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Modelling global forest products supply and demand: recent results from FAO and their potential implications for New Zealand[1]

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INTRODUCTION

Forecasts of the future supply and demand for wood and wood products are an important aid to planning and decision making in the forestry sector. Consequently, the Food and Agriculture Organization of the United Nations (FAO) carries-out periodic reviews of global forest product markets in order to produce supply and demand forecasts. FAO has two main forecasting models that can be used to produce wood supply and demand projections: the Global Fibre Supply Model (GFSM) and the Global Forest Products Model (GFPM). This short article briefly explains how these two models work (see references for further details) before presenting some results from the latest forecasting exercise and describing their potential implications for forestry in New Zealand.

THE GLOBAL FIBRE SUPPLY MODEL (GFSM)

The GFSM is a model of future potential wood and fibre supply, based on detailed information about the area and characteristics of forests, harvesting regimes and growth rates, harvesting efficiency, recovery of wastepaper and non-wood fibre pulping capacity. The model contains this information for nearly every country in the world (including all the large producers and consumers) and can be used to project future fibre supply potential.

In terms of forest characteristics, the model contains information such as: forest area by type and stocking; area logged and unlogged; and information about the areas which are potentially available for wood supply or unavailable due to legal, economic, or biological factors or reasons of accessibility.

The model projects future supply potential as a function of area multiplied by harvesting intensity or yield, depending on the type of forest, for each of the forest types available for wood supply in each country (Bull, Mabee and Scharpenberg, 1998). An extension to the model that has recently been developed is a separate forest plantations component, which produces projections of potential supply based on more detailed information about area, species, yield and plantation age structure (Brown, 1999; and Whiteman and Brown, 1999). The yield forecasts from all types of forest are

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also reduced to take into account harvesting efficiencies or the proportion of utilisable yield that is usually taken from the forest. In addition to these forest-based supply components, the model also contains estimates of future potential wastepaper recovery and non-wood fibre utilisation.

The model can be used to project potential supply under a range of alternative assumptions about rates of deforestation, rates of harvesting in the unlogged forest and the expansion of the harvesting frontier into previously inaccessible forest. Changes in future plantation establishment, wastepaper recovery and non-wood pulping capacity are also important variables that affect future potential supply and future scenarios for these variables can be examined in the model. The scenario used in the analysis presented here is one of continuation of past trends in these variables.

THE GLOBAL FOREST PRODUCTS MODEL (GFPM)

The GFPM is a market simulation model of future wood and wood product production, consumption and trade for every country of the world. The model takes supply and demand curves for each country, fixes these such that the model roughly replicates global production, consumption and trade in the last year for which actual data is available and then shifts these curves out for every country and each year of the forecast. As part of this process, the model identifies the trade flows and price changes necessary to clear all markets within each year of the forecast, using a linear programming algorithm. In contrast to the GFSM, the GFPM produces projections of actual wood production rather than potential production.

The demand curves used in the GFPM were estimated from an econometric analysis of past consumption, using data taken from the Forest Products Yearbook (FAO, 1996). This analysis gave estimates of price and income elasticity for countries and projections of future income growth were used to shift the demand curves for each year of the forecast. On the supply side, estimates of the price elasticity of industrial roundwood supply were taken from the forest economics research literature. The supply curves for each country were then shifted in each year of the forecast on the basis of the projected changes in future supply potential given by the GFSM.

Wood product production and the links between future product demand and roundwood and product supply in the model are included in the model as a series of technical coefficients such as roundwood to product conversion factors, capacity utilisation rates and wastepaper recovery rates (Tomberlin *et al*, 1998). The baseline analysis presented here assumes no change in future technology, but does assume that the recovery and utilisation of wastepaper will increase in the future at the same rate as it has in the past.

FORECASTS OF FUTURE SUPPLY AND DEMAND TO 2010

The main results of the modelling exercises are shown in the two tables below. Table 1 shows the forecasts, to the year 2010, of overall supply and demand by broad geographical region and Table 2 shows the global supply and demand forecasts by main product categories. More detailed forecasts by individual country and product categories can be found in Zhu *et al* (1998).

Table 1 shows that global industrial forest product production and consumption is projected to increase at an annual rate of about 1.7%. However, the expected level of consumption in 2010 (1.9 billion m^3 EQ) will only be about 10% higher than the peak in consumption (of 1.7 billion m^3 EQ) experienced around 1990.

