Chapter 13

GLOBALIZATION AND WORLD TRADE

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Abstract. This chapter discusses economic globalization and world trade in relation to forest sector modeling for the US/North American region. It discusses drivers of economic globalization and related structural changes in US forest product markets, including currency exchange rates and differences in manufacturing costs that have contributed to the displacement of global manufacturing capacity. It includes detailed discussion of paper and paperboard trends. Bilateral trade flows between the USA and Canada for all wood products, were modeled within the Timber Assessment Projection System, with currency exchange rate assumptions among key elements influencing projected trade. This chapter describes how assumptions about globalization and trade influenced model results, using examples of recent RPA Timber Assessments. Techniques and results of the Timber Assessment Projection System models are compared to those of a more general global trade model, the Global Forest Products Model (GFPM). The GFPM was used recently to project international forest sector developments conditional on the 2000 RPA Timber Assessment. The results showed that while the USA, Japan, and Europe were predicted to remain major importers of forest products out to 2030, the rapid economic growth of China would make it the world's largest market for raw wood and intermediate and final forest products. In a separate study, exchange rate assumptions were found to be important determinants of major US trade flows as projected by GFPM, particularly for manufactured commodities such as pulp and paper.

Keywords: globalization, structural change, forest sector, trade, competitiveness

13.1 INTRODUCTION

In recent years, expanded opportunities for trade have accelerated changes in the US economy and US forest sector. Since the early 1990s, trade liberalization, shifts in currency exchange rates and comparative

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advantages in manufacturing (such as low labor costs in China) have led to global realignment of economic growth and manufacturing capacity. Historically, changes in the US forest sector involved shifts in regional production capacity in response to shifts in regional timber supply, or technological advances associated with economic gains. Recently, however, economic globalization has contributed to reduced demands for US timber, with job losses and declining investment in the US forest sector.

The US trade deficit in goods climbed to record levels over the last 10 years as the value of the US dollar soared well above its historical average from 1997 to 2004. During that period, growth in US industrial production wavered, and the domestically produced shares of US consumption declined for all major categories of wood products (lumber, wood panels, and also related products such as wood furniture, flooring, and millwork). The impact of globalization on US demand for paper and paperboard was particularly noteworthy. Global paper and paperboard output increased by 105 million tonnes (metric tons), or by 40% worldwide from 1996 to 2005 (RISI 2006), but in that decade, US paper and paperboard consumption peaked at around 94 million tonnes in 1999 and dropped by 7% to 87 million tonnes by 2003 (AF&PA 2006). In 2006 US consumption stood at 90 million tonnes, still well below the 1999 peak level. Likewise, after a century of robust growth, US wood pulp output peaked in the mid-1990s and then declined. Consequently the volume of pulpwood receipts at US wood pulp mills fell by 16% from 1994 to 2002, and has not yet fully recovered (Forest Resources Association 2006). The average stumpage price paid for Southern pine pulpwood in the US South peaked in 1997, declined to half that level by 2002, and has remained well below the peak level since then (Timber Mart-South 2006).

Since the early 1990s, there was also a widening gap between US imports and exports of solid wood products. US exports of lumber, plywood, logs, and wood chips all generally declined since the early 1990s, while US imports of wood products expanded (Howard 2003). US imports of softwood lumber increased from 28% of consumption in 1990 to 40% by 2005. The number of major softwood sawmills in the USA dropped from 862 in 1995 to 664 in 2004 with a 60% increase in average capacity, as competition forced the closure of smaller, less efficient mills (Spelter and Alderman 2006). Imports of the leading structural wood panel product, OSB, increased from 20% of US consumption in 1990 to 42% of consumption in 2005. Rising imports of wood furniture displaced growth in the domestic furniture industry,

and US hardwood lumber consumption declined after peaking in the late 1990s (Howard 2003).

By 2002, the volume of timber products produced and estimated timber harvest in the US had declined by 12% since peaking in 1991 (Howard 2003). With limited capacity growth, forest product markets exhibited cyclical volatility, but productivity gains and imports offset long-run inflationary pressures, and timber price movements were relatively subdued due to adequate supplies and slow growth in demand. Current projections of future US timber demand and prices are much lower than projected a decade ago. It is apparent that US timber market trends are being driven by the forces of economic globalization, with shifts in currency exchange rates and comparative advantages in manufacturing driving the development of global-scale forest product enterprises that increasingly serve global markets. This raises questions about how future US forest sector models will need to comprehensively account for global market developments and global trade.

In this chapter we discuss globalization, making a case that globalization and trade contributed to significant changes in the US forest sector outlook. We give examples of how those changes have been recognized in the Timber Assessment Projection System (hereafter the Assessment System), focusing on US paper and paperboard projections. We compare the Assessment System projections with those of a global forest product trade model to highlight the consequences of a more comprehensive treatment of trade. We explain that there is one aspect of change in global supply and demand conditions that has been a recognized driver of change in the Assessment System — shifts in currency exchange rates — and we explain that shifts in exchange rates are also important in the context of a global forest product trade model. We conclude by describing how the global model could integrate a more detailed US forest sector into its framework for future RPA Timber Assessments.

13.2 IMPORTANCE OF GLOBALIZATION AND TRADE

Economic globalization and trade emerged in the early 1990s as increasingly important drivers of US timber markets and the timber market outlook. The trade between the USA and Canada has long been important, but recently broader global developments have gained standing as causes of change.

The large forest product trade between the USA and Canada was given careful consideration in the Assessment System models. Since the late 1970s, one-quarter to one-third of US softwood lumber consumption has been imported from Canada. Thus TAMM was designed in the 1970s to endogenously project US imports of softwood lumber from Canada, and the model was used to evaluate market impacts of related tariffs and trade agreements. In addition, Canadian producers maintained in recent decades more than a 50% share of the US newsprint market. Accordingly, the NAPAP model was designed in collaboration with Forestry Canada and used to project the trade between the USA and Canada of newsprint and other grades of paper and paperboard, and wood pulp (shipped in large volumes to the USA), as well as trade in recovered paper shipped in large volumes from the USA to Canada for recycling at Canadian paper mills (Jacques and Ince 1992).

