliable forestry statistics from sectors outside Forest Department authority.

(4) To establish efficiency and reliability of forestry sector statistics through better co-ordination with related sectors.

Uganda

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	8906000	9201000	9507000	9815000	10140000	10487000	10866000	11255000	11656000	12077000
INDUSTRIAL ROUNDWOOD	1362000	1399000	1438000	1483000	1529000	1579000	1633000	1688000	1746000	1796000
SAWNWOOD & SLEEPERS	23900	23900	23000	23000	23000	23000	23000	23000	23000	28100
CHARCOAL	101000F	104000F	108000F	111000F	115000F	119000F	123000F	128000F	132000F	137000F
PANELS	1200	1200	1200	2000	2000	2450	2450	2565	3530	3300
PAPER AND PAPERBOARD	0	0	0	200	200	200	2000	2000	2000	2000
Export Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	400	400	0	0	0	0	0	0	0	0
Export Value (1000 US$)										
SAWNWOOD & SLEEPERS	38	38	0	0	0	0	0	0	0	0
Import Quantity (CUM/MT)										
SAWNWOOD & SLEEPERS	400	400	100	100	100	100	0	0	0	0
PANELS	205	205	205	205	205	205	205	205	205	205
PAPER AND PAPERBOARD	2900	2900	2900	600	600	600	1000	1000	1000	1000
Import Value (1000 US$)										
SAWNWOOD & SLEEPERS	33	33	22	22	22	22	0	0	0	0
PANELS	236	236	236	236	236	236	236	236	236	236
PAPER AND PAPERBOARD	3231	3232	3233	640	640	640	930	930	930	930

Zambia

W.M. Phiri

INTRODUCTION

Forest Area

Zambia has a total land area of about 752614 sq.km. Total natural forest area is approximately 61203 million hectares. Source: Wood Consumption Survey, 1986.

About 7 436,107 ha of Forest and woodland have been gazetted as reserves. Of this total 5 138 580 ha are classified as National Forest, while the other 2 297 527 ha are Local Forest. Another 5 000 000 ha are protected as National Parks and Game Reserves. That is approximately 16.5 percent of the total land area of Zambia is under Official Management.

Zambia Forestry and Forest Industries Corporation (ZAFFICO) formerly a Forest Department Division has a total of 59 000 ha of Forest plantation. 9 000 ha of this total are for Eucalyptus and the remaining 50000 ha are for Pines. Most of the plantations are situated in the Copperbelt Province. Pines are the most important species.

The following figures show the land use in Zambia as in 1988: (Source: Forest Department)

Land use in Zambia as in 1988

	Million ha.	Percentage
Council land	61.320	81.4%
Forest estates	7.436	9.9%
National parks	5.471	7.3%
Water	1.020	1.4%

The mean national woodland volume obtained by the survey was 73.35 m^3/ha.

Total standing volume

	Volume (m^3)
Merchantable	3 763 395
Bole	1 447 591
Total	4 474 472

Forest sector statistics

The Forest Department at present has not specific section which deals in assembling or up-dating of Forest statistic data. However, all Forest Provincial Offices and Divisions submit annual returns or reports to Forest Department H/Q in Ndola. This information is filed for record purposes and preparations of annual reports.

These reports cover the activities done in that particular year e.g. Production of timber, poles and fuelwood and revenue received.

The Department has recently devised a Forest Products statistics form which is sent to all Provincial offices, Private companies and big Industries. These statistics forms are sent back to Forest Department annually from parties concerned.

Charcoal

The survey conclusively demonstrated that charcoal is more important to rural dwellers as a source of income rather than as a source of fuel. Mean rural per capita charcoal consumption was only 0.06 kg/day. Many rural consumers of charcoal were civil servants, teachers and others who tended to look to urban consumption standards for their model.

The survey also showed that urban households consumed 0.52kg/person per day. Urban consumers primarily liked charcoal because it is cheaper than petroleum based fuels, which require costly appliances.

Average daily fuelwood and charcoal consumption per capita

Sector	*Household*		*Non-Household*	
	Fuelwood (KG/Day/capita)	Charcoal	Fuelwood (KG/Day/capita)	Charcoal
Rural	3.99	0.06	0.0071	0.0023
Urban	0.257	0.52	0.0115	0.0117
Nat. average	1.985	0.27	0.0091	0.0063

Total fuelwood and charcoal consumption in cubic meters

Sector	Household		Non-Household	
	Fuelwood (million m³/yr)	Charcoal	Fuelwood (million m³/yr)	Charcoal
Rural	6.33	0.90	0.013	0.035
Urban	0.39	6.38	0.018	0.143
Total	6.72	7.28	0.031	0.178

Total Household wood demand for 1985 is as follows:

	Woodfuel (million m³/yr.)	Roundwood (million m³/yr.)	Total (million m³/yr.)
Rural	7.230	0.207	7.437
Urban	6.770	0.144	6.914
	14.000	0.351	14.351

Woodfuel used by non-household consumers

The survey collected information on wood energy consumption among selected non-household users, including food vendors, bars, restaurants, kiosk and schools.

Charcoal was the main woodfuel used by non-household consumers in the large urban centres, e.g.

In Lusaka non-household interviews respondents-reported using a total of 643.80 kg of charcoal on the day of survey, and 188.50 kg of firewood.

In Western province - which included the wood importing municipality of Mongu, the household sector in contrast relied heavily on fuelwood.

- reported 868.55 kg of fuelwood on the day of survey
- reported also 29.00 kg of charcoal on the day of survey.

These figures are suggestive of the great difference in wood fuel use patterns non-households consumers also for urban and rural consumers.

SAWMILLING

Sawmilling is the main forestry industry in Zambia. It is based on both indigenous and plantation grown timber. The mills vary in size from portable sawmills with a capacity of 3 000 m³/ annum to mills with capacity up to 35 000 m³/annum.

Zambia Forestry and Forest Industry Corporation (ZAFFICO) exploits only the plantation timber, the Pine and Eucalyputus species. The Corporation has grown a total of 59 000 ha. of forest plantation. About 85% of this is Pine and the rest for Eucalyptus and other minor species. The Forest Department as at present has a total forest plantation area of about 600 ha.

Departmental and private sawmills add up to 30 mills. The private sawmills utilizes both indigenous and exotic species.

The corporation (ZAFFICO) has 5 operational sawmills. Table 2 shows number of mills, production and production capacity according to size.

Production of departmental and private sawmills is shown in Table 3. In addition there are some 1650 pitsawyers estimated to produce 16 000 m³ of sawnwood annually.

TABLE 2.1

Yearly production range	Production Number	Year: 1988/89 m³ Production	Capacity
1,001 - 5,000 m³	1	6 000	7 000
10,000 - 25,000 m³	2	36 000	40 000
25,001 - 50,000 m³	3	25 000	35 000
TOTAL		67 000	82 000

TABLE 2.2

Consumption of sawlogs and production of sawnwood by ZAFFICO sawmills

	Year: 1988/89 m³ Sawlog Consumption	Sawnwood Production
Coniferous	64 000	26 800
Non-coniferous (exotic spps)	96 000	40 200
TOTAL	160 000	67 000

TABLE 3
Production of sawnwood by Departmental and Private sawmills

Province/name of mill	Year: 1988 Production (m^3)
Western province	1 269
Samfya s/mill	194
Minga	3 018
Zambia Teak province	16 764
Northern province	3 134
C/Belt	39 694
Likonge timber licence	1 652
Nyambi timber licence	119
TOTAL	65 844

PUBLICATIONS

Annual reports of the Forest Department are produced every year. They review status of the Forest, new developments in the Department, timber production and any other noticeable achievements in the year under review.

Specialized Divisions also produce occasional reports for the projects done.

CONCLUSION

The major problem with the National Statistics of the Forestry Sector is that there is no proper or standard formats for recording Forestry statistical data. You could find similar information filed under different subject matters from various sections. If certain information is required one has to go through many files to get what one wants.

Forestry based industries should be submitting their annual production and plant capacity also to the Forest Department, and not only to the Central Statistical Office which normally has such data for publications.

