FOREST PRODUCT CONVERSION FACTORS: PROJECT OVERVIEW AND STATUS

1. USE OF CONVERSION FACTORS

1.1 Background

The term "forest products conversion factors" is used to cover a broad spectrum of ratios utilized in the forest resource, manufacturing, and energy sectors. For the purpose of this paper, conversion factor is defined as using a known figure to determine or estimate an unknown figure via a ratio. Often these ratios are absolute, for example converting cubic feet to cubic metres (always 35.315 cubic feet in a cubic metre); and often ratios are not absolute, but rather a good average; for example, one m^3 (under bark volume) of freshly felled Norway spruce sawlogs weighs 860 kg of which 80 kg is bark and 780 kg is wood.

In other instances, conversion factors may have little meaning unless one knows some of the parameters of what is being converted from and to. For example; one m^3 of logs with an average small end diameter of 15 cm will make 0.41 m^3 of sawnwood that is dried and surfaced(<20% moisture content, and planed to a smooth finish); but, one m^3 of logs with an average small-end diameter of 60 cm will make 0.63 m^3 of sawnwood (dried and surfaced). That is not to say that one cannot use a single factor to convert roundwood to sawnwood, this can be done with an accurate factor and when looking at a large population in the aggregate. When looking at a lower level, however, factors that account for various parameters or factors that utilize the parameters via a regression formula are better suited.

Often in combination with the use of forest product conversion factors is the use of the "material balance". The sawnwood example above could leave one with the incorrect assumption that only 41% of the wood fibre in the 15 cm sawlog and 63% of the 60 cm sawlog were utilized. In fact, virtually 100% of the wood in both log groups were utilized. The remaining volume went to several wood residues having other and often distinct uses. For example: one m^3 of 15 cm sawlogs could have a material balance of 41% sawnwood, 43% chips (raw material for paper), 9% sawdust (for making energy pellets, particleboard, MDF) and finally 7% shavings (for particle board, and energy fuel). The components balance with 100%. Although not part of the material balance as the log volume was represented as under bark, one might also apply a conversion factor to this scenario to estimate that 80 kg of bark is potentially available from each m^3 of roundwood (measured under bark) for energy use (if the logs in question were Norway spruce).

Trees and wood in particular have a predisposition toward the approximate as a result of the irregularity of shape and form, the variability of density and moisture content in wood fibre, and other natural variables that affect conversion factors such as species, size, age, defects, provenance, etc. Wood fibre is also hygroscopic, thus its volume and weight in the green-roundwood state will be less once dried or exposed to the atmosphere. Compounding the aforementioned variables are the man-made biases and misrepresentation that also have to be accounted for, such as measurement inaccuracy, differences in measurement procedures which often reflect a unit volume differently than another standard does. Finally, there are differences that occur as a result of product manufacturing efficiency levels and utilization practices, which vary significantly from one region to another.

***In science, there is only physics, all the rest is stamp collecting…*Lord Rutherford.**

1.2 Conversion factors general use: what do people use them for

Conversion factors have long been utilized by the forest sector as an analysis tool for managing forests and forest products manufacturing facilities. In fact, many forestry handbooks have substantial sections on conversion factors, and there are quite a number of books available that are entirely dedicated to forest products conversion factors.

Virtually every aspect of forecasting and analysis in the forest sector is somehow touched by conversion factors. Silvicultural growth models, biomass calculations, carbon sequestered in the forest, timber sale appraisals, to name just a few, are all dependent on conversion factors.

A practical level example of this would be a timber sale appraisal that a sawmill is conducting to determine a bid price per unit. The stand volume may be reported in cubic metres outside bark but the purchaser may need to convert these volumes into inside bark volumes, weight or cubic foot to match their analysis units. To determine the value of the timber, the purchaser will need to know the cost of getting the timber from the stump to the mill site where weight to volume ratios are likely an important parameter for determining transport costs (m^3 per truckload given a net weight capacity of 25 tonnes per truck). Primary product recovery will need to be estimated using conversion factors from roundwood to the primary product, e.g., 2 m^3 roundwood = 1 m^3 sawnwood. A material balance will be used to determine the quantity and thus value of the residual products made, and finally, ratios may be used to estimate the quantity of unmeasured products from the timber sale such as bark and logging residue (top-wood, limbs, foliage) which may be profitable to utilize for energy purposes.

At a higher level, policy analysts and policymakers utilize conversion factors to determine the sequestered carbon in the forests of their country. The sawnwood trade agreement between the US and Canada was disputed in large part based on a quoted by FAO m^3/mbf conversion factor from the 1940s. Outlook studies on long-term wood availability and use are also highly dependent on the use of conversion factors.

Analysts have used conversion factors in an effort to try to indicate illegally logged roundwood in the supply chain of manufacturing facilities in a region, i.e., when the roundwood removal volume is less than the apparent demand as determined via conversion factors; it is assumed that the disparity may be made up of illegally logged volume. Additionally organizations such as CITES and others have been looking into the possibility of applying conversion factors to manufactured product volumes as an indication of the harvest level of endangered species such as bigleaf mahogany[1].

Finally, roundwood to product conversion factors are a good indication of efficiency levels and thus are often used to benchmark a manufacturing facility's effectiveness at converting raw materials into products.

1.3 Conversion factor use by UNECE/FAO: what do we use them for

To paraphrase directly from the preface of *Conversion Factors (Raw Material/Product) for Forest Products, 1987*[2]: "Since its early days in the 1950s, the Joint FAO/ECE Working Party on Forest Economics and Statistics has been regularly dealing with conversion factor problems. It was therefore considered necessary to monitor on a regular basis, changes in the raw material/product conversion factors. Information was collected for the years 1963, 1967, 1970, 1972, 1975, 1979, 1983, and 1987. A major objective of collecting and publishing this information on an international basis is to calculate national and international wood balances, notably in the context of the FAO/ECE studies of the FAO/ECE studies of European timber trends and prospects, in order to estimate wood requirements. This information is also of use in the preparation of other national and international studies with a wood balance element."

More recently, conversion factors were used for the European Forest Sector Outlook Study, which was published in 2005[3] (see annex 1). Moreover, there has been recent and ongoing work (and workshops) on Wood mobilization, National Wood Resource Balances and Potential Wood Supply[4].