In TAMM and NAPAP, exogenous assumptions about future trends in US/Canada currency exchange rates were among principal determinants of the projected bilateral trade, along with tariff schedules, regional production costs, regional wood input requirements, and endogenous regional timber prices. However, in TAMM and NAPAP, global trade and the effects of global economic developments outside the USA and Canada took the form of exogenous assumptions, which could be adjusted to create alternative scenarios.

In both TAMM and NAPAP, exogenously specified trends determined the projected trade flows between the USA and Europe, Asia, Latin America, and the rest of the world (but not Canada). In addition, US demands for some products were adjusted to reflect impacts of economic globalization, such as displacement of demand for paper and paperboard in US manufacturing resulting from expanded goods imports. Although US bilateral trade flows outside of North America remained, as of 2005, generally smaller than the trade between the USA and Canada, the assumptions about globalization and trade with other regions have become increasingly important since the early 1990s.

For example, Canada still accounts for the bulk of US softwood lumber imports in total volume, but since the early 1990s, imports of higher value grades of clear softwood lumber (shop and better grades) have expanded rapidly from Chile, Brazil, and New Zealand, based mainly on plantation-grown radiata pine. By 2003, those countries were supplying more than half of all the shop and better grade

softwood lumber consumed in the USA (Wood Markets 2004). In addition, globalization and changes in US manufacturing have reduced the growth of US demand for pulp and paper. With displacement of US manufacturing by imports, the US demand for industrial and commercial paper and paperboard has decreased over the past decade, while it has grown elsewhere, most notably in Asia (and China in particular). Meanwhile changes in global capital markets helped finance a US housing boom in recent years, but after the housing boom peaked in 2005, there has been a downturn in demand and prices for lumber and wood panels.

In conjunction with liberalized trade policies and a strong US economy in the 1990s, the real trade-weighted exchange value of the US dollar soared well above its historical average from 1997 through 2004. With a strong dollar, the USA was a global engine of economic growth, more than tripling the value of imported goods, from $0.49 trillion in 1991 to $1.68 trillion in 2005 (US BEA 2006). This expansion of imports resulted in the largest goods trade deficits of any country in history ($783 billion in 2005, a tenfold expansion since 1991). The flood of foreign goods reduced output and profits for US manufacturers, resulting in a notable decline of growth in US industrial production from the late 1990s to 2003. Figure 13-1 shows the overlapping trends in US industrial production growth and US paper and paperboard production.

Growth in US industrial production began to weaken during the Asian financial crisis of 1997–1998, and then fell precipitously in 2000 and 2001, with rollbacks in capital investment expenditures. US paper and paperboard output plunged along with US industrial output, due to weaker commercial demand for paper and paperboard in packaging and print advertising. Lower interest rates and tax reductions helped restore economic growth, contributing to a housing boom from 2001 to 2005, but US industrial output only began to show sustained recovery late in 2003 and 2004. Paper and paperboard demand has been gradually increasing since 2002 as the dollar weakened and as growth in industrial production somewhat recovered, but growth in US paper and paperboard consumption in recent years has averaged less than half the growth rate of decades prior to the 1990s. US pulpwood consumption is still not back to its peak level of the 1990s. Thus, economic globalization and rising goods imports have notably reduced growth in the US pulp and paper sector (previously a leading growth sector for wood and wood fiber consumption).

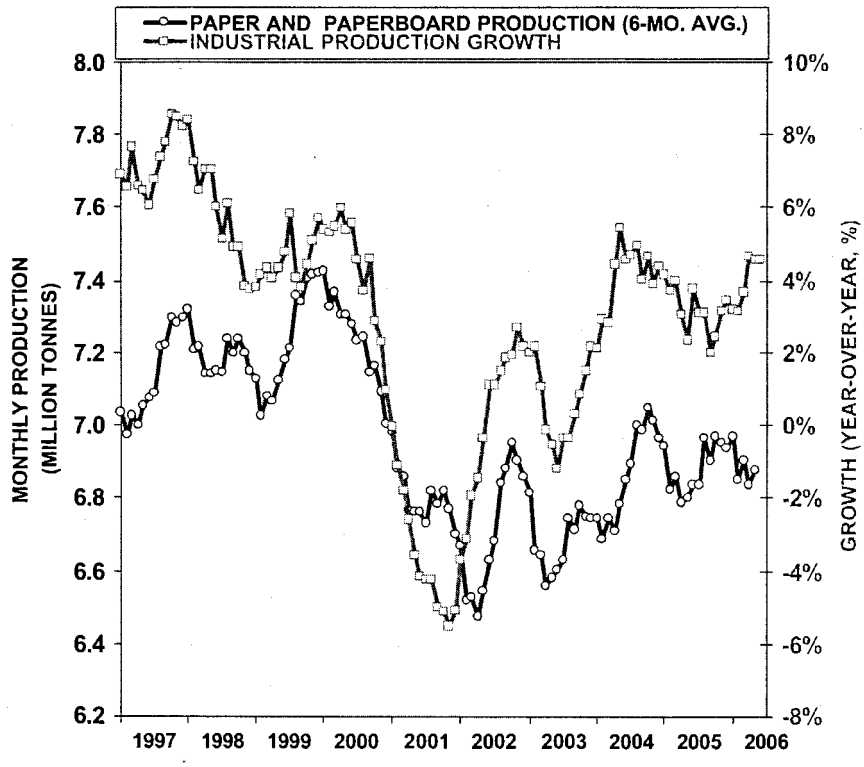

Figure 13-1. Growth in US industrial production index, monthly year-over-year (Federal Reserve), and US paper and paperboard production, 6-month moving average (AF&PA), 1997–2006.