The table also highlights the differences in supply and demand growth expected between the different regions. The highest rates of growth in supply and demand are expected in Asia and Oceania, despite the recent economic problems experienced in Asia (see FAO (1998) for a further discussion of this issue). In contrast, relatively slow growth in supply and demand is expected in North and Central America and only moderate increases are expected in Africa and South America. However, North and Central America will remain the largest producing and exporting region, although in terms of its share of global consumption it will continue to fall behind Asia.

TABLE 1 *Industrial roundwood production, finished wood product production and finished wood product consumption in 1996 and forecast for 2010*

Region	Industrial roundwood production (million m^3)			Product production (million m^3 EQ)			Product consumption (million m^3 EQ)		
	1996	2010	Annual growth	1996	2010	Annual growth	1996	2010	Annual growth
Africa	68	84	1.5%	61	74	1.4%	35	37	0.6%
Asia	280	421	3.0%	334	479	2.6%	510	653	2.1%
Oceania	41	54	1.9%	23	39	3.8%	18	28	3.3%
Europe	370	502	2.2%	368	509	2.4%	347	469	2.4%
N & C America	600	658	0.7%	585	639	0.7%	499	589	0.8%
S America	130	153	1.2%	120	131	0.7%	80	97	1.4%
WORLD	1,490	1,872	1.7%	1,490	1,872	1.7%	1,490	1,872	1.7%

Note: Finished wood product production and consumption have been converted to their roundwood equivalents (m^3 EQ) to be comparable to the industrial roundwood production figures.

In terms of trade, Asia will continue to produce more finished wood products than industrial roundwood and, therefore, continue to be a net industrial roundwood importer. Asia will also continue to be the world's only net importing region of finished wood products. Three countries in Asia (Japan, China and Republic of Korea) account for the majority of this net import demand.

Overall, major changes in trading patterns are not expected in the future, but the shape and form of trade will continue to change. Firstly, many countries are expected to continue giving priority to developing manufacturing capacity to process (rather than export) raw materials and intermediate products such as roundwood and pulp. Similarly, greater trade in higher value-added products is also expected in the future. Secondly, as developing countries continue to grow and mature, their domestic markets are expected to expand and some of this expansion will be at the expense of their export markets.

Table 2 shows that the supply and demand for paper and paperboard is expected to grow faster than other products in the period to 2010, increasing at an annual rate of 2.4% per year. In contrast, the use of pulp is only expected to rise by 1.1% per year, reflecting the expected increase in the use

of recovered paper in the total fibre furnish. Supply and demand for solid wood products is expected to grow moderately: 1.1% per annum in the case of sawnwood and 1.3% per annum for wood-based panels. The highest growth in wood-based panel supply and demand is expected in reconstituted wood panels rather than the plywood sector.

TABLE 2 *Forecast future supply and demand by product category for 1996 and 2010*

Product category	Production/consumption		Total growth	Annual growth
	1996	2010	1996-2010	1996-2010
Industrial roundwood	1,490	1,872	26%	1.6%
Sawnwood	430	501	17%	1.1%
Wood-based panels	149	180	20%	1.3%
Pulp	179	208	16%	1.1%
Paper and paperboard	284	394	39%	2.4%

Note: Volume figures for roundwood, sawnwood and wood-based panels are in million m^3*, figures for pulp and paper are in million metric tonnes.*

The projected expansion of wood product supply and demand will undoubtedly require an increase in roundwood and fibre supply. This is of interest because it will affect the way in which forests might be managed in the future and this information provides a useful input to forestry policy analysis.

The first point worth noting is that the ability of the forestry sector to respond to these changes will differ widely between countries. In some countries, wood supplies may be expanded by opening up new areas of forest or by taking advantage of maturing forest plantations. In other countries, the forest industry will respond by trying to achieve greater efficiency in harvesting and processing, or by starting to utilise a much broader and more diverse range of wood and fibre supplies. For example, a detailed analysis of supply and demand in the Asia-Pacific region (FAO, 1998) showed that many countries there are already starting to use a more diverse range of forest and non-forest supply sources in order to meet their production needs, in response to greater scarcity of certain types of raw material.

FAO does not yet have sufficient data to make a robust and accurate assessment of global wood and fibre supply potential. For example, the GFSM covers a large part of the world, but doesn't cover the important contribution (to wood supply) of trees outside of forests. However, the GFSM can be used to compare projected levels of supply with supply potential from forests and recovered and non-wood fibre sources across some regions. Such a comparison has shown that forecast supply levels are well within the expected limits of supply potential in South America and Oceania, but approaching the limits in Asia and Africa (FAO, 1999). This comparison has also shown that supplies of large logs are becoming increasingly scarce in Asia and Africa. Therefore, consumers of wood and fibre in these areas will look increasingly to alternative supply sources to meet this demand. It is also likely that the markets for forest products will continue to respond to this scarcity, by moving towards replacing sawnwood and plywood with other wood-based panels and engineered wood products, which can be manufactured from small-sized wood or roundwood substitutes.