At the data collection level, we also use conversion factors for the following:

1. Where a country has explicitly provided data in non-standard units. Typically this involves a conversion from m^2 to m^3 or from mt to m^3. We use the factors from FAO for the mt to m^3. For the

[1] http://www.cites.org/eng/com/pc/17/E-PC17-16-01-03.pdf

[2] UNECE/FAO. 1991. Conversion Factors (Raw Material/Product) for Forest Products [ECE/TIM/55], 1987. UNECE/FAO. United Nations, New York

[3] ECECE/FAO. 2005. European Forest Sector Outlook Study 1960-2000-2020 Main Report [ECE/TIM/SP/20]

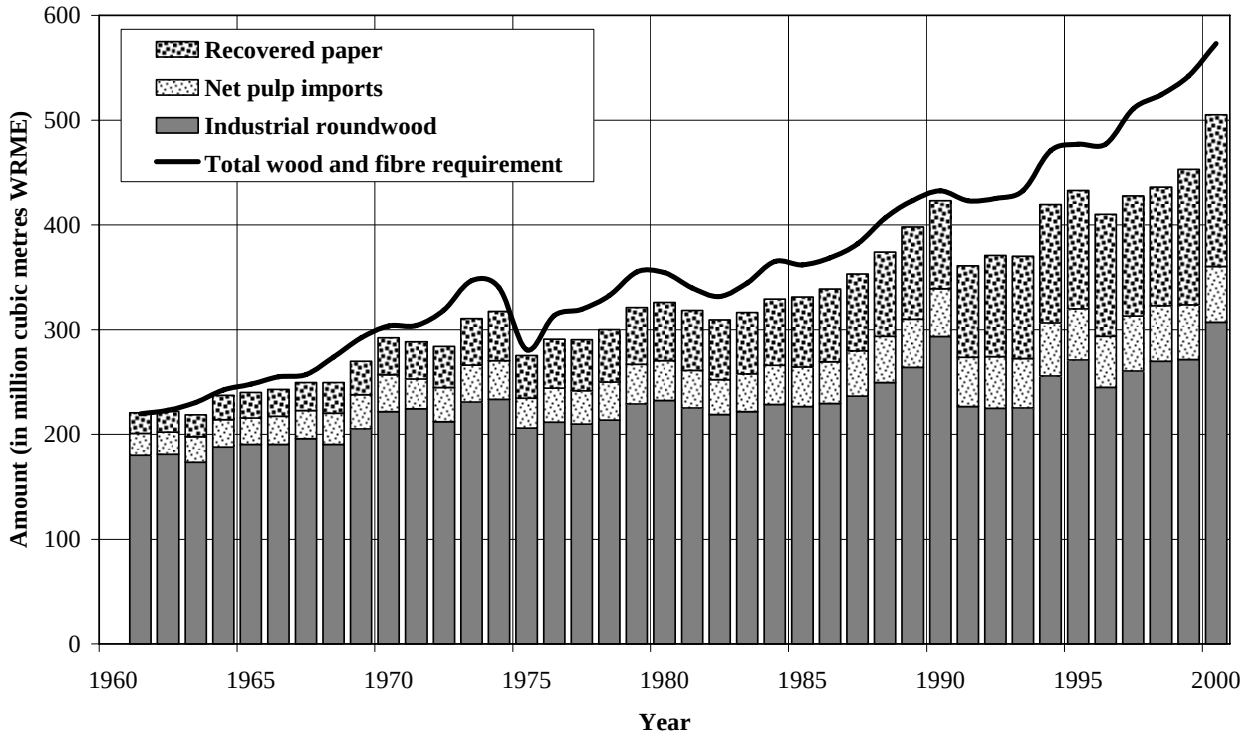
[4] Documentation of this work can be found at: http://www.unece.org/timber/tc-docs_old.htm and at http://timber.unece.org/index.php?id=128

m^2 to m^3 conversion of panels we estimate the average thickness of the type of panels (see annex 2, Joint Questionnaire conversion factors sheet).

2. Where we suspect that data are incorrect. Often the unit value (dividing value of trade in an item by the volume of trade) will indicate that one or the other element is incorrect. Most obviously, plywood and fibreboard data are often reported in m^2 rather than m^3 without this being explicitly stated. Here, normally rather than a conversion factor, we use a standard unit value (e.g. Europe average) to convert the value figure into volume to replace the supposedly incorrect volume figure.So this is an example of a non-physical conversion factor.
3. Converting data from other sources to our standards (e.g. COMTRADE kilograms). Official trade statistics usually indicate a trade volume in kilograms. Other units are also used but these are often not consistently applied. Thus when extracting data from COMTRADE, for example, we will total the weight and then convert from mt to m^3 using the FAO standard factors. This obviously leads to uncertainties because typically you are dealing with a shipping weight here, not a product weight.

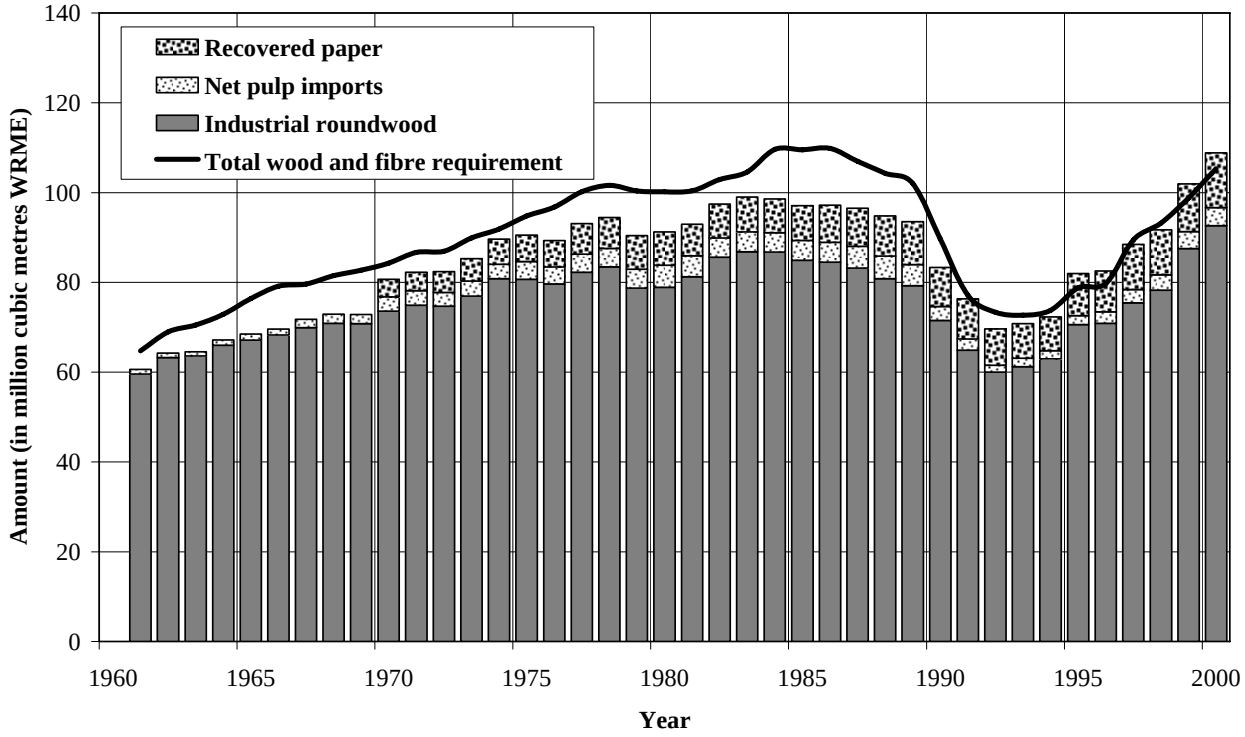
For all uses, improved and current conversion factors have been asked for. This issue was brought up during the work on EFSOS (2005). Adrian Whiteman, showed this graphically by comparing documented sources of wood fibre against the amount needed as determined via conversion factors for the years 1961-2000. This was shown for both western Europe (figure 1) and Eastern Europe (figure 2).