Expansion of US trade deficits since the early 1990s also contributed to recent instability in the US housing industry, another main wood user. Increasing flows of dollars sent overseas to pay for imported goods returned in record foreign purchases of US financial assets, including US government-sponsored agencies that supply mortgage funds to US home buyers. These purchases expanded tenfold from the early 1990s, and by 2004 and 2005 exceeded $200 billion per year, an infusion of funds amounting to over $110,000 per US housing unit built in those years. This infusion of mortgage funds contributed to exceptionally low mortgage interest rates, and substantial increases in home prices and housing construction activity. Thus, as shown in Figure 13-2, US housing starts climbed in parallel with the US goods trade deficit from 1995 through 2005.

Housing starts leveled out briefly from 1999 to 2000, when the Federal Reserve raised short-term interest rates, but foreign purchases of US financial assets continued and helped push mortgage rates back down. Expanding liquidity from foreign purchases of financial assets

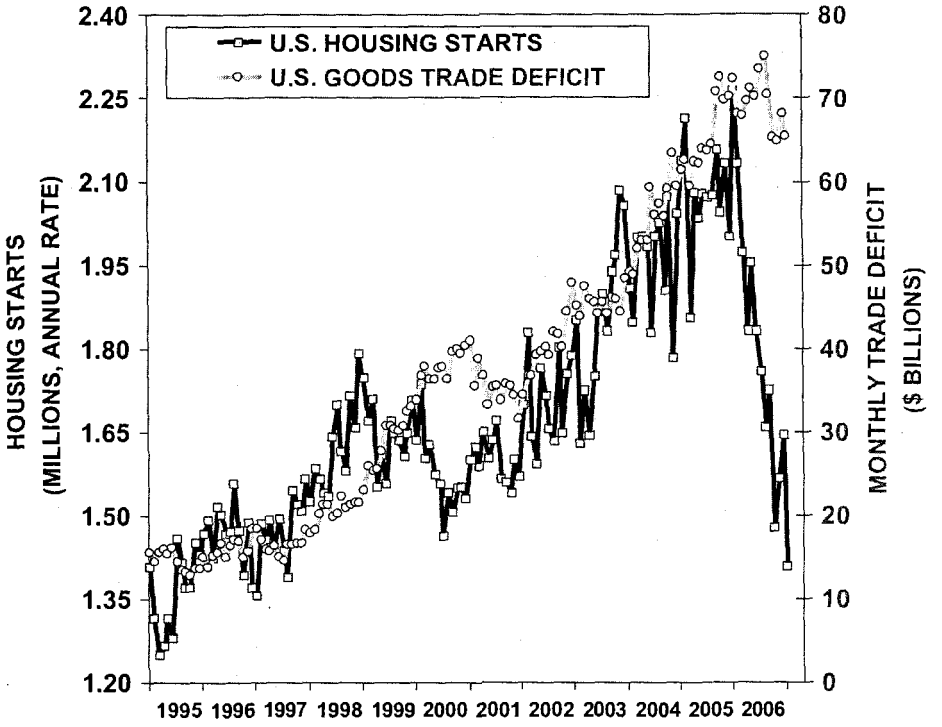

Figure 13-2. US housing starts, monthly at seasonally adjusted annual rate (Census Bureau), and US trade deficit in goods, monthly balance-of-payments basis (US BEA).

stimulated the 30% increase in US housing starts from 2001 to 2005. Notably, this housing boom began when US employment was receding (particularly in manufacturing), with slower growth in real wages. With cheap financing, the size of new homes and amount of wood consumed in housing construction also increased, and the median sales price of new houses soared by 43% from 2000 to 2005. However, by 2006 inventories of new and existing homes for sale were climbing far above the numbers of homes being sold, as price increases and limited income gains reduced affordability. Home prices leveled out and US housing starts dropped abruptly by 34% from January to October of 2006, erasing all the gains in housing construction activity of the previous five years (Figure 13-2).

Thus, economic globalization and foreign direct investment contributed to a mortgage lending boom and recent US housing boom, but also instability in the housing sector. The collapse of housing construction in 2006 led inevitably to a collapse in the demand and

price of wood products, including softwood lumber, OSB, plywood, and engineered wood products.

There are also other recent and dramatic impacts of economic globalization in the US forest sector, such as the recent decline in US wood furniture production and hardwood lumber demand associated with rising imports of wood furniture (chiefly from China). More than half of US wood household furniture consumption is now imported, up from around 20% in the early 1990s. There has also been a displacement of US wood chip exports by plantation grown fiber from Asia and Latin America. In general, recent history points to economic globalization and global trade as increasingly important drivers of US timber markets. To some extent the impacts of these drivers were taken into account in past RPA Timber Assessments, as described in the next section, but globalization has led also to new concepts for Assessment System models of the future.

13.3 TWO RPA TIMBER ASSESSMENT CASE STUDIES

The 2000 RPA Timber Assessment was a landmark study in that it projected a surplus of US timber inventory (timber growth in excess of timber harvest) for decades into the future along with relatively stable timber prices. The study incorporated a number of technical adjustments to timber supply and demand relationships, but the biggest single adjustment on the demand side was slower growth in projected US pulpwood demand than in previous RPA Timber Assessments. This was largely due to foreseen impacts of globalization on the US pulp and paper sector. The pulpwood outlook included downward adjustments in projected US paper and paperboard demand growth, along with assumptions of slow future growth in US pulp, paper, and paperboard exports.

While the 2000 RPA Timber Assessment was being developed, US pulp and paper markets were beginning to recede under the impacts of economic globalization along with receding output in the US manufacturing sector (Figure 13-1). In 2000, the US dollar was still climbing toward its recent historical high of 2002, and thus the RPA projection was influenced by prevailing economic perspectives, a stronger dollar, with declining competitiveness and weaker profit ability in US

manufacturing, and declining growth in US industrial output. Nevertheless, the 2000 RPA Timber Assessment was also strongly influenced by long-run growth assumptions for US population and GDP, along with econometric demand relationships that predicted continuation of growth trends observed in previous decades. Projections of US pulpwood consumption from the 2000 RPA Timber Assessment can be compared to other RPA Timber Assessments, including those from 1989, 1993, and later projections developed for the 2005 RPA Timber Assessment. The 2005 RPA Timber Assessment was further influenced by awareness that the dollar had peaked (in 2002) and was declining in value, and that profitability and output in US manufacturing were recovering to some extent.

