

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Forestry and Forest Products Division

CONVERTING FACTORS

1. National statistics relating to forest resources and forest products are expressed in many units of measurement. To summarize these statistics FAO must adopt a series of converting factors. A tentative series of factors is presented herewith for discussion, and amendment where necessary, by the Conference on Forest Statistics.
2. It is most important that factors, once chosen, should not be changed from time to time. Only thus can the comparability of successive series of statistics be assured.
3. Factors for the conversion of individual units of measurement should be universally applicable.
4. Some of the factors submitted in the attached table will be applied, in practice, only to the limited quantities of forest products which are exchanged in international trade. Thus, the small errors inherent in the use of "average" converting factors will be relatively insignificant in the establishment of regional or national wood balance sheets.
5. With respect to conversion factors based on positive mathematical relationships, such as the ratio between acres and hectares, no problem exists.

6. Other conversion factors must represent averages: for example, the number of cubic metres of solid wood contained in one store (piled cubic metre) of pulpwood, or the number of cubic metres of roundwood represented by a standard of sawn lumber. In such cases there is a good deal of variation, and the problem becomes one of selecting that figure which appears most acceptable as a general average. The final selection must be arbitrary to some degree, because precise mathematical calculation is impracticable.
7. Conversions of cubic volume to weight, and vice-versa, present special difficulties because of the differences between weights of species. An attempt to secure international statistics by individual species would place an intolerable burden on reporting countries and on FAO. The broad groups, "softwoods" and "hardwoods" alone can be recognized.

Exports from certain countries, reported by weight, have formerly been converted to cubic volumes by CIB by means of separate series of converting factors supplied by individual countries. These factors were themselves averages, since different species of wood were involved and the proportions of these species, as well as their average moisture contents, were subject to change. Critical examination of these "country" series indicates that the use of single average factors for each product is not likely to result in significant errors. Where imports are reported by weight, single average factors must be used, and the same is true when it is desired to convert cubic volumes to weights.

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CONVERTING FACTORS

Table 1 - Roundwood

Product	(1) Unit	Solid Volume without bark		Piled Volume	
		Cubic Metres	Cubic Feet	Cubic Metres	Cubic Feet
Roundwood (general)	Cubic metre	1	35.3	—	—
	Cubic foot	0.0283	1	—	—
	Load	1.13	40.0	—	—
Sawlogs	1000 board feet)	5.38	190	—	—
	1000 stow feet)				
Pulpwood and fuelwood	Cord	2.55	90.0	3.63	128
	Stem )	0.700	24.7	1	35.3
	Rail (ster)				
	Rail an fathom	7.40	261.0	9.71	343
Pitprops	Fathom	4.30	152.0	6.13	216
T & T poles	1000 linear feet	15.4	545.0	—	—
	1 piece	0.43	15.2	—	—

(1) Units are grouped opposite the products for which they are most commonly used, but certain units are applicable to a variety of products.

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CONVERTING FACTORS

Table 2 - Processed Wood

Product	Unit	Solid Volume		Roundwood Equivalent	
		Cubic Metres	Cubic Feet	Cubic Metres	Cubic Feet
Sawn lumber and hewn wood	Standard	4.67	165	7.80	275
	1000 board feet)	2.36	83.3	4.73	167
	1000 super feet)	1.42	50.0	2.37	83.7
	Load	1	35.3	1.67	59.0
Sleepers	Cubic metre	1	35.3	1.67	59.0
	Load	1.42	50.0	2.58	91.1
	Piece (Europe)	0.10	3.53	0.182	6.43
	Piece (other continents)	0.0827	2.92	0.142	5.00
Laths	1000 pieces	0.442	15.6	—	—
Shingles	1 square	0.240	8.47	0.473	16.7
Plywood					
	(Europe - avg. thickness 6mm)	1000 sq. metres	6.00	212	7.50
	(North America - avg. thickness 5/8 inch)	1000 sq. feet	0.885	31.2	1.11
					39.