Information from such Industries is not really available at Forest Department Headquarters. Hence once we receive international questionnaires we physically seek the information from these Companies concerned, and sometimes we get no response at all, or if the information is provided, this is done so after long delays.

Zambia

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	8093000	8404000	8737000	9075000	9453000	9835000	10285000	10708000	11142000	11565000
INDUSTRIAL ROUNDWOOD	450000	462000	474000	488000	502000	518000	535000	551000	568000	584000
SAWNWOOD & SLEEPERS	42000	42000	42000	42000	50000	50000	50000	67000	51000	76000
CHARCOAL	618000F	649000F	682000F	715000F	753000F	790000F	835000F	878000F	922000F	965000F
PANELS	3700	3700	3700	8000	13000	13000	12000	12800	20000	26000
PAPER AND PAPERBOARD	0	0	0	7500	5000	3000	2000	5000	3000	2000
Import Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	9700	1800	8600	8600	8600	8600	200	20000	0	0
SAWNWOOD & SLEEPERS	8800	14100	6100	6100	6100	6100	1400	1600	1600	1600
PANELS	8700	13300	10200	10200	10200	10200	10200	6800	3600	3600
PAPER AND PAPERBOARD	18300	18800	7500	6400	6400	6400	5800	6000	8500	8500
Import Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	1179	216	1046	1046	1046	1046	27	27	0	0
SAWNWOOD & SLEEPERS	1394	1664	748	748	748	748	161	252	252	252
PANELS	1371	2216	1743	1743	1743	1743	1743	414	123	123
PAPER AND PAPERBOARD	12963	18257	5850	4840	4840	4840	4440	4170	5365	5415

Zimbabwe

D. Mabvurira

INTRODUCTION

The total forest area in Zimbabwe is estimated at 23 million ha. (+59% of the total land area) spread over private commercial areas, communal areas, national park areas and demarcated forest reserves.

Over 50% of the forest area is situated in the Communal lands and has traditionally been exploited for firewood and poles under uncontrolled conditions. However, only 64 000 ha. of this (Communal lands area) has now been set aside for controlled exploitation.

About 20% of the forest area is National Parks administered by the Department of National parks and Wildlife Management while about 4% is demarcated forest reserve administered by the Forestry Commission, the State Forestry Authority.

The indigenous forests consist of species associations of various general of which *Branchystegia Tulbernarida, Colospernium, Baikiae, Pterocarpus, Parinaria* and *Burkea* are economically the most important. Plantation forests comprise about 114 000 ha. of which 69% is of exotic conifers and 31% exotic hardwoods. The major plantation species are *Pinus patula, Pinus elliottii, Pinus taeda, Eucalyptus* and *Acacia species.*

The forest area under the control of the Department of National Parks and Wildlife Management is managed for purposes of tourism, recreation and Wildlife utilization. The Forestry Commission manages its forests mostly for the production of sawn structural and industrial timber and for soil and water conservation of the major catchment areas of Zimbabwe. Additional to the traditional forestry practices, the Forestry Commission has recently diversified into the Commercial production of fruit, livestock, honey and wildlife safaris within its demarcated forest reserves.

The forestry sector makes a considerable contribution to the economy of Zimbabwe. About 57% of the nation's total energy is provided by the forests, while almost 100% of the rural household energy requirements is provided by fuelwood. The value of fuelwood alone amounts to over ZS 180 million.

The utilization of wildlife, recreation and tourism in National Parks provide valuable foreign currency in addition to the other non monetary social and economic benefits.

Industrial production of wood and wood products on Zimbabwe's Commercial Forest plantations is dominated by sawmilling by both the Forestry Commission and the private sector. In 1987/88, 29 Sawmills including 1 match factory and 2 veneer mills were in operation. About 70% of the area is managed for sawlogs, 12% for wattle extract, 9% for poles, 5% for pulpwood and the remaining 4% for other purposes. About 80% of sawn timber is used locally for construction purposes while the remainder is exported to other Southern African Countries. About 30 000 tons of pulp and 43 000 m^3 of panel products are produced annually by the private sector for local consumption.

The total value of commercial timber plantations is estimated ZS 95 million while roundwood processing of timber and paper products are estimated to account for ZS 100 million.

FOREST SECTOR STATISTICS

The Forestry Commission is responsible for the collection and analysis of all national forestry statistics concerning area, age, ownership, species, uses and product input, and output for both industrial and non-industrial plantations.

At the end of each financial year, comprehensive questionnaires are sent by the Forestry Commission to owners of forest plantations for completion and return. As a result, the Forestry Commission produces 3 comprehensive reports annually viz (a) Commercial and Industrial Plantations Survey, (b) Primary Roundwood Processing Survey, (c) Non-commercial and Non-industrial Plantation Survey. In 1984, the report "A Survey of Forestry Plantations in the communal lands of Zimbabwe" was discontinued as the information produced was provided by other reports.

Where coverage is incomplete, due to late submission or non-submission of questionnaires, so estimates or interpolations are made.

The information produced in the above reports is used by the Forestry Commission for internal planning

purposes and as a a basis for advising the Minister of Natural Resources on reviewing national forest policy.

The Forestry Commission is currently embarking on a major national survey/inventory using aerial photos and remote sensing techniques to estimate the quantities and quality of forest resources in Communal lands and National Parks.

The Central Statistical Office compiles national statistics on the production and valuation of forest products including Statistics on timber trade and pricing. In conjunction with the Ministry of Trade and Commerce the Central Statistical Office compiles data on the import and export of forest products. The office collects data through questionnaires and consulting management reports of various forest products is published annually in "Production Account for Agriculture, Forestry and Fisheries" by the Central Statistical Office.

INFORMAL SECTOR PRODUCTS

Fuelwood and Charcoal

Zimbabwe's rural and poorer urban population depend on wood entirely for their primary energy needs. (Whitsum Foundation, 1981; Mazambani, 1980; Whitlow, 1980 and Mazambani, 1979).

Although rural folk alone accounted for over 80% of the total population, very little was done, prior to independence, in the collection and analysis of data on the rural folk's energy use patterns and requirements. Instead, a lot of effort and investment was directed towards the urban industrial sector, resulting in remarkable successes in the development of hydroelectricity, coal generated thermal power and ethanol utilization for fuel. Despite these developments on alternative sources of energy, demand for fuelwood by the informal sector has remained the single largest drain on Zimbabwe's forest resource. It has therefore been realized that national forestry statistics that ignore the informal sectors use of fuelwood for energy are incomplete.

The first serious attempt at qualifying the household energy situation in Zimbabwe was by the Whitsun Foundation in 1981. The report highlighted the importance of fuelwood to the rural population and indentified some parts of Masvingo, Manicaland and Mashonaland East facing critical shortages of woodfuel. As a result, severe deforestation and environmental degradation has occurred in these areas. Other surveys that followed include the Forestry Commission's Baseline Survey 1984, The Masvingo Province Rural Afforestation Study (Harvey, 1983) the Masvingo Stove Study (Hancock and Hancock, 1985), The Zimbabwe Energy Accounting Project (Biejer Institute, 1985) and the Energy Pricing Study (Coopers Lybrand, 1986).

The surveys and studies all revealed a household energy problem and forecasted a shortfall in the supply of fuelwood should fuelwood continue to be an indispensable commodity for the rural folk and the urban poor. Fuelwood is mostly used for cooking, heating and lighting.

Recently, the Forestry Commission engaged consultants to conduct on urban fuelwood survey for Harare. The survey included (a) firewood user survey (b) depot survey of fuelwood outlets (c) transport survey on selected entry points into the city and (d) source survey to establish the origin of fuelwood. The survey has yielded comprehensive results (Cambell, 1989).

The Department of Energy has also conducted various surveys on fuelwood supply and demand. The Department, in conjuction with the University of Zimbabwe has been actively involved in the promotion of more efficient cook stoves and in investigating possibilities of substituting woodfuel by electricity, coal, solar, biogas and oil (Katerere 1988).