Figure 13-3 shows projected US pulpwood consumption (tonnage of pulpwood receipts at US wood pulp mills) from the 1989, 1993, 2000, and 2005 RPA Timber Assessments. The projections were produced by using the same general type of PELPS-based modeling framework (see Chap. 4 for discussion of NAPAP model), but process

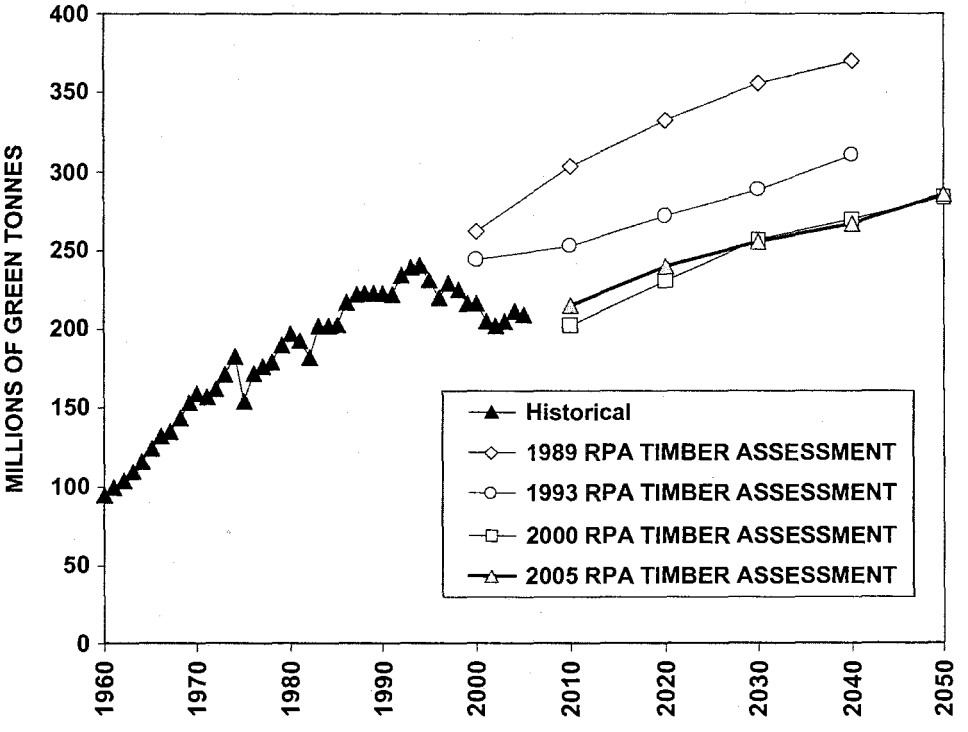

Figure 13-3. Pulpwood receipts at US wood pulp mills, 1960–2005 (Forest Resources Association), with NAPAP projections of pulpwood receipts from periodic RPA Timber Assessments.

technology, trade, and demand growth assumptions were changed from one study to the next. Between 1989 and 1995, the first complete version of the NAPAP model was developed, providing an improved model of papermaking technology and paper recycling. This resulted in higher projected levels of paper recycling and lower projected pulpwood consumption for the USA than in the 1989 RPA Timber Assessment. Furthermore, the 2000 and 2005 RPA Timber Assessments took into account changes in US pulpwood demand resulting from shifts in trade and economic globalization. Thus, the range of projections from the 1989 to 2005 RPA Timber Assessments reflect changes in projected pulpwood demand due to the effects of increased paper recycling (introduced in the 1995 RPA Timber Assessment) and the recent effects of economic globalization (recognized in the 2000 and 2005 RPA Timber Assessments).

Both the 2000 and 2005 RPA Timber Assessments projected only gradual recovery for US pulpwood Consumption after the economic downturn that occurred, beginning in the mid-1990s. The changes since 1989 in model structure and assumptions cumulatively reduced projected pulpwood consumption by around 100 million green tonnes per year over the projection period from 2010 to 2050. Projected future growth rates for pulpwood consumption (just under 1% per year) are much lower than historical growth rates prior to the 1990s (when growth was over 2% per year). The 2000 RPA Timber Assessment anticipated that growth recovery would begin during the current decade, and in fact an apparent recovery did begin around 2002, as a weakening US dollar contributed to resumption of growth in US industrial production. The 2005 projections are slightly higher than the 2000 projections, but the projected growth rate for pulpwood consumption is similar (less than 1% per year).

The same version of the NAPAP model was used to project US pulpwood markets in the 2000 and 2005 RPA Timber Assessments, but adjustments were made in demand and trade assumptions. In general, derived demand for pulpwood (pulpwood consumption in the USA) in the NAPAP model is determined mainly by US production of paper and paperboard, but also influenced by global trade in wood pulp and recovered paper. In the NAPAP model, US production of paper and paperboard is balanced with consumption and trade (imports and exports). The slight differences in projected US pulpwood consumption between the 2000 and 2005 RPA Timber Assessments (Figure 13-3) were the result of differences in projections of