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CONVERTING FACTORS

Table 5 - Pulp and Paper

Product	Unit	Solid Volume		Roundwood Equivalent	
		Cubic Metres	Cubic Feet	Cubic Metres	Cubic Feet
Wood pulp					
Mechanical	Metric ton			2.55	90
Chemical	Metric ton			5.04	178
Building board (pulp)	Metric ton	Avg. mech. pulp content about 0.7 tons		1.80	65
Newsprint paper	Metric ton	(0.13 tons chemical and) (0.92 tons mechanical pulp)		3.00	106
All other paper and paper board	Metric ton	(0.80 tons chemical and) (0.10 tons mechanical pulp)		4.30	150

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CONVERTING FACTORS

Table 4 - Weights

Product	Unit	Average Weight as shipped by rail		Kilos per Cubic Metre	Lb. per Cubic Foot
		Kilos	Lb.*		
Sawlogs- softwood	1000 board feet	5300	7300	620	39
	Cubic metre	620	1400		
Sawlogs- hardwood	1000 board feet	5100	11000	940	59
	Cubic metre	940	2100		
Pulpwood	Cord	1300	2900	500	31
	Stere	350	770		
Fuelwood- mixed	Cord	1800	4000	700	44
	Stere	490	1100		
Pitprops	Fathom	2700	6000	620	39
Poles	1 piece	250	550	620	39
Sleepers-(Europe)	1 piece	62	140	620	39
	1 piece	94	210	940	59
Sawn lumber- softwood	1000 board feet	1200	2600	520	32
	Standard	2400	5300		
Sawn lumber- hardwood	1000 board feet	1700	3700	730	46
	Standard	3400	7500		
Plywood	Cubic metre	650	1400	650	40

\* Calculated from the equivalent number of kilos: Since the figures shown are approximations and since lbs. per cubic foot are shown only to two figures, this result will not necessarily agree with the result obtained by multiplying lbs. per cubic foot by the equivalent number of cubic feet.

F A O  
Forestry and Forest Products Division

CONVERTING FACTORS

Table 5 - Miscellaneous

The following ratios are useful for approximate calculations:

1 cubic metre per hectare equals 14.3 cubic feet per acre

1 cubic foot per acre equals 0.07 cubic metres per hectare

1 kilo per cubic metre equals 0.062 pounds per cubic foot

1 pound per cubic foot equals 16.2 kilos per cubic metre

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CONFERENCE ON FOREST STATISTICS  
Grafton Hotel Annex, 1735 DeSales Street  
Washington, 11-14 February, 1947

REPORT OF SUBCOMMITTEE ON UNITS OF MEASUREMENT\*  
13 February, 1947

The subcommittee on converting factors has reviewed the memorandum submitted for its consideration, and with the exceptions noted below in tabular form, gives its approval to the figures therein. The reasons for the suggested changes are given immediately after the table of recommendations.

The subcommittee points out the desirability of securing adequate information concerning the units of measurement used in all countries. It recommends that all countries be invited to furnish their definitions of the units used and, if needed, a factor for their conversion into metric units.

The subcommittee understands that the conversion factors which it has approved are for FAO staff use and upon request are to be made available to all countries. While the conversion factors are recommended for FAO staff use, it is recognized that all the factors may not be suitable for use by some countries. It is further recommended that countries, to the extent practicable, use the factors listed herein; but if these are not suitable the country should supply FAO with the conversion factor used and the basis for such substitution.

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\* The report of the subcommittee as adopted by the main committee in its February 13th meeting. The main committee accepted the original report, except for the last sentence of the third paragraph which was deleted and the sentence shown above inserted. (This report of the subcommittee should be read in conjunction with the FAO memorandum of converting factors which it amends.)



RECOMMENDATIONS

2.

Item No.	Converting Factor Table	Product	Unit	Reference to Column with Indicated Changes
1	1	Sawlogs	1000 board ft. 1000 super ft.	Solid volume without bark; Should read 160 cubic ft. with corresponding change for cubic metres.
2	1 (It was decided that converting factors for pulpwood and for fuelwood should be shown separately. The following changes were made.)	Sawlogs	100 pulgadas	Solid volume: 170 cubic ft.
3.	1	Pulpwood	Russian fathom	Solid volume without bark; should read 240 cubic ft. with corresponding change for cubic metres.
4.	1	Fuelwood	Cord	Solid volume without bark; Should read 75.0 cubic feet with corresponding changes for cubic metres.
5.	1	Fuelwood	stero	Solid volume without bark; Should read 20.7 cubic feet with corresponding changes for cubic metres.
6.	1	Fuelwood	Russian fathom	Solid volume without bark; Should read 200 cubic feet with corresponding changes for cubic metres.
7.	1	Wood for charcoal	metro linear	Solid volume: 25 cubic ft.
8.	2	Sawn lumber & Hewn wood	1000 board ft. 1000 super ft.	Roundwood Equivalent; Should read 140 cubic feet with corresponding changes for cubic metres.
9.	2	Sawn lumber	100 pulgadas	Solid volume: 83.3 cu. ft; Roundwood Equivalent: 170 cu. ft.
10.	2	Sawn lumber	1 load	Roundwood Equivalent; Should read 83.3 cubic feet