Figure 1 Trends in wood raw material consumption in Western Europe from 1961 to 2000



Source: derived from FAOSTAT production and trade statistics (http://faostat.external.fao.org).

Figure 2 Trends in wood raw material consumption in Eastern Europe from 1961 to 2000



Source: derived from FAOSTAT production and trade statistics (http://faostat.external.fao.org). Note: totals for Eastern Europe before 1992 have been estimated from statistics for the USSR.

Note that in western Europe prior to 1990, the wood fibre requirement as determined via conversion factors appeared to parallel the apparent consumption, however, after 1990 this trend changed, apparently showing that either the conversion factors were no longer accurate or that there may be some undocumented sources of wood fibre entering into the usage pool. In Eastern Europe a less pronounced and opposite trend appears.

Defining units is also an area that has been identified as not only necessary for obtaining accurate conversion factors but also beneficial in understanding volumes when comparing national statistics, e.g., is an m^3 of roundwood or sawnwood as reported from one country the same as that from another.

2. CURRENT WORK ON FOREST PRODUCT CONVERSION FACTORS BY THE UNECE/FAO

2.1 Background on the Forest Products Conversion Factor Task Force

During the 31 March – 1 April 2008 Workshop on National Wood Energy Resource Balances the need for better forest product conversion factors was cited. At the subsequent Joint UNECE/FAO Working Party on Forest Economics and Statistics this was recognized and the UNECE/FAO Timber Section was mandated to lead a cooperative effort to develop accurate conversion factors for the ECE region for establishing national and regional wood balances.

A task force of national and sector-based experts was formed in the spring of 2008 and this was followed with a meeting of the task force members on 17-18 June in Geneva. The task force reviewed the current problems with existing conversion factors and finalized the units and definitions as well as the desired factors and balances of the various forest products. A list of country groupings (19 groups) was developed based on similarities of the forest sector (resources and manufacturing) so that known conversion factors can be applied to countries or regions without conversion factors (annex 3). The meeting report of the Task Force is available at: http://timber.unece.org/fileadmin/DAM/CF_TF_08_Report.pdf.

A questionnaire was developed and distributed to the Task Force members as well as other national correspondents for completion of national conversion factors. The target date for submission of the national factors was 6 December, however, as of mid January 2009 it has become clear that this target was not realistic, as many countries have not been able to obtain the data, given the complexity of the information requested, and the lack of resources available to deal with such a technical issue.

2.2 Objectives of the Task Force

To gather data on the ratio of roundwood to product volumes for all of the major forest products made or consumed in the ECE region and use this data to produce a report with the ratios for each country in the region, as well as regional standard factors. Additionally, harmonization of definitions and units will need to be agreed upon, and roundwood to roundwood ratios will need to be determined (m^3 log from one countries standards, or green weight, to a harmonized standard m^3). One of the major intended aims for these conversion factors is the ability to use these factors for constructing a wood resource balances for ECE countries and the region as a whole, notably in the context of forest sector outlook studies.

2.3 Current status of the work of the Task Force

As of early March 2009, we have received the filled in questionnaires from five countries (Germany, Ireland, the Netherlands, the U.K. and the U.S.) and one trade association (CEPI). We have commitments that we will soon receive filled in questionnaires from: Austria, Canada, Finland, France, Spain, and Sweden. In addition, we are hoping to receive questionnaires from countries other than those listed above. Figure 3 shows the material balances for coniferous sawnwood for the three countries that submitted this data. Table 1 shows some key conversion factors from the countries that have returned questionnaires.

Figure 3. Coniferous sawnwood material balance for Germany, Ireland and the US

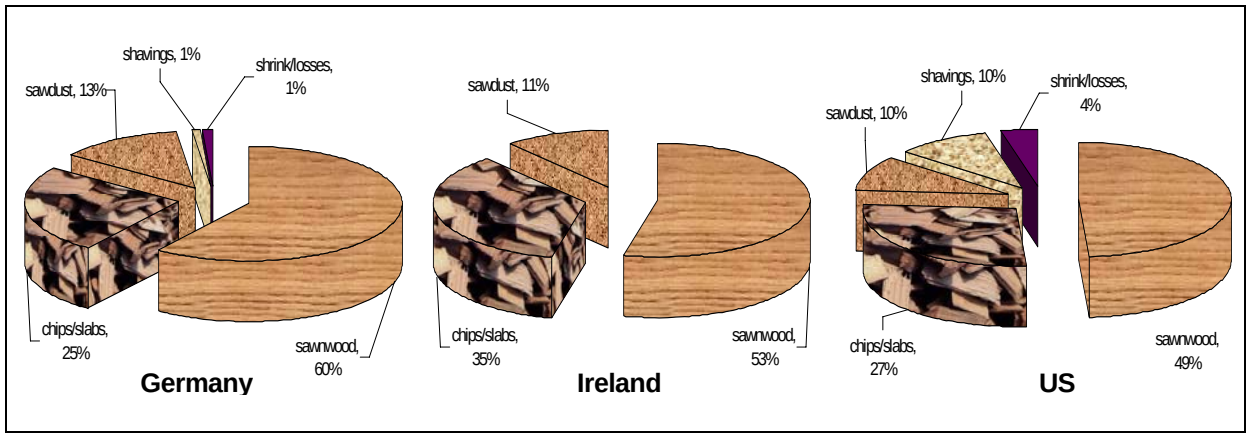


Table 1 Selected conversion factors by country from submitted questionnaires as of March 2009