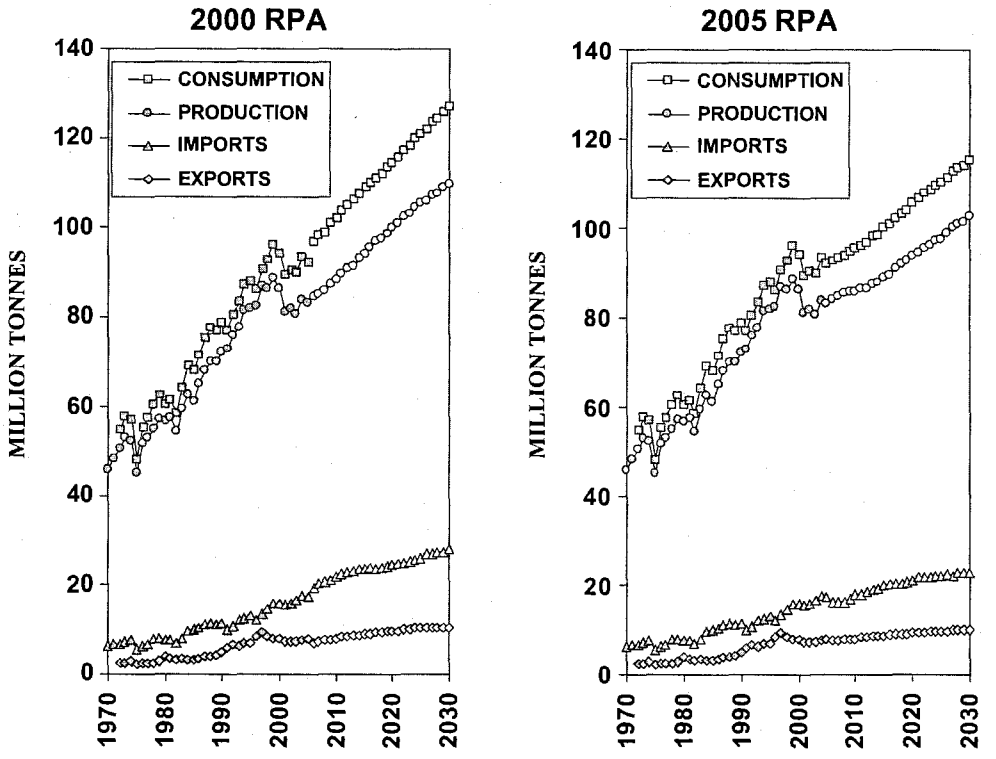

Figure 13-4. US paper and paperboard consumption, production, imports, and exports, 1970–2005 (AF&PA 2006), with projections from the 2000 and 2005 RPA Timber Assessments, 2006–2030 (base case results).

US paper and paperboard production, consumption, and trade, along with other adjustments in global trade for wood pulp and recovered paper. Figure 13-4 displays the projections of total US paper and paperboard consumption, production and trade for the 2000 and 2005 RPA Timber Assessments.

As shown in Figure 13-4, the 2005 RPA projections of US paper and paperboard consumption and production were lower than the projections in the 2000 RPA Timber Assessment, but so too were the projections of paper and paperboard imports. The projections from the 2005 RPA Timber Assessment assumed a weakening dollar would contribute to slower growth in domestic paper and paperboard demand and also slower growth in projected imports of paper and paperboard. Nevertheless, the 2005 projections of pulpwood consumption were similar to the 2000 projections (as shown in Figure 13-3). This outcome (lower paper and paperboard production but similar pulpwood consumption) is due to two further changes in the trade assumptions in the 2005 RPA Timber Assessment: (1) higher US imports of

market pulp and (2) higher US exports of recovered paper, both of which influenced projected pulpwood demand.

Ongoing global expansion of wood pulp capacity, based on low-cost wood from expanding hardwood fiber plantations, particularly in Latin America and Asia, led to an assumption of higher growth in US wood pulp imports in the 2005 RPA Timber Assessment. They were projected to climb from 6.2 million tonnes in 2005 to nearly 9 million tonnes by 2020, and just over 12 million tonnes by 2050. The 2000 RPA Timber Assessment had assumed slower growth in US imports of wood pulp, reaching just over 9 million tonnes by 2050. The higher projection of wood pulp imports in the 2005 outlook offset the lower projection of paper and paperboard imports, reducing the net impact on pulpwood requirements.

In addition, the assumption on US exports of recovered paper was revised in 2005. In the 2000 RPA Timber Assessment, US recovered-paper exports were projected to increase from 9.3 million tonnes in 2000 to around 16 million tonnes by 2030 and just over 20 million tonnes by 2050. Over half of that projected increase was projected exports to Canada. However, in the past decade and especially since 2001, it became clear that US exports of recovered paper to China were growing more rapidly than previously anticipated. With limited fiber supplies in China and a booming economy creating growing demand for paper and paperboard, Chinese producers have been compelled to import fiber, and recycled fiber in particular. By 2005 it was apparent that earlier projections of recovered paper exports were too conservative, as exports were already approaching 15 million tonnes. In the 2005 RPA Timber Assessment, the US recovered-paper export projections to regions other than Canada were increased so that total exports of recovered paper were assumed to climb to over 17 million tonnes by 2010 and to reach 20 million tonnes by 2020. That adjustment was also justified by the weaker US dollar outlook. With more rapid expansion of recovered paper exports in the 2005 RPA Timber Assessment, projected US paper recycling volumes were lower than in the 2000 RPA Timber Assessment, boosting pulpwood needs and contributing to similar projections of pulpwood consumption, despite lower paper and paperboard production.

Thus, significant adjustments were made in the model assumptions of the RPA Timber Assessments to reflect contemporaneous observations and corresponding beliefs about the effects of shifts in currency exchange rates, trade, and globalization. Recognizing the recent impacts of dollar appreciation on US manufacturing and trade,

the 2000 and 2005 RPA Timber Assessments produced significantly lower projections of US pulp and paper consumption and production than earlier RPA Timber Assessments, with lower projected pulpwood receipts at US wood pulp mills (Figure 13-3). The 2000 and 2005 RPA Timber Assessments were based on the same modeling framework (TAMM-NAPAP-ATLAS), but the projections reflected differences in the outlook for the US dollar and related trade consequences. The value of the US dollar had peaked in 2002, and thus with a weaker dollar outlook, the 2005 RPA Timber Assessment assumed lower imports of paper and paperboard and higher exports of recovered paper. Imports of hardwood pulp were increased in the 2005 RPA Timber Assessment because of observed expansion of fiber plantations in Latin America and Asia (despite the weaker dollar outlook). The net result of these trade adjustments was to produce similar projections of pulpwood consumption at US wood pulp mills despite lower projections of paper and paperboard production.