Item No.	Converting Factor Table	Product	Unit	Reference to Column with Indicated Changes
11	2	Shingles	1 square	Solid volume: Should read 5.6 cubic feet with corresponding changes for cubic metres. Roundwood Equivalent: Should read 11.1 cubic feet. (Plywood - For North America it was decided to separate hardwood plywood from softwood plywood.)
12	2	Plywood		Plywood, Softwood (North America: of 3/8" thickness)
13	2	The following column is added: Veneers, hardwood (average thickness of 1/10 inch)		Solid volume: - enter 8.3 cubic feet. Roundwood Equivalent: - enter 16.7 cubic feet.
14	3	Building Board - Entries should read Metric Ton		Average mechanical pulp content about 0.62 tons with Roundwood Equivalent of 56 cubic feet. (It was decided to compute conversion factors for the following paper and paperboard items.)
15	3	Paper other than Newsprint and Building Paper.	Metric Ton	Entries should read (0.73 tons chemical and 0.12 tons mechanical pulp) Roundwood Equivalent 140 cubic feet.
16	3	Paperboard other than Building Boards	Metric Ton	Entries should read (0.32 tons chemical and 0.07 tons mechanical) Roundwood Equivalent is 63 cubic feet.
17	3	Building Paper	Metric Ton	Entries should read (0.19 tons mechanical) Roundwood Equivalent is 17 cubic feet.
18	3	All Paper and Paperboard except Newsprint and Building Board		Entries should read (0.48 tons chemical and 0.10 tons mechanical) Roundwood Equivalent is 95 cubic feet.
19	5			The equivalent of one pound per cubic foot should read 16.0 kilos per cubic metre.

Recommended Changes in the Accompanying Memorandum

Paragraph 2. In principle, it is most important that factors, once chosen, should not be changed unless there are important changes in utilization practices. Only thus can the comparability of successive series of statistics be assured. But, if it is necessary to adopt for the time being a conversion factor based on fragmentary or inadequate information, a revision should be made when additional information permits the adoption of a more accurate factor.

Paragraph 3. If possible, factors for the conversion of individual units of measurement should be universally applicable.

EXPLANATION OF RECOMMENDATIONS

Item No.

- 1 This is assuming a 12% overrun from the logs and the utilization factor of 60% instead of 50%. This factor seems to correspond pretty well with North American sawing practice.
- 2 New item.
3. It seemed to the Committee the ratio between solid and piled volume should be the same for the Russian fathom as for the stere and for the ordinary fathom, namely 70%.
- 4, 5, 6 In the opinion of the Committee, the ratio of solid to piled volume for fuelwood should be less than for pulpwood. The figure 75 cubic feet solid wood without bark corresponds closely to American experience. It is believed that the same ratio would be reasonably accurate for other countries in view of the fact that firewood averages smaller sticks and often includes crooked and knotty sticks which do not pile so closely as pulpwood.
- 7 New item.
- 8 This is based on actual cubic foot volume of logs and the lumber content by the International 1/4 inch rule which corresponds closely to the actual lumber produced at the mill. Note also that a single world-wide ratio is used for lumber measured in cubic metres without distinction between continents.
- 9 New item.

## Item No.

- 10 To correct error in computation.
- 11 This is based mainly on the standard shipping weight of one square of shingles which is approximately 140 pounds net after deducting fastenings. The average weight of the western red cedar from which most shingles are made is approximately 25 pounds per cubic foot.
- 12 A separation was made because production of hardwood plywood is not reported in usable form. It is possible, on the other hand, to obtain figures on production of hardwood veneer.
- 13 Studies have indicated that the hardwood veneer produced in the United States in recent years has run about 120 square feet to each cubic foot of actual wood volume and that about 50% of the veneer log is utilized in the form of veneer.
- 14-18 The new breakdown and changes in figures are based on a survey by the U. S. War Production Board of the actual use of woodpulp in the paper and paperboard manufactured in the United States during the year ending September 30, 1944. This survey is the most comprehensive and the most accurate that has been made, to the best of our knowledge.