

THE USE OF FOREST PRODUCTS CONVERSION FACTORS IN OUTLOOK STUDIES

Background paper for the Team of Specialists on Forest Sector Outlook meeting 23-24 November 2009

Prepared by Matt Fonseca, UNECE/FAO Timber Section

Matthew.fonseca@unece.org

This background paper introduces the term “forest products conversion factors” and explains their use, linked a wood balance. It explains how conversion factors have been used in Forest Sector Outlook Studies. In a second part, this paper explains how up-to-date conversion factors have been collected by UNECE/FAO and invites ToS members and Outlook correspondents to take note of the data supplied by members of the Task Force on Conversion Factors for their country, or to inform of updates and changes, in case no updated data is available (see enclosed draft Discussion Paper on Forest Product Conversion Factors).

Introduction

The term “forest products conversion factors” is used to cover a broad spectrum of ratios utilized in the wood-based 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 exact, for example converting cubic feet to cubic metres (there is exactly 35.315 cubic feet in a cubic metre).

Often ratios are not exact, but rather a good average; for example, one m³ (under bark volume) of freshly felled Norway spruce sawlogs may average 860 kg of which 80 kg is bark and 780 kg is wood, but might vary as a result of wood density, moisture content, the presence or lack of bark, etc.

In other instances, conversion factors may have little meaning unless one knows some of the parameters of numerator and the denominator of the ratio. For example: one m³ of logs with an average small end diameter of 15 cm might make 0.41 m³ of sawnwood, while one m³ of logs with an average small-end diameter of 60 cm might make 0.63 m³ (50% more). 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 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, almost 100% of the wood in each of these logs may have been utilized. The remaining non-sawnwood volume went to several wood residues having other and often distinct uses. For example: one m³ of 15 cm sawlogs could have a material balance of 41% sawnwood, 43% chips (raw material for paper, panels, wood energy, etc.), 9% sawdust (for making energy pellets, particleboard, MDF) and finally 7% shavings (particle board, MDF, animal bedding 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 m³ of roundwood (measured under bark) for energy or other uses.

Trees and wood, in particular, have a predisposition toward the inexact 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 change once dried in a kiln or exposed to the atmosphere. In addition, there are man-made biases that also have to be accounted for, such as 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.

Conversion factor use by UNECE/FAO

To paraphrase directly from *Conversion Factors (Raw Material/Product) for Forest Products, 1987*¹: “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 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.

The use of conversion factors for outlook studies is to predict the needed amount of raw material from the forest to supply a given quantity of manufactured forest products and vice-versa. With the addition of a wood balance, one can check the accuracy of conversion factors and understand the flow and availability of wood residues (figure 1). This figure is an example of a simple wood balance utilizing conversion factors (figures in bold under the red arrows) and could represent a national or subregional balance. In the example 500,000 m³ of sawnwood is predicted to be produced from 1,000,000 m³ of roundwood using the 2.0 input/output factor. One might assume that 500,000 m³ of sawnwood wood have a solid wood equivalent volume that is the same, but this is not the case, as wood products (including sawnwood) are often more or less dense than the parent wood used as the raw material. In this example the 500 m³ of dried sawnwood was 530 m³ in the green state (prior to shrinkage), so a 1.06 factor is used to determine the solid wood equivalent (swe). The wood fibre balance (far right column) is used to determine the production of wood residues from the manufacture of sawnwood. Note that the total production of wood products in swe plus the losses (1590 m³) balances with the roundwood consumed (excluding bark volume and wood energy produced).

¹ UNECE/FAO. 1991. Conversion Factors (Raw Material/Product) for Forest Products, 1987 [ECE/TIM/55].

Collection of up-to-date information on Conversion Factors: Method

During the 31 March – 1 April 2008 Workshop on National Wood Energy Resource Balances the need for better forest product conversion factors was cited. One of the background papers, *Conversion Factors: A Necessity for an Accurate Estimation of Wood Consumption by Industries* (Thivolle-Cazat, 2008), was presented. It outlined the situation in the UNECE region regarding this need. At the subsequent Joint UNECE/FAO Working Party on Forest Economics and Statistics this need was recognized and the UNECE/FAO Timber Section was mandated to lead a cooperative effort to develop accurate conversion factors for the UNECE region for establishing national and subregional 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 (see annex table 1.2 in the enclosed draft Discussion Paper on Conversion Factors).

A questionnaire was developed and distributed to the Task Force members as well as other national correspondents for completion of national conversion factors. The final questionnaires were received in November 2009. Thirteen countries submitted data.

Information on the country data on conversion factors received is available in the enclosed draft Discussion Paper on Conversion Factors per the following groupings: roundwood, wood particles, sawnwood, veneer and plywood, panels made-up of particles, woodpulp and paper, roundwood and splitwood products, energy wood products and properties. The draft Discussion Paper also includes the conversion factors used in the 1987 and the 2005 outlook studies.

Outlook ToS members and country correspondents are encouraged to take note of the updated conversion factors submitted by members of the Forest Products Conversion Factor Task Force from their country (listed on page v). Should updated conversion factors from their countries not have been submitted, they are encouraged to take note of the Conversion Factors included in the 2005 outlook study and to communicate updates and changes directly to Matthew Fonseca at matthew.fonseca@unece.org.

The use of forest products conversion factors in EFSOS II will be crucial, in particular in the wood resource balance (see separate background paper) to correctly reflect the amount of raw material from the forest needed to supply a given quantity of manufactured forest products as forecasted by the econometric market projections.