The last two RPA Timber Assessments have shown that global trade assumptions were key drivers of the outlook for domestic wood and wood fiber consumption. Specifically, the assumptions about the trade of paper, paperboard, wood pulp, and recovered paper have had overlapping influences on projected pulpwood consumption. As noted earlier, globalization and trade have also become more important drivers of changes in the solid wood sector too. An implication is that future RPA Timber Assessments need to include a global modeling framework. To meet this need, attention has focused on the GFPM.

13.4 COMPARISON OF GFPM TO THE TIMBER ASSESSMENT PROJECTION SYSTEM

The GFPM is based on a dynamic spatial equilibrium theory similar to that used for solid wood products in the Timber Assessment Projection System, but the structure of GFPM is different. The current GFPM uses the QPELPS modeling system (Zhu et al. 2006a, b), a development of the PELPS system used in the NAPAP model. The categories of products and technologies represented in GFPM are more aggregated than NAPAP and TAMM models in the Timber Assessment Projection System. For example, the NAPAP model includes 12 categories of paper and paperboard commodities (see Chap. 4)

but in GFPM, paper and paperboard are aggregated into just three commodity groups, newsprint, printing and writing paper, and other paper and paperboard. In NAPAP there are ten categories of fiber raw materials, including hardwood and softwood roundwood pulpwood, hardwood and softwood residue chips, hardwood agrifiber, and five categories of recovered paper commodities. Sawtimber is also represented separately from pulpwood in the Assessment System, with sawtimber used as raw material for lumber and other wood products in TAMM. By contrast, in GFPM all of pulpwood and sawtimber are aggregated into a single commodity group, 'undifferentiated by timber species. Solid wood product categories in GFPM include sawnwood (lumber), veneer/plywood, particleboard (including OSB), and fiberboard. Whereas the Timber Assessment Projection System encompasses dozens of categories of forest products and timber commodities, GFPM aggregates these into just 14 groups of forest products and timber commodities, in addition to forest inventory and forest area. In GFPM, the USA is represented as just one region, while in the Timber Assessment Projection System multiple US subregions are represented.

Although GFPM is less detailed in modeling forest resources, forest products, and timber markets than the Timber Assessment Projection System, it projects the markets for all forest products in aggregate worldwide. While the Timber Assessment Projection System models such as NAPAP and TAMM focus primarily on modeling the evolution of regional timber markets in the USA and Canada, GFPM predicts production, consumption, imports, exports, and prices for all forest products in each of 180 countries (Buongiorno et al. 2003). Global trade between North America and the rest of the world was incorporated into the Assessment System, but trade flows outside of the USA and Canada were based on exogenous assumptions. GFPM calculates endogenously the trade between each country and the rest of the world.

The general principle of GFPM is that world markets balance demand and supply in the short run, while long-run changes are governed by market forces and by resource policy (Turner et al. 2005). For example, forest product demand depends on equilibrium prices and economic growth assumptions for each of the 180 countries, while wood supply and paper recovery for recycling depend on local resource supply policies and derived demands. GFPM projections, like those in

the RPA Timber Assessments, reflect particular assumptions regarding the working of markets, subject to additional assumptions about economic growth, and resource policies.

In the various models that make up the Assessment System, the equilibrium solution encompasses trade between the USA and Canada, while exogenous assumptions govern trade with the rest of the world. In GFPM, each country exports to, and imports from, the world market. Projected prices clear the markets in every country so that demand is equal to supply for every product and country worldwide. Barriers to trade are described by trade inertia constraints and ad valorem tariffs, although tariffs on solid wood products have been reduced to their Uruguay Round levels (Barbier 1996)) and general tariffs on pulp and paper have been eliminated. By predicting developments of the entire forest sector worldwide, GFPM provides explicit information about how the US forest sector is expected to evolve in the context of global forest sector development and increasing economic globalization.

Discussion of globalization and modeling in this chapter focuses mainly on pulp and paper, but inferences can be made about all wood products. In general, likely gains from an endogenous global trade model include explicit modeling of global trade and global forest sector development. With a model such as GFPM, the global trade equilibrium becomes the driver of domestic wood and wood fiber consumption, rather than exogenous global trade assumptions. However, models such as GFPM generally have less detail than the models in the Timber Assessment Projection System (in regions, product categories, or wood species for example).

13.5 RPA TIMBER ASSESSMENT IN GFPM CONTEXT

In this section we discuss how paper and paperboard projections from the 2000 RPA Timber Assessment (which included detailed US trade assumptions) compare to recent GFPM results. GFPM was used to develop projections of global forest sector developments to 2030, conditional on 2000 RPA Timber Assessment projections of domestic changes in the forest sector of the USA (Turner et al. 2005). GFPM was programmed with assumed changes in US and Canadian GDP (drivers of future demand) similar to those used in the

2000 RPA Timber Assessment (Adams et al. 2003). Results allow some aspects of the RPA Timber Assessment to be viewed through a global model, and here we focus on the projections of US paper and paperboard production, consumption, and trade. Differences between GFPM predictions (Turner et al. 2005) and projections from the 2000 RPA Timber Assessment can be ascribed largely to differences in model structure and the interaction of US markets with global economic development and trade.

The assumptions regarding future US and Canadian GDP driving future demands in GFPM were similar to those in the 2000 RPA Timber Assessment. The elasticities of end product demand and of import demand were adapted from Buongiorno et al. (2003, Chap. 4) and Turner and Buongiorno (2004). In GFPM, the demand for raw wood and intermediate products (such as pulp and recovered paper) derives from demand for final products through input/output coefficients and corresponding manufacturing costs that describe technologies in each country, subject to production levels, which change endogenously (Buongiorno et al. 2003). The supply of wood and nonwood fiber in each country is represented by supply equations. Shifts in wood supply assumed in GFPM were consistent with the changes in production predicted in the 2000 RPA Timber Assessment between 2000 and 2030 (0.5–0.8% per year in the USA, and 0% per year in Canada).