The Central Statistical Office also conducted a major national household energy survey in 1984. The survey was comprehensive covering both the formal and informal sectors on appliance ownership, fuel procurement and use, scarcity of fuelwood etc. The results further revealed the relliance on fuelwood by the rural folk for energy. (Hosier, 1984).

Unlike other countries around her, Zimbabwe rural folk or urban poor do not use charcoal as a fuel. Charcoal is only used by the urban elite for barbecuing outdoors. (Katerere, 1988).

CONCLUSION AND RECOMMENDATIONS

Zimbabwe is in a situation where statistics on the formal Industrial Sector are adequate while those for the informal sector are inadequate. This is because past efforts on data collection and planning were directed only at the formal sector completely ignoring the informal sector. Because the greatest proportion of our forest area is situated in the Communal areas where about 80% of the population live, our efforts should now be directed towards collecting as much information as possible from the Communal areas. This will facilitate more accurate planning for the economic development of these areas. Since fuelwood is an essential commodity to the rural folk, data should be made readily available

to planners on the consumption, supply and demand for each locality.

Statistics on Forest Product prices needs to be improved. As well backlogs in the annual publication of Production Accounts of Forestry Products by the Central Statistical Office need to be cleared. The latest issue was published in 1984. Perhaps the Forestry Commission could assist in the distribution and collection of questionnaires on forest products.

The Forestry Commission should be given more legislative power in order that it would be accessible to confidential sales/profit and production reports on forest products by private individuals and companies. This could guard against the potential for false returns.

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Zimbabwe

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Production (CUM/MT)										
FUELWOOD AND CHARCOAL	4972000	5154000	5496000	5671600	5554100	5733100	5880500	5988100	6139500	6269200
INDUSTRIAL ROUNDWOOD	1126000	1211000	1303000	1417800	1198000	1327800	1289400	1277500	1432500	1562500
SAWNWOOD & SLEEPERS	147000	191000	200000	198000	131000	149000	138000	114000	175000	190000
CHARCOAL	1000	1000	1000	1600	1100	800	1700	800	700	1500
PANELS	35000	42000	32000	46400	38600	23400	22800	31500	41000	33000
WOOD PULP	24000	26000	26000	25000	26000	33000	31000	28000	32000	37000
PAPER AND PAPERBOARD	53000	57000	62000	67000	65000	64000	76000	75000	81000	82000
Export Quantity (CUM/MT)										
INDUSTRIAL ROUNDWOOD	700	600	2700	27600	10000	10200	10200	4700	26700	2400
SAWNWOOD & SLEEPERS	24200	21300	18900	22700	18700	12900	8200	24400	24300	8400
PANELS	3800	2100	1400	800	2300	5300	5300	800	2700	2000
PAPER AND PAPERBOARD	4200	1500	700	1900	4100	9400	9400	3800	11700	4200
Export Value (1000 US$)										
INDUSTRIAL ROUNDWOOD	39	54	139	1396	513	515	515	216	533	106
SAWNWOOD & SLEEPERS	4470	6001	5936	5306	3999	2591	2104	5871	3503	1760
PANELS	1720	1547	1166	459	731	1652	1652	351	911	594
PAPER AND PAPERBOARD	763	933	710	1130	1503	3867	3867	1621	4270	1709
Import Quantity (CUM/MT)										
FUELWOOD AND CHARCOAL	0	0	600	1200	0	0	0	0	0	0
INDUSTRIAL ROUNDWOOD	1900	2100	3200	2800	4700	4700	4700	3000	3000	0
SAWNWOOD & SLEEPERS	7000	9400	14800	8600	5300	3700	3700	2800	2600	400
CHARCOAL	0	0	100	200	0	0	0	0	0F	0
PANELS	2800	3500	4300	3500	3300	2600	2600	1100	600	600
WOOD PULP	19100	17900	19800	14600	5000	11300	11300	16700	20700	20700
PAPER AND PAPERBOARD	13000	18800	24600	19900	16700	14700	14700	12100	12800	2400
Import Value (1000 US$)										
FUELWOOD AND CHARCOAL	0	0	211	345	0	0	0	0	0	0
INDUSTRIAL ROUNDWOOD	69	76	165	96	209	209	209	358	359	0
SAWNWOOD & SLEEPERS	1530	2977	4295	2211	1269	1056	1056	601	453	88
CHARCOAL	0	0	211	345	0	0	0	0	0F	0
PANELS	1614	2827	3509	2134	1611	1232	1232	487	135	135
WOOD PULP	4541	6313	7509	5857	1939	3375	3375	4366	2477	2477
PAPER AND PAPERBOARD	10913	17756	24022	15823	11167	10124	10124	8717	16598	3065

SADCC Forestry sector: a statistical overview

R.W.S. Nyirenda

SUMMARY

This paper attempts at giving a statistical overview of the forestry sector in the Southern African Development Coordination Conference (SADCC) region. It presents, in brief, statistical information available at the SADCC Forestry Sector Technical Coordination Unit (FSTCU), how this is collected, processed, and disseminated.

Statistics on forestry are already being kept by most SADCC countries. Unfortunately, they are kept in such a general fashion as to render them unusable for various purposes. Statistics on forestry in the SADCC region have been collected in a number of areas including the forest resource, policy and legislation, management, financing, wood products, marketing and trade, etc.

At present, dissemination of relevant forestry information within and between SADCC countries is in its primary stage. It is usual for some SADCC countries to send forestry information overseas for processing and analysis. Collection of statistics in the SADCC region, by the FSTCU, is usually through studies, surveys, seminars, workshops, conferences, meetings, and consultancies. Some of this information is used in up-dating the various data banks available at the FSTCU. There are forestry data banks on research, manpower, and forestry organizations in the SADCC region. Data banks have been installed in an IBM-AT micro-computer.

Forests in the SADCC region are predominantly open woodland and dry savanna. They cover about 67% of the total land area of 4.74 million square kilometers. There are 0.61 million hectares of plantations in the region of which 73% is industrial plantations comprising of softwood species (80%), fast-growing hardwoods (19%) and other hardwoods (about 1%). About 23% of plantations are established for fuelwood production. Total forest harvest in the region is about 83 million cubic meters of fuelwood and 7.7 million cubic meters of industrial roundwood. Processed forest products in the SADCC region is not great, accounting for only 7% of Africa's sawn-wood production, 9% of panels, 12% of pulpwood and only 4% of the paper and paperboard. Per capita fuelwood consumption in the SADCC region is amongst the highest in the world. The region has 207 sawmills, 9 plywood and veneer mills, 6 fibre/particle board mills, 1 blockboard mill, 4 pulp and paper mills and 4 paper mills.

The FSTCU is continuously up-dating statistics of the forestry sector in the SADCC region. Additional data banks are being developed.

1. INTRODUCTION

Based on a questionnaire survey and a technical mission report, conducted by SADCC Forestry Sector Coordinator (Malawi) in 1983, statistics on forestry and forestry products are already being kept by most SADCC countries. Unfortunately, they are kept in such a general fashion as to render them unusable for various purposes. In the mission's report, several areas were studied including: the forest resources in relation to land and human population; forestry policy and legislation; organization and management of forestry; forestry financing; forest production, consumption, marketing and trade; and the existing forestry development programmes. At present dissemination of relevant forestry information within and between SADCC member states is in its primary stage.

Even though forestry statistics are being collected and analyzed, most SADCC Member States do not have well defined forestry data storage facilities. Information being collected is usually sent overseas for processing and analysis. There is need therefore for a prefeasibility study to look at ways and possibilities of forestry data collection and processing within the SADCC Region. A standard format for data collection could be developed or adapted from one of the following; the Food and Agriculture Organization (FAO) system or the Oxford Indexing system.

The SADCC Forestry Sector Technical Coordination Unit (FSTCU), with Canadian Technical Assistance, is at present, trying to redress this situation. Various forestry data banks are being developed. An IBM - AT Micro-computer - has been procured for the purpose. A

number of studies, surveys seminars, workshops, conferences, meetings and consultancies are being carried out. Through this, more statistics on forestry in the SADCC region are being collected and consolidated.