Products	unit in/unit out	DE	IRL	NL	UK	US
ROUNDWOOD TOTAL	Kg/m³	865		820		1105
Conifer	Kg/m³	810		780	1018	1000
Non-conifer	Kg/m³	1130		910	1143	1315
Conifer	ub/ob	0.89	0.89	0.81	0.89	0.88
Non-conifer	ub/ob	0.91		0.83	0.88	0.88
CHIPS AND PARTICLES TOTAL	m³/odmt	2.31				2.27
Conifer	m³/odmt	2.47	2.78			2.31
Non-conifer	m³/odmt	1.77				2.00
Conifers and nonconifers (loose to solid)	m³/m³	2.44	2.70	2.94		3.04
SAWNWOOD TOTAL	m³rw/m³p	1.64				
Conifer (rough-green)	m³rw/m³p	1.66	1.89	1.67		1.62
Non-conifer (rough-green)	m³rw/m³p	1.53	1.89	1.82		2.22
Conifer (rough-dry)	m³rw/m³p		1.99		2.0	1.69
Non-conifer (rough-dry)	m³rw/m³p				2.50	2.33
Conifer (surfaced-dry)	m³rw/m³p	1.97	2.13			2.08
Non-conifer (surfaced-dry)	m³rw/m³p					2.86
VENEER AND PLYWOOD TOTAL	m³rw/m³p			1.55		1.89
Conifer (veneer)	m³rw/m³p	1.80				1.60
Non-conifer (veneer)	m³rw/m³p	1.80			2.59	2.00
Conifer (plywood)	m³rw/m³p	2.30			1.62	1.90
Non-conifer (plywood)	m³rw/m³p	2.30				2.10
PANELS MADE FROM PARTICLES TOTAL	m³sw/m³p		1.93			
Particle board (without OSB)	m³sw/m³p	1.30		1.30	1.62	1.60
OSB and waferboard	m³sw/m³p	1.30		1.30		1.65
Fibreboard, hard	m³sw/m³p	2.40		1.45	2.37	1.75
Fibreboard, medium (MDF)	m³sw/m³p	1.70		1.45	1.50	1.60
Insulation board	m³sw/m³p	1.10		1.45	0.63	0.71
WOOD PULP						
Mechanical	m³/mt	2.60		2.50	2.50	2.51
Semi-chemical	m³/mt	2.70		2.50	2.75	3.35
Chemical	m³/mt			4.90		3.35
Sulfate bleached	m³/mt	3.90		4.90	6.00	3.35
Sulfate unbleached	m³/mt	3.55		4.90	4.50	3.35
Sulfite bleached	m³/mt	4.15		4.90	5.00	3.35
Sulfite unbleached	m³/mt	3.55		4.90		3.35
Dissolving grades	m³/mt	5.10		5.50		
Recovered paper (input to output)	mt/mt	1.25				
PAPER AND PAPERBOARD						
Newsprint	m³/mt	3.20		2.80	2.80	
Uncoated Mechanical	m³/mt	3.50		3.50	3.50	
Coated paper	m³/mt	4.40		3.50		
Sanitary and household paper	m³/mt	4.90		3.25		
Packaging materials	m³/mt			3.25		
Case Materials	m³/mt	4.20		3.25		
Folding boxboards	m³/mt	4.00		3.25		
Wrapping paper	m³/mt	4.10		3.25		
Other paper mainly for packaging	m³/mt	4.00		3.25		
Other paper and paperboard	m³/mt	3.70		3.25	2.50	
ROUND AND SPLIT PRODUCTS						
Barrel staves	m³rw/m³p	5.00				
Utility poles	m³rw/m³p	1.20	1.10			
Posts	m³rw/m³p	1.20	1.15			
Pilings	m³rw/m³p	1.20				
ENERGY WOOD						
Fuelwood	m³sw/odmt	2.30	1.82			
Pellets	m³rw/m³p	1.46	2.20		1.20	
Pressed logs and briquettes	m³sw/odmt		2.20			
Charcoal	m³sw/odmt	5.00				
Wood based ethanol	m³/kilolitre	8.62			6.80	

Notes: m^3rw = roundwood m^3 ub, m^3sw = m^3 solid wood equivalent, m^3p = m^3 product volume, mt = metric ton

2.3.1 Ongoing challenges and opportunities

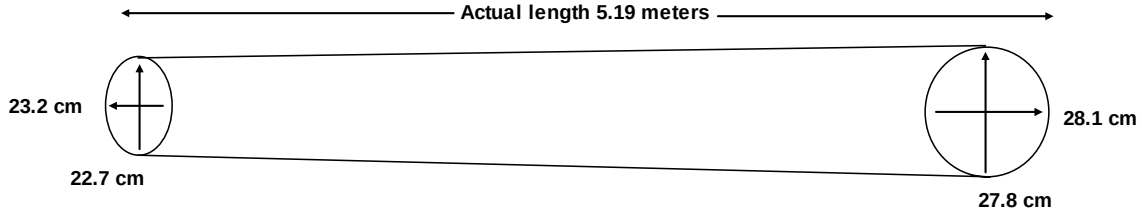
As previously mentioned, so far we have not had the level of participation that we had hoped for in returning filled in questionnaires. Some of our statistical correspondents, who have been willing to participate, do not know who to contact or where to go in order to obtain this information. For many of the countries, this data does not exist and there is no mechanism for gathering it.