POTENTIAL IMPLICATIONS FOR NEW ZEALAND

The implications of central interest to New Zealand will be those related to global industrial wood supplies and, in particular, supplies into important geographical and product markets. In view of this, this section attempts to put New Zealand's future wood production potential into a global context and examine the implications of the main trends identified for the Asia-Pacific region, which encompasses nine out of ten of New Zealand's largest forest products markets.

The plantation supply modelling extension to the GFSM examined plantation production potential for the 65 largest plantation countries under 3 scenarios. Modelling New Zealand's plantation production produced results similar to those outlined in the National Exotic Forest Description National and Regional Wood Supply Forecasts 1996. The model estimated New Zealand plantation production in 1995 at 16 million m^3, with production forecast to increase to around 29 million m^3 in 2010; a range of 32.7-43.9 million m^3 in 2020; and to a maximum of 66 million m^3 in 2050 under the highest planting scenario. This maximum scenario occurs under a scenario requiring an increase in the New Zealand plantation estate to 3.4 million hectares. Perhaps a more likely scenario to 2050 sees the plantation estate increase to 2.4 million hectares and roundwood production increasing to 43.6 million m^3.

At a global level, the plantation modelling study (Brown, 1999) estimates that forest plantations in 1995 had the potential to produce 331 million m^3 or 22.2% of global industrial roundwood production. New Zealand's plantation production consequently contributed just over 1% of global industrial roundwood production and 4.8% of potential global production from forest plantations. In the future the proportion of global industrial roundwood that could be sourced from forest plantations may increase to between 30.6% and 34.1% in 2010, and a range of 31.5 – 46.6% in 2020. Under the highest new planting assumptions New Zealand has the potential to produce 6.5% of the world's plantation production by 2020 and 11% by 2050. The reality is almost certain to be more modest.

The GFPM results suggest industrial roundwood production in the Asia-Pacific region will be around 475 million m^3 in 2010, with a roundwood equivalent consumption estimate of 681 million m^3. A central conclusion is that the region will offer significant export opportunities for producer countries such as New Zealand. For example, the modelling estimates that 80 million m^3 of industrial roundwood (log and woodchip) will continue to be imported into the Asia-Pacific region and suggests that around 30.6 million m^3 may come from countries inside the region (FAO 1998).

The two important conclusions of the GFPM and GFSM modelling are:

- in general, global demand for all industrial wood products will increase significantly due to population growth and strong economic performance; and

- wood supplies at a global level will be adequate to meet demands for both industrial roundwood and fuelwood in the immediate future. For the Asia-Pacific region as a whole, there is little evidence to suggest that the overall supply and demand balance up until 2010 will be radically different to today. The one major exception is for large-sized logs, which are already becoming relatively scarce.

Several other specific points relative to the forest products trade in the Asia-Pacific region are important to highlight:

- the region will continue to increase its dependence on imports for all industrial wood products;
- by 2010, Asia-Pacific consumption of sawnwood will be second only to that in North America;
- the region may also become a net importer of wood-based panels, changing from its current position as a net exporter;
- for the region as a whole, imports are expected to supply 16% of industrial roundwood demand, 18% of sawnwood demand, 28% of wood-based panels demand; 9.2% of paper and paperboard demand; and 11.6% of the fibre-furnish used in the region;
- consumption of practically all commodities is led by the needs of North Asia, particularly demand in Japan and China; these countries will continue to be the dominant influence in regional forest products trade; and
- a very large latent market for paper and related products could emerge to create huge new demands for paper, particularly if economic growth accelerates in large countries such as India.

A critical aspect of the outlook for the region is the considerable differences among countries, with respect to their resource endowments, levels of economic development and population growth rates. Such differences may have a significant impact on trade in the region. For example, supply will expand dramatically in some countries (e.g. from forest plantations) while, in others, domestic markets will grow and, as forest resources decline, supply potential will shrink. One conclusion that can be drawn from this is that there are likely to be opportunities for countries with significant forest plantation resources to expand market share. The modelling also shows that intra-regional trade will continue to be extremely important, particularly between neighbouring countries and between those with trade agreements. Thus, not surprisingly, Australian markets (along with those of North Asia) will remain extremely important for New Zealand.

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