2. BACKGROUND

On 1st April, 1980, at the summit in Lusaka, Zambia, the Southern African Development Coordination Conference (SADCC) was borne. The nine Member Governments of the Southern African States adopted the declaration entitled Southern Africa Towards Economic Liberation. This declaration states the guiding principles and objectives of the new organization.

The Southern African Development Coordination Conference (SADCC) comprises nine member states, namely Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe (Fig. 1). These countries are extremely diverse in area, population, resources, etc. (Table 1). Some 67 million persons live in an area of nearly 5 million square kilometers, ranging from desert to rain forest. Population density varies from over 100 inhabitants per sq.km. to under 2 per sq.km. Latitudes range from 1 degree south of the equator to 31 degrees south and the region extends 3 thousand kilometers across the breadth of Southern Africa. The climate is also diverse although it is predominantly of the savanna type with hot summers, warm winters and precipitation largely confined to the summer season. Overall rainfall varies from less than 250mm to 2,500mm.

All the countries of the region have low per capita GNP. Most are predominantly agricultural. Only in Zimbabwe, Zambia and Botswana does industry make up a greater share of GNP than does agriculture. In almost all SADCC countries, services comprise between one-third and one-half of GNP.

At the SADCC Council of Ministers' Meeting held in Blantyre, Malawi in November, 1981, forestry was identified and approved as a sector. This was primarily so because of its role and importance to the people of the region in providing a myriad of goods and services essential for food production, agricultural development, livestock production, natural resource conservation and environmental protection. Forestry is one of the thirteen SADCC sectors. The Government of the Republic of Malawi has been entrusted with the responsibility to coordinate planning, conservation, management, utilization and development of the forestry sector within the SADCC member states.

TABLE 1

SADCC: Population and land use

	Population (106)	Total Land (106km2)	Total Forest (%)	Wildlife Reserves (%)	Cultivated (%)	Other (%)
Angola	8.54	1.25	1.6	7.4	3.4	87.6
Botswana	1.05	0.58	1.6	18.1	2.3	78.1
Lesotho	1.40	0.03	0.8	0.2	9.3	89.7
Malawi	7.00	0.09	11.7	11.5	36.0	39.8
Mozambique	13.40	0.78	25.5	4.1	2.9	67.5
Swaziland	0.61	0.02	13.2	4.1	14.7	68.0
Tanzania	20.30	0.88	13.6	15.1	5.2	65.5
Zambia	6.24	0.75	9.9	29.6	5.3	55.5
Zimbabwe	8.40	0.39	2.8	11.9	9.6	75.7
SADCC	66.94	4.74	5.4	13.6	5.0	72.0

Source: SADCC FSTCU: Manpower Survey 1987

3. ORGANIZATION OF THE SADCC FORESTRY SECTOR

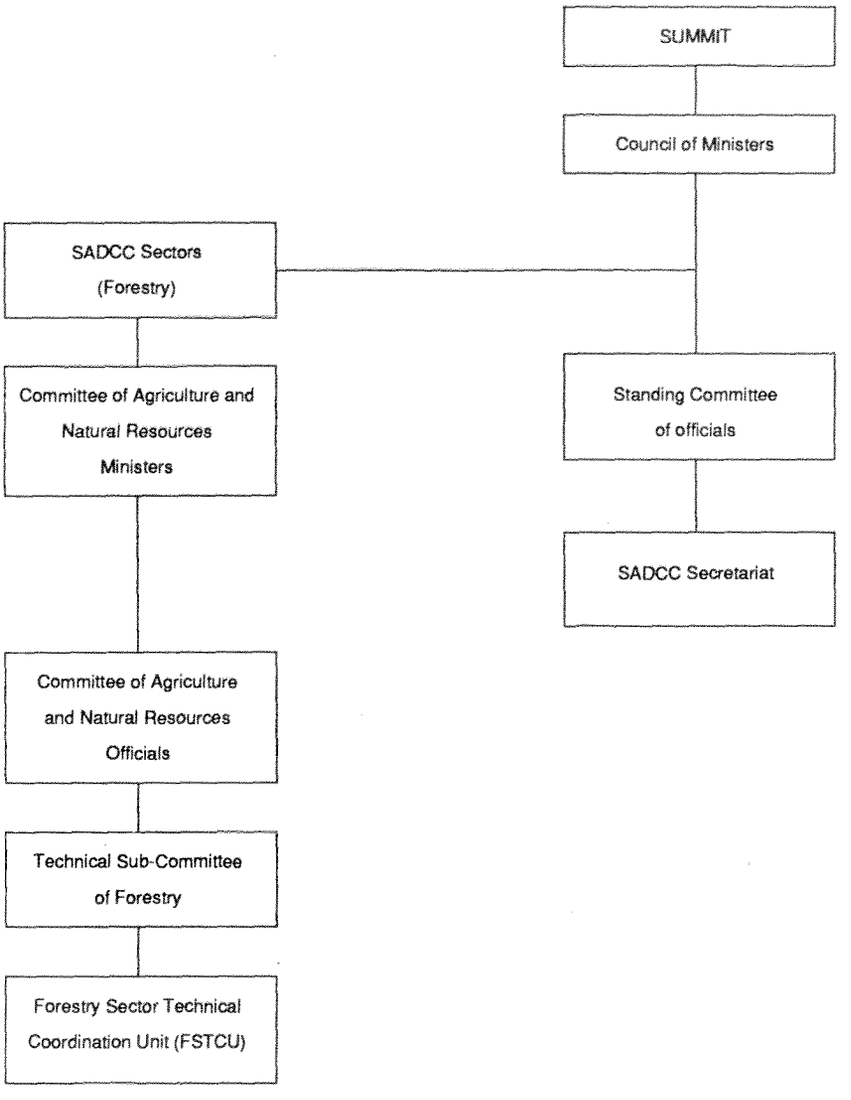
The organizational structure of SADCC has got four levels with the summit (Heads of State or Government) at the top (Fig. 2).

The carrying out of forestry programmes is a function of the Technical Sub-Committee of Forestry with the Forestry Sector Technical Coordination Unit (FSTCU) as the secretariat for the sub-committee. Approval of programmes (projects) proposed by the sub-committee for forestry is done by the committee of Agriculture and Natural Resources Ministers.

The SADCC Forestry Sector Technical Coordination Unit (FSTCU) has been established. It is part of the Department of Forestry in the Ministry of Forestry and Natural Resources and is being supported from local resources. The FSTCU has been established to ensure that Malawi's role and responsibility for regional forestry coordination, cooperation, resource mobilization and development of action-oriented programmes and activities are carried out efficiently. CIDA and FAO are providing some financial and technical assistance to the FSTCU under Memorandum of Understandings.

The SADCC FSTCU is located in Lilongwe, Malawi but its field contact involves the nine SADCC Forestry Sector National Contact Points in the SADCC countries. Its basic functions are to provide technical, organizational, managerial and informational service on SADCC Forestry matters. At present the FSTCU comprises the following professional officers, one Deputy Chief - Forestry Officer, a Principal Forestry

FIGURE 2
Organizational structure of SADCC



Officer (both local officers) and a Forestry Specialist provided through technical assistance from CIDA.

Since being assigned the responsibility for regional forestry cooperation and coordination, Malawi has organized sectoral meetings, prepared progress reports and project proposals. So far twenty-three development projects have been formulated and approved for funding. Whereas most of these projects are being funded a few of them have so far not yet received pledging from funding agencies.

4. FORESTRY RESOURCES OF THE SADCC REGION

Forests of the SADCC countries are predominantly of open woodland, relatively dry savanna and dry wooded steppes. Of the total 4.74 million square kilometers of land in the SADCC region, 67% is made up of woody vegetation of which 41% is comprised of open and closed forests (39 and 2 percent respectively). Only 9% of the total wood area is made up of what could be termed productive forest. The unproductive forest, classified in terms of the low level of commercial wood supply, accounts for 32% of the total woody area of the

TABLE 2
Areas of plantations in SADCC countries

(Thousand ha)

	Total	Industrial			
		Total	Softwood	Hardwood	Other
Angola	157.2	68.0	20.0	48.0	N/A
Botswana	N/A	-	-	-	-
Lesotho	N/A	-	-	-	-
Malawi	80.3	78.0	69.0	3.7	5.3
Mozambique	25.4	15.9	12.3	3.2	0.4
Swaziland	102.0	101.0	76.0	25.0	Nil
Tanzania	97.8	67.8	57.6	0.5	9.7
Zambia	38.0	33.5	22.6	10.7	Nil
Zimbabwe	100.2	71.6	62.8	8.4	0.5
SADCC	601.0	438.0	321.0	101.0	16.0

Source: Country Reports from SADCC Member States

fuelwood plantations etc. Over 90% of these non-industrial plantations comprise of fast growing hardwood species.