We also see opportunities in gaining a better understanding of the units of measurement for forest products with possibilities for improving data quality, not only for conversion factors, but also for the reported volumes in all timber databases. While we have long agreed, at least in principle, on the basic units (m^3, metric tons, etc.), there are fundamental differences in the way we measure products, which can lead to significant volume differences, e.g., one country's cubic meter of wood contains a different amount of wood volume than another country's. The Task Force discussed these at length and one can review the Task Force Meeting Report for more detail (http://timber.unece.org/fileadmin/DAM/CF_TF_08_Report.pdf). The Task Force does not necessarily advocate that all measurement procedures need to be standardized, although it is an option, but rather that we need to be aware of the bias in order to harmonize these units into something that can be integrated into regional totals, or used to make comparisons. Listed below are the unit definitions that have the most significance in terms of potential differences:

2.3.1.1 Roundwood m^3

We define the unit of measure for roundwood as m^3 under bark, however the rounding conventions used for diameter and lengths can differ significantly dependent on many local and regional standards. The Task Force agreed that we want conversion factors based on "true cubic", which is defined here as having unbiased rounding logic. There are other differences caused by the formula used, however, these differences do not appear to be as significant, nor did the Task Force feel it was appropriate to "second guess" the use of one formula over another. Figure 4 is an example of the differences caused by rounding rules, which in this example resulted in more than an 11% difference. Note that 0.7854 is a constant and that we are concerned about the volumetric bias caused by rounding, not the particular cubic formula (Smalian) used in the example.

Figure 4. Example of rounding bias when measuring roundwood



Example of a country standard

1. Diameters are rounded down to next lower cm (fractions are dropped), e.g., 23.7 = 23 cm
2. Diameters are measured on each end twice; narrow dimension and wide dimension
3. The diameters on each end are averaged and fractions are dropped, e.g., (27 + 28) ÷ 2 = 27 cm
4. Lengths are rounded down to the next lower 0.2 meter class to allow for trim, e.g., 5.19 = 5.0 m
5. Volume formula ((diameter of small end^2 + large end^2)/2) x Length x .07854 ÷ 10,000 = m^3

National standard = $((22^2 + 27^2)/2) \times 5.0 \times .07854 \div 10{,}000 = 0.23817\ m^3$

Example of "true cubic"

1. Diameters are rounded to nearest cm, e.g., 23.7 = 24 cm
2. Diameters are measured on each end twice; narrow dimension and wide dimension
3. The diameters on each end are averaged and rounded to nearest even number, e.g., 27 + 28 = 28 cm
4. Lengths are rounded to closest 0.1 meter, e.g., 5.19 = 5.2 m
5. Volume formula ((diameter of small end^2 + large end^2)/2) x Length x 0.7854 ÷ 10,000 = m^3

True cubic = $((232 + 282)/2) \times 5.2 \times .07854 \div 10{,}000 = 0.26812\ m^3$

In this example ratio of national standard to true cubic = 0.23817 ÷ 0.26812 = .888

We have asked for "true cubic" volumes in the questionnaire, but we are unsure if these are in fact provided. Additionally, if the roundwood production numbers are not reported in "true cubic"; conversion factors based on true cubic and applied to uncorrected numbers will lead to erroneous results.

2.3.1.2 Oven dry density

This unit of measure is used for virtually all forest products and is generally the preferred basis measure of raw materials composed of wood particles. Input of raw materials is often represented in this measure for products such as: panels from reconstituted wood, pulp and paper and wood energy. It is generally reflected in "basic density" (BD), which is the weight of an m^3 of wood devoid of moisture; or in specific gravity (SG), which is an index of the weight of a given volume of water (SG equals basic density x 1,000, as an m^3 of water weighs exactly 1,000 kg.). This measure is also important to determine sequestered carbon, which generally accounts for very close to 50% (+ or – a few percentage points) of the oven dry weight.

One of the problems is that there is a significant variable to measuring oven dry density that is often not clarified and can lead to a substantial misrepresentation; when dried from the green state to oven dry, a hardwood can easily lose 16% of its volume to shrinkage and a softwood can easily lose 8% (generally the denser the wood, the more it shrinks). Thus if wood volume is measured prior to drying (in the green state), the BD or SG will be lower than if the wood is dried and then measured. The task force agreed that the bias of the oven dry weight needs to be specified as to whether volume is represented in the green-state SG^G, BD^G, or dry state (shrunken); SG^D, BD^D, however the preference is to use the representation for green-state as this volume can be tied directly back to roundwood or standing volume without knowing the shrinkage averages, which vary significantly by species.

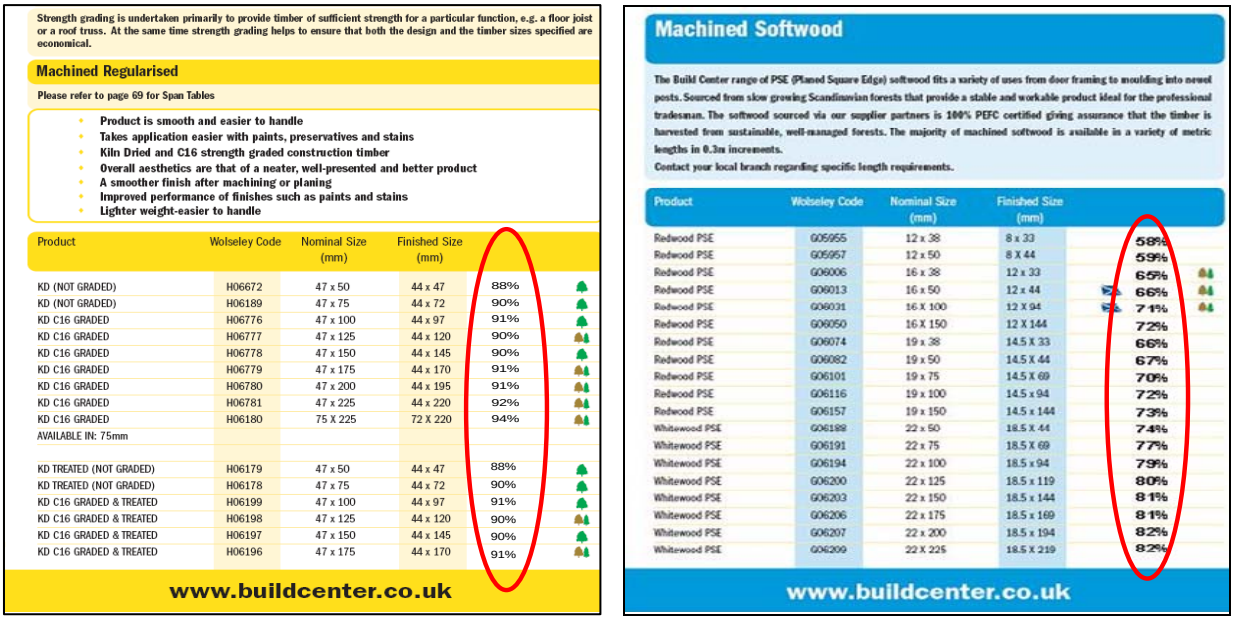
2.3.1.3 Sawnwood m^3

There are two significant issues with the measurement of sawnwood in the UNECE region, which have the potential to distort volumes to a significant degree:

Nominal vs. actual measurement: a good example of this is the measurement convention for measuring coniferous sawnwood in North America with the regional standard "board foot" measure. A board foot is usually defined as being a measure of wood being one inch (2.54 cm) in thickness and one foot squared (0.3048 m), thus containing 0.00236 m^3 per board foot. This was probably true when sawnwood was sold as rough and green, now however, most wood is dried and surfaced, so there is a set of nominal standards that allow wood of smaller dimensions (0.75" thick sawnwood is represented as being 1" thick) to be sold on a nominal basis ignoring the shrinkage and material removed during surfacing. The width, and to a smaller degree, lengths of sawnwood also have nominal measurement allowances. In other words, what nominally is represented as having one m^3 is actually about 0.72 m^3. Since this is known, it is adjusted for in the conversion factors and the UNECE/FAO Timber Database. The problem is that we have anecdotal information that this is also the case in other countries, and thus far we have not been able to identify where and to what degree this occurs. Figure 5 is a list of nominal to actual sizes used by a European sawnwood dealer. According to the sawmill that supplies this wood dealer with their sawnwood, they report sawnwood volumes to the government based on volumes determined from the nominal sizes. Note that volumes based on actual sizes vary from 58% to 94% of nominal measure for these two categories of wood.

Sawnwood state of manufacture (semi processed vs. finished): As previously mentioned, sawnwood shrinks when it is dried, so if sawnwood volume is accounted for in the green state, it will not have the same volume once it reaches equalization with atmospheric humidity levels. Additionally, some sawnwood is accounted for volumetrically in a partially manufactured state (boules, flitches, cants), that is to say it is often only sawn on two faces and thus only a percentage is actually usable, with the rest later ending up as a residue which will be used as the raw material for other products or as energy wood. This can be quite misleading when utilizing a wood balance, makes integration into regional averages inaccurate (apples and oranges), and makes it difficult to benchmark efficiency levels. Related to the above, is that it is more difficult to precisely measure boules and flitches, and the standard for measuring them differs by region (notably between the UK and the rest of Europe). Figure 6 shows the difference between boules and finished sawnwood.

Figure 5. Nominal to actual sizes for sawnwood



Strength grading is undertaken primarily to provide timber of sufficient strength for a particular function, e.g. a floor joist or a roof truss. At the same time strength grading helps to ensure that both the design and the timber sizes specified are economical.

Machined Regularised

Please refer to page 69 for Span Tables

- Product is smooth and easier to handle
- Takes application easier with paints, preservatives and stains
- Kiln Dried and C16 strength graded construction timber
- Overall aesthetics are that of a neater, well-presented and better product
- A smoother finish after machining or planing
- Improved performance of finishes such as paints and stains
- Lighter weight-easier to handle

Product	Wolseley Code	Nominal Size (mm)	Finished Size (mm)	
KD (NOT GRADED)	H06672	47 x 50	44 x 47	88%
KD (NOT GRADED)	H06189	47 x 75	44 x 72	90%
KD C16 GRADED	H06776	47 x 100	44 x 97	91%
KD C16 GRADED	H06777	47 x 125	44 x 120	90%
KD C16 GRADED	H06778	47 x 150	44 x 145	90%
KD C16 GRADED	H06779	47 x 175	44 x 170	91%
KD C16 GRADED	H06780	47 x 200	44 x 195	91%
KD C16 GRADED	H06781	47 x 225	44 x 220	92%
KD C16 GRADED	H06180	75 X 225	72 X 220	94%
AVAILABLE IN: 75mm				
KD TREATED (NOT GRADED)	H06179	47 x 50	44 x 47	88%
KD TREATED (NOT GRADED)	H06178	47 x 75	44 x 72	90%
KD C16 GRADED & TREATED	H06199	47 x 100	44 x 97	91%
KD C16 GRADED & TREATED	H06198	47 x 125	44 x 120	90%
KD C16 GRADED & TREATED	H06197	47 x 150	44 x 145	90%
KD C16 GRADED & TREATED	H06196	47 x 175	44 x 170	91%

www.buildcenter.co.uk

Machined Softwood

The Build Center range of PSE (Planed Square Edge) softwood fits a variety of uses from door framing to moulding into newel posts. Sourced from slow growing Scandinavian forests that provide a stable and workable product ideal for the professional tradesman. The softwood sourced via our supplier partners is 100% PEFC certified giving assurance that the timber is harvested from sustainable, well-managed forests. The majority of machined softwood is available in a variety of metric lengths in 0.3m increments.
Contact your local branch regarding specific length requirements.

Product	Wolseley Code	Nominal Size (mm)	Finished Size (mm)	
Redwood PSE	G05955	12 x 38	8 x 33	58%
Redwood PSE	G05957	12 x 50	8 X 44	59%
Redwood PSE	G06006	16 x 38	12 x 33	65%
Redwood PSE	G06013	16 x 50	12 x 44	66%
Redwood PSE	G06031	16 X 100	12 X 94	71%
Redwood PSE	G06050	16 X 150	12 X 144	72%
Redwood PSE	G06074	19 x 38	14.5 X 33	66%
Redwood PSE	G06082	19 x 50	14.5 X 44	67%
Redwood PSE	G06101	19 x 75	14.5 X 69	70%
Redwood PSE	G06116	19 x 100	14.5 x 94	72%
Redwood PSE	G06157	19 x 150	14.5 x 144	73%
Whitewood PSE	G06188	22 x 50	18.5 X 44	74%
Whitewood PSE	G06191	22 x 75	18.5 X 69	77%
Whitewood PSE	G06194	22 x 100	18.5 x 94	79%
Whitewood PSE	G06200	22 x 125	18.5 x 119	80%
Whitewood PSE	G06203	22 x 150	18.5 x 144	81%
Whitewood PSE	G06206	22 x 175	18.5 x 169	81%
Whitewood PSE	G06207	22 x 200	18.5 x 194	82%
Whitewood PSE	G06209	22 X 225	18.5 X 219	82%

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Figure 6. Boules vs. finished sawnwood

Boules

Finished sawnwood

2.4 Future steps

We will need to synthesize the questionnaire data into a report (Discussion paper) by the fall of 2009. Between now and then, we hope to get more conversion factors submitted by UNECE Region countries, which have thus far not done so. We need direction, support and assistance from the Working Party on verifying national methods of measuring the items covered briefly in section 2.3.1 and the future role of the Task Force in accomplishing this.