According to GFPM, the USA, Japan, and Europe are predicted to remain major importers of forest products out to 2030. The rapid economic growth of China is predicted to make it the world's largest market for raw wood, and also intermediate and final forest products. Mexico and the Republic of Korea are also predicted to become important markets for solid wood and fiber products. In competition with the USA, Finland, Austria, Latvia, Chile, and New Zealand will increase their share of global lumber exports, and Austria and the Republic of Korea will emerge as exporters of printing and writing paper. However, in contrast to the fairly pessimistic outlook for US exports in recent RPA Timber Assessments, GFPM predicts that the US share of global exports of industrial roundwood and other paper and paperboard will expand out to the year 2030.

According to GFPM (Turner et al. 2005), US consumption will increase significantly for all paper and paperboard products, except for newsprint. For commodities in which the USA has relatively high production costs, such as printing and writing paper, the share of US imports in total consumption increases over the projection period, but

not as much as in the RPA Assessment System projections. Meanwhile, the GFPM predicts that the USA will increase exports of other paper and paperboard.

Although GFPM projections were conditional on the projections of domestic market trends from the 2000 RPA Timber Assessment, it is worth comparing in greater detail the GFPM projections to the RPA projections of US paper and paperboard production, consumption, and trade. In the 2000 RPA Timber Assessment, for example, it was noted that substitution of electronic media for newsprint has contributed to stagnation of both US newsprint consumption and imports since the early 1990s) despite strong US economic growth. These changes were captured in the NAPAP model by imposing negative shifts on US demand growth for newsprint, while in the GFPM the changes were captured by adjusting income elasticities of domestic demand for newsprint in the US until the GFPM projections of US newsprint consumption resembled those in the 2000 RPA Timber Assessment. However, GFPM still projected substantial growth in US newsprint consumption and production, whereas the RPA projections indicated a steady decline for US newsprint consumption and production.

The GFPM projections also differed notably from the RPA projections of slower US export and demand for other paper and paperboard. In the RPA Timber Assessment, China's low wage rate was assumed to give them competitive advantages in manufacturing, and the ongoing expansion of China's overall manufacturing sector was assumed to continue. This dampened the US demand outlook for paperboard commodities such as linerboard and corrugating medium used to produce corrugated boxes for shipment of manufactured goods. In the 2000 RPA Timber Assessment, it was assumed that China would satisfy its expanding need for packaging paper and paperboard with expanded output based mainly on recycled fiber, and thus limited growth was assumed in US exports of those products. However, in GFPM the manufacturing costs for other paper and paperboard, calculated from FAO production, consumption, and price data, gave China little competitive advantage (Buongiorno et al. 2003, p73), and hence China's imports and US exports were projected by GFPM to significantly increase for other paper and paperboard.

The 2000 and 2005 RPA paper and paperboard projections emphasized the recent impacts of economic globalization and recent declines since the 1990s in the US paper and paperboard production and consumption (Figure 13-4), while GFPM focused on long-term trends.

Important differences between GFPM projections and RPA projections become readily apparent when projections are compared to historical data for the specific groups of paper and paperboard commodities that are included in GFPM (newsprint, printing and writing paper, and other paper and paperboard). The American Forest & Paper Association provides production and consumption data for pulp, paper, and paperboard (AF&PA 2006) and these are reported annually to UNECE/FAO. Those data were used also as historical reference data in the RPA Timber Assessments and NAPAP model, while the FAO data are used in GFPM. Thus both modeling systems use essentially the same paper and paperboard data.

Figure 13-5 shows historical data from 1970 to 2005 for US newsprint consumption, production, and trade (AF&PA 2006), and compares the GFPM projections (Turner et al. 2005) to the projections from the 2000 RPA Timber Assessment. The GFPM projections show continued growth in US newsprint consumption to 2030, roughly in line with the historical trend that prevailed from 1970 to the 1990s. In contrast, the 2000 RPA projections show a real departure from that trend, reflecting how US newsprint demand has undergone a structural

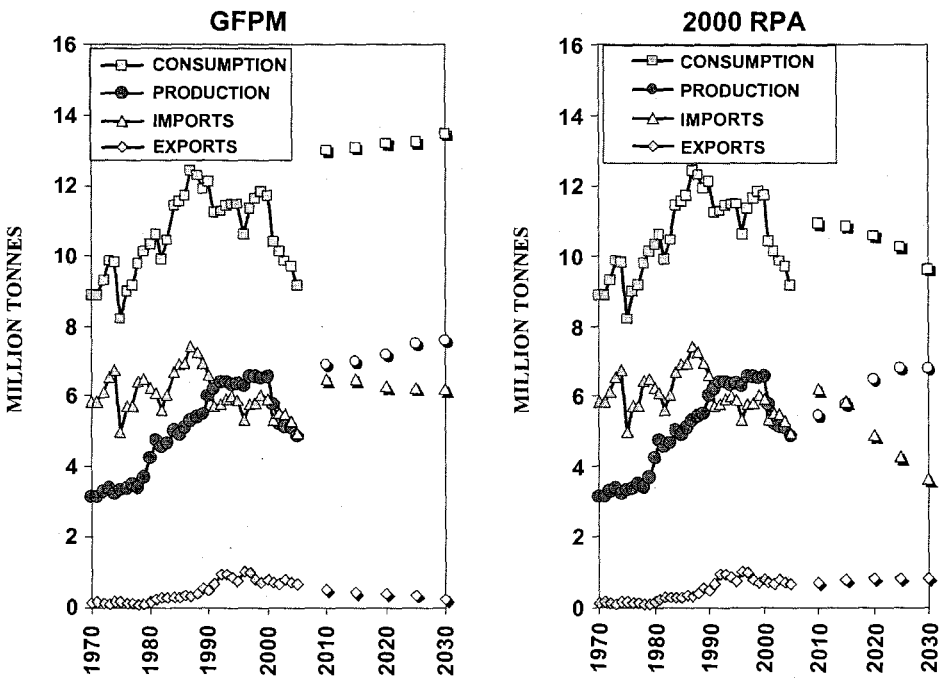

Figure 13-5. US newsprint consumption, production, imports, and exports, 1970–2005 (AF&PA 2006), with projections from GFPM (Turner et al. 2005) and the 2000 RPA Timber Assessment, 2010–2030.