Because commercially productive natural forests are quite limited, considerable industrial output comes from portions of woodland areas and plantations. Total forest harvest is annually in the order of 83 million m3 of fuelwood and 7.7 million m^3 of industrial roundwood (sawlogs, pulpwood, pit props, poles and posts) (Table 3).

Output of processed forest products in the region is not great accounting for only 7% of Africa's sawnwood production, 9% of the panels, 12% of pulpwood and only 4% of the paper and paperboard. At present there are 207 sawmills, 9 plywood and veneer mills, 6 fibre/particle board mills, 1 blockboard mill, 4 pulp and paper and 4 paper mills (CIDA/FSTCU, 1987). Table 4 summarizes trade in forest products in the SADCC region. At present, in all SADCC countries, except Botswana and Lesotho, there is a given surplus of raw wood from industrial plantations.

TABLE 3
SADCC: Output of forest products ('000 m3)

	Roundwood	Fuelwood	Industrial	Sawlogs	Pitprops	Pulpwood	.Other	Sawn-wood	Panels	Veneer	Plywood	P/Board	F/Board	W/Pulp	Paper
Angola	8500	8000	500	72	-	28	400	10	32	2	30	-	-	5	-
Botswana	865	800	65	15	-	-	50	30	-	-	-	-	-	-	-
Lesotho	293	293	-	-	-	-	-	-	-	-	-	-	-	-	-
Malawi	8703	7340	1363	103	-	-	1260	41	10	6	4	-	-	-	-
Mozambique	17873	17030	843	143	-	-	700	75	3	1	2	-	-	-	-
Swaziland	2078	560	1518	319	65	1123	11	107	5	-	5	-	-	175	-
Tanzania	38747	37461	1286	341	-	-	945	55	7	-	2	4	2	-	-
Zambia	5690	5219	471	120	37	-	314	35	3	-	3	-	-	-	-
Zimbabwe	7340	5802	1538	435	43	101	959	188	48	5	14	25	-	30	64
SADCC	90089	82505	7564	1546	145	1252	4639	541	108	14	60	29	2	210	64

Source: CIDA/SADCC Consultancy, 1984

region. The remaining 17% of the woody area is shrubland while about 8% if fallow (Table 1).

Forest plantations, with an area of about one-tenth that of the region's productive closed forests, have been established largely on grasslands, higher elevation and moister locations. There are 610 thousand hectares of plantations comprising of softwood species (about 80%), fast growing hardwoods (about 19%) and other hardwoods (less than 1%) (Table 2). About 23% of the plantation in the region are non-industrial; made up of

Existing industry has neither the necessary capacity nor the needed market to utilize annual yields of these plantations.

The SADCC region as a whole has a substantial export balance for sawnwood products, sawnwood and wood pulp (Table 4). Some member states are importers of sawnwood, woodbased panels, sawlogs, paper and paperboard. Per capita fuelwood consumption in the region is amongst the highest in the world. For the great bulk of the rural population wood is the most affordable

TABLE 4
SADCC: Trade in forest products (Units are in thousands)

	Logs (m3)	Pit props (m^3)	Pulpwood (m^3)	Other (m^3)	Sawnwood (m^3)	Veneer (m^3)	Plywood (m^3)	P/Board (m^3)	F/Board (mt)	Wood Pulp (mt)	Paper (mt)
Exports	5	92	173	29	145	7	3	0	0	175	0
Imports	4	0	0	41	30	4	7	2	12	15	107
Export Balance	1	92	173	- 13	115	3	- 4	- 2	- 12	160	- 107

("negative implies Import Balance)
Source: Adapted from CIDA/SADCC Consultancy, 1984.

household energy source. It accounts for over 80% of the total energy requirements.

Generally there is a great potential in the SADCC region for forest industry development and inter-country trade in forest products from the region's own forest resources.

With regard to forest manpower development, the SADCC region has two universities which offer forestry degree training. There are at present seven colleges in the region offering training at technical level (diploma and certificate in forestry). A Forest Industries Training Center for the region is under construction. In some member states vocational courses in forestry are offered (Table 5). There is generally a shortage of forestry manpower at professional, technical and vocational levels in the SADCC region.

5.0 FOREST POLICY AND ADMINISTRATION IN THE SADCC REGION

The SADCC Forestry Policy and Development Strategies have been formulated and are an integral component of the SADCC Natural Resources Policy and Development Strategy. Most states have recognized forest policies, usually founded in those of the former British or Portuguese colonial services. In all cases these have been or are subject to updating and improvement. In general, policies are becoming more specific in relation to plantations and to fuelwood and other communal problems. At present, Angola only has guidelines for forestry development in its plan. Mozambique has a recently formulated policy. Tanzania and Zimbabwe have recently revised their policy statements. Malawi has recognized the need for revising its forest policy. Zambia still supports the existing forest policy. In most instances legislation is undergoing revision and updating. Lesotho has recently issued a formal policy statement not yet implemented. Swaziland and Botswana do not appear to have official government forest policies.

All states even those with little forest resources, have some form of forest authority. Most have a Forestry Department or Forestry Division in a Ministry of Agriculture or of Natural Resources. Most forest authorities have responsibility for several aspects of conservation or work closely with other agencies which do. Zimbabwe has the special situation of having a parastatal Forestry Commission with a board of Commissioners responsible to the Ministry of Natural Resources and Tourism.

In Swaziland, where forestry has been a private venture, the Forest Service is in its infancy, while in Lesotho a new Division of Conservation and Forestry has been established in the Ministry of Agriculture.

Some aspects of forest industry may be the responsibility of the forestry agency, which may undertake logging, at least in public plantations and

TABLE 5
SADCC: Manpower in forestry and forest industries

	Professional	Technical	Vocational	Other
Angola	2	25	863	3110
Botswana	1	84	120	684
Lesotho	12	53	75	82
Malawi	36	699	1102	1750
Mozambique	21	181	351	21295
Swaziland	23	144	441	3542
Tanzania	251	847	5824	1772
Zambia	44	352	6924	Unknown
Zimbabwe	48	175	647	2898
SADCC	434	2454	16347	31230

Source: SADCC Manpower Survey, 1988

may operate processing industries. In Malawi, Tanzania and Zambia, forest industry is the function of parastatal bodies - the Malawi Wood Industries Corporation (WICO), the Tanzania Wood Industries Corporation (TWICO) and the Zambia Forestry and Forest Industries Corporation (ZAFFICO). Zimbabwe's Forestry Commission also has logging and processing responsibilities.

In almost all states there has been a gradual transition from the colonial forest services, through a stage of maintaining some expatriate forest officers to one of complete or nearly complete use of national officers. Considerable use has been made during this period of both multinational and bilateral assistance in grants or loans. In general, most of the forestry authorities are partially staffed with reasonably well trained national professional and sub-professional officers. Lack of both adequate funds and trained candidates prevent the completion of established structures. Often other areas of public or private services have drained forest services of qualified professionals. All states have the problem of understaffing to some degree. The situation has been especially serious in Angola and Mozambique. The problem is often more severe at the sub-professional levels where substantial staff is needed.

In addition to private industry corporations which are important in Swaziland and Zimbabwe, there is a Forest Association in Botswana which is a focal point for non-governmental forestry activities and the Timber Council of Zimbabwe which is an association of private millers, processors and traders.