There are other people who have done work on conversion factors and material balances whom we may be able to cooperate with; for example European Cooperation in Science and Technology (COST), (see *A European Wood Processing Strategy: Country Reports*[5]). Additionally, we need to consult the Teams of Specialists on Outlook Studies, Sustainable Forest Management and Forest Products Markets.

The questionnaire responses need to be used to identify areas where conversion factors and timber data may have quality or harmonization issues at a country level. Finally the conversion factors will be used for wood resource balances in the new outlook studies.

[5] http://dfwm.ugent.be/woodlab/CostE44/home.htm

ANNEXES

Annex 1

ANNEX 1: CONVERSION FACTORS USED IN THE EUROPEAN FOREST SECTOR OUTLOOK STUDY

Country	Volume of roundwood (underbark) required to produce one cubic metre of product						Volume of roundwood (underbark) required to produce one metric tonne of product							Felling volume per cubic metre of roundwood production
	Coniferous sawnwood	Non-coniferous sawnwood	Particleboard	Fibreboard	Plywood	Veneer sheets	Mechanical pulp	Chemical pulp	Semi-chemical pulp	Newsprint	Printing and writing paper	Other paper and paperboard	Recovered paper	
Austria	1.54	1.50	1.30	1.82	2.00	2.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.44
Belgium	1.60	1.60	1.40	1.80	1.90	1.90	2.30	4.50	2.90	3.20	4.00	3.40	3.80	1.16
Denmark	1.76	1.69	1.44	1.82	2.89	2.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.02
Finland	2.10	2.40	1.80	1.50	2.70	2.00	2.40	4.70	2.20	3.20	4.00	3.40	3.80	1.28
France	1.81	2.05	1.20	1.80	1.95	1.67	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.48
Germany	1.56	1.46	1.22	1.51	1.94	2.06	2.60	4.70	2.70	3.20	4.00	3.39	3.80	1.31
Greece	1.80	1.70	1.40	1.80	2.90	3.10	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.25
Iceland	1.76	1.69	1.44	1.82	2.89	2.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.40
Ireland	1.76	1.69	1.44	1.82	2.89	2.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.11
Italy	1.76	1.69	1.44	1.82	2.89	2.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.12
Luxembourg	1.60	1.60	1.40	1.80	1.90	1.90	2.30	4.50	2.90	3.20	4.00	3.40	3.80	1.15
Netherlands	1.64	1.57	1.44	1.82	1.89	1.89	2.27	4.48	2.86	3.20	4.00	3.39	3.80	1.43
Norway	1.76	1.69	1.44	1.82	2.89	2.20	2.39	4.50	2.86	3.20	4.00	3.39	3.80	1.25
Portugal	1.42	3.52	1.57	1.94	3.10	1.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.23
Spain	1.42	3.52	1.57	1.94	3.10	1.20	2.48	4.48	2.86	3.20	4.00	3.39	3.80	1.12
Sweden	2.00	1.90	1.40	1.70	2.30	2.20	2.30	4.70	2.20	3.20	4.00	3.39	3.80	1.21
Switzerland	1.70	1.80	1.40	1.60	1.50	1.90	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.37
United Kingdom	1.71	1.61	1.40	1.80	2.89	2.20	2.16	4.48	2.86	3.20	4.00	3.39	3.80	1.30
Albania	2.00	2.00	1.40	2.80	2.50	2.90	1.20	4.50	2.90	3.20	4.00	3.40	3.80	1.20
Bosnia and Herzegovina	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.25
Bulgaria	1.70	2.10	1.40	2.30	2.50	2.60	2.30	5.30	2.30	3.20	4.00	3.40	3.80	1.45
Croatia	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.24
Czech Republic	1.60	1.50	1.50	2.60	2.30	1.70	2.60	5.30	2.90	3.20	4.00	3.40	3.80	1.32
Estonia	1.70	1.60	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.33
Hungary	1.50	1.70	1.60	3.30	1.80	2.00	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.25
Latvia	1.70	1.60	1.40	1.80	2.70	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.37
Lithuania	1.60	1.70	1.80	2.60	2.30	2.20	2.50	4.80	2.90	3.20	4.00	3.40	3.80	1.32
Poland	1.50	1.40	1.80	1.80	2.30	1.90	2.60	5.30	3.10	3.20	4.00	4.70	3.80	1.44
Romania	1.70	1.60	1.70	2.10	2.30	2.90	2.90	6.40	3.20	3.20	4.00	3.40	3.80	1.43
Serbia and Montenegro	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.25
Slovakia	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.44
Slovenia	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.15
TFYR Macedonia	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.10
Turkey	1.80	1.70	1.40	1.80	2.90	2.20	2.50	4.50	2.90	3.20	4.00	3.40	3.80	1.22
Belarus	1.60	1.45	1.60	3.00	2.65	2.00	2.50	5.21	2.90	3.50	4.20	3.80	3.80	1.14
Republic of Moldova	2.00	2.00	1.40	2.80	2.50	2.90	1.20	4.48	2.86	3.50	4.20	3.80	3.80	1.76
Russian Federation	1.60	1.50	1.60	3.00	2.70	2.00	2.50	5.20	2.90	3.50	4.20	3.80	3.80	1.45
Ukraine	1.60	1.50	1.60	3.00	2.70	2.00	2.50	5.20	2.90	3.50	4.20	3.80	3.80	1.33