6.0 SADCC FORESTRY DATA BANKS

It is generally felt by SADCC that economic development and to a lesser extent, increased agricultural production depend, to a large extent, on the wise use and long-term conservation of the region's natural resource base including forest resources. This is the basis of the SADCC Natural Resources Policy and Development Strategies. As a SADCC Policy element, since the management and use of the forest resources in the SADCC region aims at maximizing productivity, with a view to promoting regional self-sufficiency in all forest and wood products, for economic development, the gathering and dissemination of statistics on forestry in the region is a preliquisite. As a development strategy, it is felt that there should be a continuous survey, evaluation and monitoring of forest resources. This is through the compilation of forest inventories and the establishment of forest data banks of the region's forest resources. Review of this information as a basis for planning and sustainable utilization of forest resources would be done frequently.

Since 1987, the FSTCU has been developing and maintaining forestry data banks. The main objectives of this activity has been:-

(i) to analyze, structure and programme a database capable of performing the various tasks in storing, sorting and disseminating forestry information;
(ii) dissemination, through trained FSTCU staff, forestry information to SADCC member states, cooperating partners and other interested groups.

At present there are four data banks that have been installed in the IBA - AT micro-computer based at the FSTCU. These data banks cover the areas of forestry research documentation, forestry manpower in the SADCC region (2) and non-governmental forestry organizations in the SADCC region.

In selecting a computer for the FSTCU, various factors were considered:

(i) the presence of other similar computers within Malawi and other SADCC member states;
(ii) the presence of a reliable dealer in Malawi with available maintenance for the machine;
(iii) the need for a computer with adequate memory for the work programme of the FSTCU;
(iv) the advantage of a computer which can be used by the unit personnel as opposed to a computer specialist.

The IBM PC-AT, with a 512 KB memory, was chosen for these basic reasons. It is also versatile machine. It can be transformed for use as a Telex machine; computer-to-computer communications can be established; a tracing table can be added to produce maps and other drawings; another hard disk or tape drive can be added to enhance the computer's memory capacity, and finally, it has many programmes related to statistics, administration and forestry. These include the Lotus 1-2-3, Word Processor, and dBase III Plus. From time to time the FSTCU is being asked to produce reports, newsletter, and statistics related to the various data banks at hand.

ASHTON - TATE'S "dBASE III Plus" is a software package that facilitates the storage and sorting of any kind of data. The existing RESEARCH, MANPOWER, and NGO data bank programmes are all written in dBase languages and are menu driven. The research menu gives a dictionary of forestry research publications from SADCC member states and abroad (for a sample printout see Annex 2). The manpower menu gives a list

TABLE 5

SADCC Forestry statistical data collection, processing, and dissemination by the FSTCU

What	Data collection	Data storage and processing	Information Dissemination
Where	SADCC Region	• FSTCU Lilongwe (MALAWI)	• SADCC region and Abroad
Who	• FSTCU Staff • Consultants • SADCC Forestry Contact Points • SADCC Secretariat • Other SADCC Sector Coordinators	• FSTCU's IBM-AT computer using dBASE III Plus & Lotus 1-2-3 programmes • Statistical Analysis	• FSTCU Staff • Consultants • SADCC Contact Points • Other SADCC Sector Coordinators • Other organizations
How	• Questionnaires • Reports • Consultancies • Studies • Publications • Correspondence	• Research Data Bank • Manpower Data Bank • NGO Data Bank • Statistical Packages	• Publications • Workshops • Seminars • Meetings • Telex • Telephone • Letters

of forestry professional active in the SADCC member states. Finally, the NGO menu gives a list of Non-Governmental Organizations that are active in the SADCC countries.

In gathering research information for the research data bank, a form was designed and circulated for completion within the SADCC member states. Information from the research data bank can be obtained in any required form as a print-out. Using support from CIDA and the Forestry Training Programme (FTP) of Finland, through a consultancy the FSTCU, in October, 1987, carried out a forestry manpower survey in the SADCC region. Most of information collected has been incorporated in the two manpower and NGO data banks. The other forestry manpower data bank is on Lotus 1-2-3. This data bank has information on forestry manpower, training institutions, forest industries, etc..

7.0 COLLECTION AND DISSEMINATION OF FORESTRY STATISTICS

The collection and dissemination of forestry statistics in the SADCC region is an area that is being developed. So far information has been gathered from SADCC member states for various purposes. This has mainly been through questionnaire surveys, country reports, studies, general correspondence publications and consultancies. Statistical information on forestry in the SADCC region has been disseminated by the FSTCU through publications, reports presented at workshops, seminars and meetings, and through other communication channels e.g. telexes, telephones and letters. The process is summarized in Figure 5 below. Statistical data on forestry is generally collected and disseminated by FSTCU staff, consultants, SADCC forestry contact points etc. Outside the processing of raw data through the various statistical analysis methods, by FSTCU staff, the computer is also used to process data ready for dissemination.

8.0 CONCLUSION AND RECOMMENDATIONS

It is clear from the above discussion that the collection and dissemination of statistics on the forestry sector within the SADCC context is still in its primary stage. This state of affairs has fortunately already been recognized by SADCC. Approaches to redress or improve the situation have been clearly outlined in the SADCC Development Policy. A document titled "SADCC Natural Resources and the Environment: Policies and Development Strategy" has been approved by the SADCC Council of Ministers at their meeting in Gaborone, Botswana, in October, 1988. In this document is outlined the SADCC Forest Policy and Development Strategies.

In line with the above, SADCC generally considers it strategic that various forestry statistics are gathered, processed and disseminated both at regional and international level. This, it is felt, would assist in the analysis of the economic implications of forest resource development, management and utilization, and the improvement of trade in forest products in the region. The FSTCU is abiding by this scenario. Amongst other things, it is and will continue developing more data banks.

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Collecting timber trade statistics: case of African Timber Organization

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INTRODUCTION

Within the framework of the active cooperation existing between FAO and African Timber Organization, I have the honour to present to you the present paper on behalf of ATO. We hope that the five years experience we have in timber trade statistics collection (ATO statistics unit was created in 1984) will deserve your attention. We also hope to gain from your own experience through this seminar. The following main points are discussed in the paper:

- ATO objectives and the prominent position of statistics collecting within ATO. The purpose here is to justify and give the importance of the creation of a statistics unit at ATO headquarters.
- The second chapter deals with the ATO statistics collecting system. In this chapter, we give the background of the project, its functioning and some illustrating records.
- Chapter III looks at primary industry product statistics collecting as opposed to secondary industry products.
- In Chapter IV, we discuss the particularities of export market and local market in ATO countries with respect to trade statistics collecting.
- Chapter V raises problems related to measurement units with a particular emphasis on secondary industry products.
- Chapter VI looks at the problem of product valuation and comparability of data in time and space.

Chapter I
ATO OBJECTIVES AND THE PROMINENT POSITION OF STATISTICS COLLECTING AND DATA BANK WITHIN ATO

I.1 ATO objectives

The African Timber Organization is an International Organization for cooperation in the field of forestry management and timber marketing. Its 13 member countries are:

1. Angola
2. Cameroon
3. Central African Republic
4. Congo
5. Côte d'Ivoire
6. Gabon
7. Ghana
8. Equatorial Guinea
9. Liberia
10. Nigeria
11. Sao Tome and Principe
12. Tanzania
13. Zaire

Its objects is to allow Member countries to study and coordinate the ways and means of ensuring an optimum development of their forests and timber products. In order to reach these goals, and in accordance with Article 2 of the Agreement, the ATO set for itself the following objectives:

a) To ensure among Member Countries a continuous exchange of information and mutual support concerning their forestry management, timber marketing and industrialization policies,
b) To coordinate the commercial policies of the Member Countries, particularly in regard to the following:

- prices,
- product designations, terminology and gradings,
- standardization of conditioning and quality control
- tax matters.

c) To ensure the study of freight rates and shipment procedures suitable for African products and to promote cooperation among Member Countries in negotiations in this regard;
d) To coordinate industrialization policies among Member Countries;
f) To harmonize policies of reforestation, and forestry and environmental management;
g) To coordinate supervisory training policies;
h) To study alternatives and implement the formation of an African timber market on an efficient basis;
i) To promote close cooperation between landlocked and coastal countries, in particular for studying new ways of transportation;
j) And, in general, to promote cooperation among Member Countries in all areas related to Forestry Management, as deemed useful.