Annex 2

JFSQ

FOREST SECTOR QUESTIONNAIRE
Conversion Factors

NOTE THESE ARE ONLY GENERAL NUMBERS. IT WOULD BE PREFERABLE TO USE SPECIES- OR COUNTRY-SPECIFIC FACTORS

Product Code	JFSQ Quantity Unit	Product	Multiply the quantity expressed in units on the right side of "per" with the factor to get the value expressed in units on left side of "per". volume to weight m^3 per MT	volume to area m^3 per m^2	volume to volume of roundwood Roundwood equivalent	
1	1000 m^3	ROUNDWOOD				
1.1	1000 m^3	WOOD FUEL, INCLUDING WOOD FOR CHARCOAL	**1.38**			
1.1.C	1000 m^3	Coniferous	**1.60**			
1.1.NC	1000 m^3	Non-Coniferous	**1.33**			
1.2	1000 m^3	INDUSTRIAL ROUNDWOOD (WOOD IN THE ROUGH)				
1.2.C	1000 m^3	Coniferous				
1.2.NC	1000 m^3	Non-Coniferous				
1.2.NC.T	1000 m^3	of which:Tropical	**1.37**			
1.2.1	1000 m^3	SAWLOGS AND VENEER LOGS				
1.2.1.C	1000 m^3	Coniferous	**1.43**			
1.2.1.NC	1000 m^3	Non-Coniferous	**1.25**			
1.2.2	1000 m^3	PULPWOOD (ROUND & SPLIT)	**1.48**			
1.2.2.C	1000 m^3	Coniferous	**1.54**			
1.2.2.NC	1000 m^3	Non-Coniferous	**1.33**			
1.2.3	1000 m^3	OTHER INDUSTRIAL ROUNDWOOD	**1.33**			
1.2.3.C	1000 m^3	Coniferous	**1.43**			
1.2.3.NC	1000 m^3	Non-Coniferous	**1.25**			
2	1000 MT	WOOD CHARCOAL	**6.00**			
3	1000 m^3	WOOD CHIPS AND PARTICLES	1.60			
4	1000 m^3	WOOD RESIDUES	1.50			
5	1000 m^3	SAWNWOOD			1.6 / 1.82*	
5.C	1000 m^3	Coniferous	**1.82**			
5.NC	1000 m^3	Non-Coniferous	**1.43**			
5.NC.T	1000 m^3	of which:Tropical				
6	1000 m^3	WOOD-BASED PANELS			1.6	
6.1	1000 m^3	VENEER SHEETS	**1.33**	0.0025	1.9*	
6.1.C	1000 m^3	Coniferous				
6.1.NC	1000 m^3	Non-Coniferous				
6.1.NC.T	1000 m^3	of which:Tropical				
6.2	1000 m^3	PLYWOOD	**1.54**		2.3*	
6.2.C	1000 m^3	Coniferous				
6.2.NC	1000 m^3	Non-Coniferous				
6.2.NC.T	1000 m^3	of which:Tropical				
6.3	1000 m^3	PARTICLE BOARD (including OSB)	**1.54**			
6.3.1	1000 m^3	of which: OSB				
6.4	1000 m^3	FIBREBOARD				
6.4.1	1000 m^3	HARDBOARD	**1.05**	0.005		
6.4.2	1000 m^3	MDF (Medium Density)	**2.00**	0.016		
6.4.3	1000 m^3	INSULATING BOARD	**4.00**	0.025		
7	1000 MT	WOOD PULP			3.37	
7.1	1000 MT	MECHANICAL				
7.2	1000 MT	SEMI-CHEMICAL				
7.3	1000 MT	CHEMICAL				
7.3.1	1000 MT	SULPHATE UNBLEACHED				
7.3.2	1000 MT	SULPHATE BLEACHED				
7.3.3	1000 MT	SULPHITE UNBLEACHED				
7.3.4	1000 MT	SULPHITE BLEACHED				
7.4	1000 MT	DISSOLVING GRADES				
8	1000 MT	OTHER PULP				
8.1	1000 MT	PULP FROM FIBRES OTHER THAN WOOD				
8.2	1000 MT	RECOVERED FIBRE PULP				
9	1000 MT	RECOVERED PAPER				
10	1000 MT	PAPER AND PAPERBOARD			3.37	
10.1	1000 MT	GRAPHIC PAPERS				
10.1.1	1000 MT	NEWSPRINT				
10.1.2	1000 MT	UNCOATED MECHANICAL				
10.1.3	1000 MT	UNCOATED WOODFREE				
10.1.4	1000 MT	COATED PAPERS				
10.2	1000 MT	SANITARY AND HOUSEHOLD PAPERS				
10.3	1000 MT	PACKAGING MATERIALS				
10.3.1	1000 MT	CASE MATERIALS				
10.3.2	1000 MT	FOLDING BOXBOARD				
10.3.3	1000 MT	WRAPPING PAPERS				
10.3.4	1000 MT	OTHER PAPERS MAINLY FOR PACKAGING				
10.4	1000 MT	OTHER PAPER AND PAPERBOARD N.E.S				

For inverse relationships divide 1 by the factor given, e.g. to convert m3 of wood charcoal to mt divide 1 by m3/mt factor of 6 = 0.167

Notes:

MT = metric tonnes (1000 kg)

m^3 = cubic meters (solid volume)

m^2 = square meters

(s) = solid volume

Unit Conversion

1 inch = 25.4 millimetres

1 square foot = 0.0929 square metre

1 pound = 0.454 kilograms

1 short ton (2000 pounds) = 0.9072 metric ton

1 long ton (2240 pounds) = 1.016 metric ton

Bold = FAO published figure

* = ITTO

Forest Measures

Unit	m3/unit
1000 board feet (sawlogs)	**4.53**
1000 board feet (sawnwood)	**2.36**
1000 square feet (1/8 inch thickness)	**0.295**
cord	**3.625**
cord (pulpwood)	**2.55**
cord (wood fuel)	**2.12**
cubic foot	**0.02832**
cubic foot (stacked)	**0.01841**
cunit	**2.83**
fathom	**6.1164**
hoppus cubic foot	0.0222
hoppus super(ficial) foot	0
hoppus ton (50 hoppus cubic feet)	0
Petrograd Standard	**4.672**
stere	**1**
stere (pulpwood)	**0.72**
stere (wood fuel)	**0.65**

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Annex 3

Proposed Country Groupings to be used in the event that conversion factors are not known

Albania	1
Bosnia and Herzegovina	1
Croatia	1
Montenegro	1
Serbia	1
The FYR of Macedonia	1
Republic of Moldova	1
Andorra	2
Portugal	2
Spain	2
Austria	3
Slovenia	3
Belgium	4
Luxembourg	4
Netherlands	4
Denmark	4
Bulgaria	5
Romania	5
Turkey	6
Cyprus	6
Greece	6
Israel	6
Malta	6
Czech Republic	7
Slovakia	7
Hungary	7
Estonia	8
Latvia	8
Lithuania	8
Finland	9
Norway	9
Sweden	9
France	10
Monaco	10
Germany	11
Ireland	12
United Kingdom	12
Italy	13
San Marino	13
Liechtenstein	14
Switzerland	14
Belarus	15
Poland	15
Ukraine	15
Armenia	16
Azerbaijan	16
Georgia	16
Kazakhstan	16
Kyrgyzstan	16
Tajikistan	16
Turkmenistan	16
Uzbekistan	16
Russian Federation	17
Canada	18
United States of America	18
Iceland	19