I.2 Role of statistics

From the above listed objectives, it is clear that the first of the objectives is to ensure among Member Countries a continuous exchange of information. Therefore the existence of a market intelligence and statistics division is of capital importance.

Every ATO member country needs statistical data not only on local level, but also on the level of other tropical timber producer countries, member of ATO or not, in order to take enlightened decisions and define appropriate and harmonised policies in the sector of forestry economy.

ATO with UNDP assistance, set up a statistics and market intelligence unit in 1984 at ATO headquarters in Libreville (Gabon).

I.3 Data Bank within ATO

Since 1984, we have been working on a data bank covering the period 1980 onwards. In p_inciple, we have data on logging, industry production and sales. For the moment, the ATO system only requests data that are judged most important. Still lacking are data on resources (areas, plantations, standing volumes, etc..). These data have been judged less important by the experts at the seminar on forestry statistics of Libreville (June 1984) and at the 8th Ministerial Conference of Yamoussoukro (November 1984) confirming, however, that these data should be incorporated in the system as soon as possible.

II. THE SET UP SYSTEM

II.1 Genesis

After the 5th Ministerial Conference had recommended the creation of the department in 1982, two preliminary reports on the subject were produced by two FAO Consultants, namely Mr. Per A. Thege and Mr. G. Noel. In particular, the report about the "Organization of an intelligence department on the tropical timber trade between the member countries of ATO" by Mr. G. Noel was examined and discussed at the 7th Conference of ATO in November 1983. During the seminar on Forestry Statistics in June 1984 in Libreville, the statisticians of the member countries, assisted by Mr. Wardle and Mr. Erfurth of the FAO amended the report in the sense of simplification, taking into consideration the relative relevance of data, the difficulties involved in data collecting and ATO limited financial means. A final project report was made by the seminar and adopted by the 8th ATO Ministerial Conference in Yamoussoukro in November 1984.

II.2 Description of the system

II.2.1 Questionnaire

ATO General Secretariat sends three categories of questionnaire regularly to official correspondents in all member countries. Correspondents are all senior civil servants in their respective Forestry Ministries. The three categories of questionnaires are the following (see models in Appendix):

- One monthly questionnaire on volumes and values of exports per type of product, to be returned in 2 months period.
- One quarterly questionnaire on volumes and prices of log exports per species and per quality, to be returned in 2 months period.
- Five annual questionnaires on forestry inventories, forestry concessions, logging, industrial production, local and export sales; to be returned in a 6 months period.

This means for member countries 21 questionnaires per year (12 monthly + 4 quarterly + 5 annual).

II.2.2. Data analysis

At ATO headquarters tables are filled annually and sent to member countries.

II.2.2.1. Monthly figures

The 17 following tables are made from the monthly questionnaire figures, giving an annual total number of 17 x 12 = 204 tables.

Table 1:	Volumes and values of timber exports per type of product and per country.
Table 2:	Volumes and values of log exports per type of product.
Table 3:	Idem, sawnwood
Table 4:	Idem, sleepers
Table 5:	Idem, veneers
Table 6:	Idem, plywood
Table 7:	Idem, particleboard
Table 8:	Idem, fibreboard
Table 9:	Idem, total of timber
Table 10 to 17:	The same as tables 2 to 9 but in index figures.

In practice table 7 and table 8 do not exist because ATO member countries practically do export neither fibreboard nor particleboard. The above tables have to be made ready and sent to countries within one month period. I.e. export figure tables of January 1989 have to be sent in May 1989. Because we have two months (February and March) for the correspondent to fill in questionnaire and one month (April) for ATO headquarters to fill tables.

II.2.2.2 Quarterly figures

The 8 following tables are made from the quarterly questionnaire, giving a total number of 8 x 4 = 32 tables.

Table 1:	LM fob prices per species and per country
Table 2:	Idem, BC
Table 3:	Idem, Standard
Table 4:	Volumes and values of log exports per species and per country (LM)
Table 5:	Idem, BC
Table 6:	Idem standard
Table 7:	Fob prices per species and per quarter, all qualities
Table 8:	Volumes and values of log exports per species and per quarter, all species.

As in the case of monthly figures, the quarterly tables must be ready and sent within the month following the date of return of the questionnaire.

II.2.2.3. Annual figures

The 150 following tables are made from the 5 annual questionnaires:

1	Useful, felled and commercialized volumes x member country
2	Felled volumes x member country x species
3	Volumes entered in the local industries x member country x species
4	Exported volumes x member country x species
5	Volumes received and produced x type of industry x member country
6	Volumes and values of local sellings and of exports x type of product x member country
7	Volumes and values of the exports x type of product x country of destination - Cameroon
8 - 19	Idem, for the other member countries
20	Idem, for the ATO
21	Exports of logs x species x country of destination -Cameroon
22	Idem for the other member countries
23	Idem, for the ATO
24	Volumes and values of imports x type of product x member country
25	Volumes and values of imports x type of product x country of origin - Cameroon
26 - 37	Idem, for the other member countries
38	Idem, for the ATO

B) Development over most recent 5 years

39	Development of volumes received and produced x type of industry, Cameroon
40 - 51	Idem, for the other member countries
52	Idem for the ATO
53	Development of volumes and values of local sales and of exports x type of product, Cameroon
54 - 65	Idem, for the other member countries
66	Idem, for the ATO
67	Development of the exports of logs x species, Cameroon
68 - 79	Idem, for the other member countries
80	Idem, for the ATO
81	Development of the imports x type of product, Cameroon
82 - 93	Idem, for the other member countries
94	Idem, for the ATO
95 - 150	The same as tables 39 - 94 but in index figures.

Annual tables have to be made ready and published within a two months period at ATO headquarters. I.e. taking account consideration the six months period needed by correspondents to fill in questionnaires, annual tables can only be published 8 months after the year concerned.

II.2.2.4. Data storage and processing

All the figures we receive from ATO member countries are systematically processed, communicated to all member countries and progressively stocked in the 10KB fixed hard disk incorporated in the central processing unit of ATO's computer. For practical and technical reasons, we also keep information on floppy disks. The computer type used at ATO headquarters is IBM, XT and the programmes we use are:

1) Lotus 1, 2, 3
2) Reflex
3) Sideways
4) Writing assistant.

II.3. Performance of the system

II.3.1. Monthly questionnaire

Some weaknesses have been registered. They are structural, logistical and even human. We failed to follow the initial schedule of information flow between countries and ATO headquarters. There is a generalised problem of delay in data collecting and transmission, and a complete absence of data in some cases.

Explanatory factors are:

- The slowness of mail between African countries.
- Some ATO Correspondents prefer to accumulate monthly questionnaires, until they have filled 3 or 4 of them. In this case the very principle of monthly information flow is altered.

TABLE 1

Monthly questionnaires in 1989 - Responses

	Months											
Countries	J	F	M	A	M	J	J	A	S	O	N	D
Country A		N	O		E	X	P	O	R	T		
Country B	X	X	X	•	•	•	•	•	•	•	•	
Country C	•	•	•	•	•	•	•	•	•	•	•	•
Country D	•	•	•	•	•	•	•	•	•	•	•	•
Country E	•	•	•	•	•	•	•	•	•	•	•	•
Country F	•	•	•	•	•	•	•	•	•	•	•	•
Country G	X	X	X	X	X	X	•	•	•	•	•	•
Country H	X	X	X	•	•	•	•	•	•	•	•	
Country I	X	X	X	X	X	X	•	•	•	•	•	•
Country J		N	O	•	E	X	P	O	R	T		
Country K		N	O	•	E	X	P	O	R	T		
Country L		N	O	•	E	X	P	O	R	T		
Country M	X	X	•	•	•	•	•	•	•	•	•	•

- In some countries, correspondents have no possibility to get figures within the 2 months fixed period because of lack of enough support, enough motivation or due to inadequate structural organization of the Administration.
- In some countries, it is completely impossible to get export figures on monthly basis, because nobody seems to be interested in doing the compilation.
- Some ATO Correspondents omit to send back one or other questionnaire, leading to gaps in the information flow.
- Personnel transfers, frequent in some countries, hinder the functioning of the system.
- In 2 member countries, ATO correspondents have never been nominated.
- In many countries, ATO Correspondents complain about the insufficient logistical means put at their disposal for fulfilling their work.

The result of the above factors is that the publication of ATO monthly statistical tables cannot be done in time and on a regular basis.

Six Correspondents however give more or less satisfaction, as regards monthly questionnaires.

It is important to note that Angola, Nigeria, Sao Tome and Principe and Tanzania do not export timber. If we take the remaining 9 countries (13 - 4 = 9), we get a performance rate of about only 70% responsiveness.

As an illustration for 1987 and 1988 monthly questionnaires were returned by 6 and seven countries respectively. The position for 1989 is illustrated by Table 1.

In October 1989, we were supposed to have got back the monthly questionnaire for the month of August from all the ATO countries. But, as it can be seen, two countries have sent back the June questionnaire, three countries have sent back the March questionnaire, once country has sent back questionnaires up to February, others have not yet transmitted any questionnaire.

II.3.2. Quarterly questionnaire

Whereas in the case of monthly questionnaire, we have at least six countries which send figures on a more or less regular basis, we have much less in the case of quarterly questionnaire.

In addition to the problem of limited number of responses, there is a problem of incomplete data in the case of quarterly questionnaires. This is mainly due to the fact that in most of the countries, log exports records are not enough detailed. It should be reminded that quarterly questionnaire is related to log FOB prices per species and per quality. The aim of the questionnaire is to compare FOB prices of log exports in time and space. When log quality details are omitted, the questionnaire becomes useless.

Six countries completed the quarterly information for 1988 but only one was complete.

For 1987, only two countries, filled in more or less completely the annual questionnaires. For 1988, no single questionnaire has been sent back.

Apparently the more detail required, the less good are the responses. We do much better with monthly questionnaire, a little better with quarterly questionnaire and we quasi completely failed as regards annual questionnaires.

II.4. Possibilities of improvement

The results registered at ATO headquarters shows that something must be done in order to make the system more effective. At ATO headquarters we are quite aware of it and efforts are being made to bet means and ways to that end. We hope to get assistance not only from member countries, but also from other international organizations, notably FAO and ITTO.

At this particular moment where forestry matters are drawing the whole world attention through the alarming ecologist reports, where timber producers, traders and consumers are desperately retorting to the ecologist attacks; more interest should be given to forestry statistics because they are basically needed for any eventual policy or action.

As regards ATO in particular, the remedy should involve the following elements:

- Particular attention has to be given to the choice of correspondent. The person has to be competent, to have enough time for his work as correspondent and has to be interested in his work.
- Incentive measures must be found to make the work of correspondent more attractive.
- Necessary administrative and logistical support must be provided to the correspondent, keeping in mind that the nature of required support varies from one country to another.
- There must a follow-up through periodical (once every two years) seminars of sensibilisation and exchange of ideas and experience and country visits, by ATO General Secretariat staff are also important.

Chapter III
STATISTICS COLLECTING ON PRIMARY INDUSTRY PRODUCTS AND SECONDARY INDUSTRY PRODUCTS IN ATO COUNTRIES

III.1. PRIMARY INDUSTRY

In most of ATO countries, logging is in hands of large scale companies well organized, well structured and hence capable of providing detailed production statistical records. The very logging companies are in most cases vertically integrated with primary processing units to produce timber products such as lumber, veneer and plywood.

So there is no particular problem as regards primary industry products. The whole question is for the governments to enlighten producers on the significance and importance of submitting accurate data on a regular basis. Naturally the government should have ways of checking the truthfulness of the supplied data, because for fiscal and/or other commercial reasons, entrepreneurs tend to supply deliberately wrong figures on their activities to the Administration.

III.2. SECONDARY PRODUCTS

III.2.1. Characteristics

Excepting Ghana where important secondary industry has emerged these last years with exporting capacity, secondary timber industry in ATO countries is generally small scale and of informal type, producing for the local market. As such, it is difficult, sometimes impossible, to get accurate data on the industry's activities. At ATO headquarters, we have no statistics on secondary industry, neither do the member countries.

III.2.2. Necessity to collect the data

When one knows that all ATO member countries count more than 200 million people, it is obvious that the market is of such importance that statistics collection should not be neglected. The problem to solve in this context is to find appropriate survey methods.

Chapter IV
EXPORT MARKET AND LOCAL MARKET IN ATO COUNTRIES

IV.1. EXPORT MARKET

ATO countries export most of their timber to EEC countries. Collection of statistical data on this market is relatively easy. The export market being a source of precious foreign currency, countries tend to follow much more closely the flow of export products.

However some problems are encountered when it comes to timber specifications. In most cases the customs office, which is the most reliable and authorized source, does not keep detailed statistical records on timber exports because they find no interest in doing so and sometimes they have no technical knowledge to do it. Here is another area where the intervention of government forestry administration is necessary.

Sources of information are diverse, complementary in some cases and substitutable in some others. There are customs offices, harbours, Central Banks, trade-Unions, export government boards, central bureaux of statistics, forestry Ministries etc... The experience we have in ATO countries is that each country is a particular case. In other words, there is no universal best source of information. All depends on the politico-administrative and structural organization of the country. Sources must be identified in each country and compared in order to specify the suitable source in function of the type of needed information.

IV.2. LOCAL MARKET

Given the quasi absence of secondary timber industry in ATO countries, local market is comprised essentially of households consumer of fuelwood and finished timber products. The market can be divided into two main categories. The rural population with high demand for fuelwood, demand for some housing timber and an insignificant level of demand for industrial timber products. These finished timber products are supplied mainly by the informal sector and on a significant level by imports.

At ATO headquarters, statistical data on local market are only partly known. We actually only know what is sold on local market by the large-scale primary industries. We know nothing about the final use of these sales, or the sales of informal sector timber industry. Neither do we know the fuelwood consumed in ATO countries, apart from the estimates made by FAO. Taking into consideration the present forestry

world conjuncture ATO countries and African countries in general should put more emphasis on statistics collection.

Chapter V
MEASUREMENT UNITS

V.1. PRIMARY INDUSTRY PRODUCTS

The standard measurement unit recommended in ATO countries is cubic meter. But in some cases, we get figures in metric tons from member countries or in cubic feet. Naturally this gives additional work, at ATO headquarters, of converting into cubic meters.

V.2. SECONDARY INDUSTRY PRODUCTS

As regards secondary industry products, for two main reasons, we opted for leaving out quantities and ask for values only. The reasons are:

The diversity of products and the predominance of the qualitative aspect over the quantitative one.

Chapter VI
PRICES

Unlike other raw material markets there exists no international reference price for timber. Timber market is characterised by a lack of transparency. Consequently, prices are not uniform. Probably, this lack of transparency is mainly due to the nature of African species which are recognised as very heterogeneous. Fixed price cannot in fact be applied to diverse products. This is why price margins are observed in ATO countries, but these margins must be in acceptable limits. That is why one of the goals of ATO is to try to make the market less opaque by supplying both volume and price information to all member countries.

VI.2. CURRENCY PROBLEM

ATO countries, non-member of French Zone, have non convertible currencies. When their local currencies have to be converted, there is that problem of rate of conversion; especially when one knows that in some cases, there are two parallel rates of conversion: the official one and the unofficial one. Also important is the money depreciation in time.

Therefore the values have to be carefully apprehended and the comparability of data in space or time must take into consideration the underlying factors.

As regards values of ATO Secretariat publications, all values are in CFA Franc. When we have series of values, we specify whether it is constant or current price. All value figures from ATO correspondents in member countries are either in CFA francs or in US dollars.

CONCLUSION

The importance of forestry statistics as a basis for any forestry policy is undeniable. ATO countries, aware of this fact, set up a system of data collection with the assistance of some international organizations. The system still suffers from some weaknesses which we discussed and we saw which solutions are likely to make the system more functional. Some technical aspects have also been raised.