change since the late 1980s. In fact, per capita US newsprint consumption has been declining since the late 1980s. Newspaper publishers are the leading consumers of newsprint, and US newspaper circulation has declined, leading to declining US newsprint demand (Hetemäki and Obersteiner 2001). Advertising revenues have also shifted increasingly from print media to electronic media, offsetting the leading source of revenues for US newspaper publishers, and most US newspapers now offer news content via the Internet.

The GFPM and RPA projections both indicated that US newsprint imports (mainly derived from Canada) will decline, but RPA projections indicate a steep decline in imports, in line with declining consumption. The GFPM and RPA projections both indicate little growth in US newsprint exports. The differences in consumption and imports result in differences in projected US newsprint production. The GFPM and 2000 RPA Timber Assessment projections both show US newsprint production increasing in the long run, but the 2000 RPA projections indicated only very gradual and delayed recovery in US newsprint production (Figure 13-5). By the year 2030, the GFPM projection of US newsprint production is 12% higher than the 2000 RPA Timber Assessment projections. As with consumption, the GFPM projections of production are more in line with the historical trend from 1970 through the 1990s, whereas the RPA projections took into account the decline in production that has occurred since the 1990s.

Figure 13-6 shows historical data from 1970 to 2005 for US printing and writing paper consumption, production and trade (AF&PA 2006), and compares the GFPM projections (Turner et al. 2005) to 2000 RPA Timber Assessment projections. The GFPM projections of US printing and writing paper consumption were similar to the 2000 RPA Timber Assessment projections. The RPA Timber Assessment projections reflected a view that per-capita US printing and writing paper consumption is unlikely to increase in the future as a result of structural changes in demand (substitution by electronic communication media), and that most of the tonnage increase in consumption will be supplied by imports.

US demand for printing and writing paper is led by demand for uncoated free sheet paper (used for office copy paper, books, and other printing and writing purposes), which is the largest category of printing and writing paper. Industry reports indicate that North American demand for uncoated free sheet paper has shrunk in recent years as demand is losing ground to electronic information systems. Despite

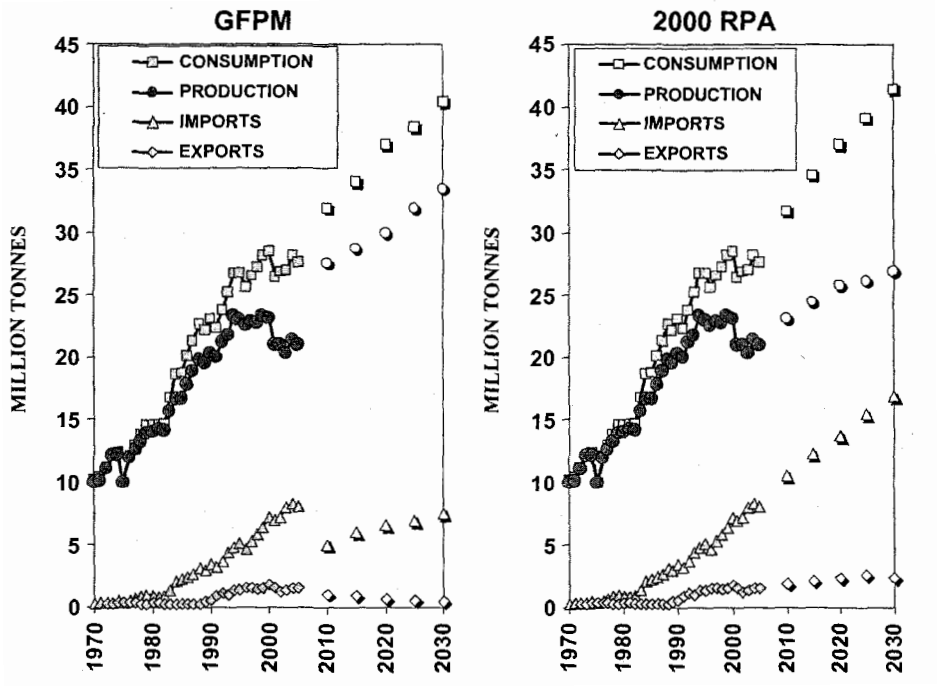

Figure 13-6. US printing and writing paper consumption, production, imports, and exports, 1970–2005 (AF&PA 2006), with projections from GFPM (Turner et al. 2005) and the 2000 RPA Timber Assessment, 2010–2030.

this trend imports have increased, as mill closures and limited capacity growth boosted operating rates to levels that have kept prices from plummeting (Cody 2006a). US printing and writing paper imports have doubled since 1990, and the RPA Timber Assessment projections showed more than a 50% increase in US printing and writing paper imports by 2030, driven largely by the assumption of continued expansion in printing and writing paper imports from Asia and Latin America.

As a consequence of slow growth in US demand and rising imports, US production of printing and writing paper was projected to grow very slowly according to the 2000 RPA Timber Assessment projections. By contrast, the GFPM projections show only a modest increase in US printing and writing paper imports, along with significant increases in US production of printing and writing paper. By 2030, the GFPM projection of US printing and writing paper production is 25% higher than the 2000 RPA Timber Assessment projection. As with newsprint, the GFPM projections of US printing and writing paper production appear to be more in line with historical trends from 1970 to the 1990s. In contrast, the 2000 RPA Timber Assessment

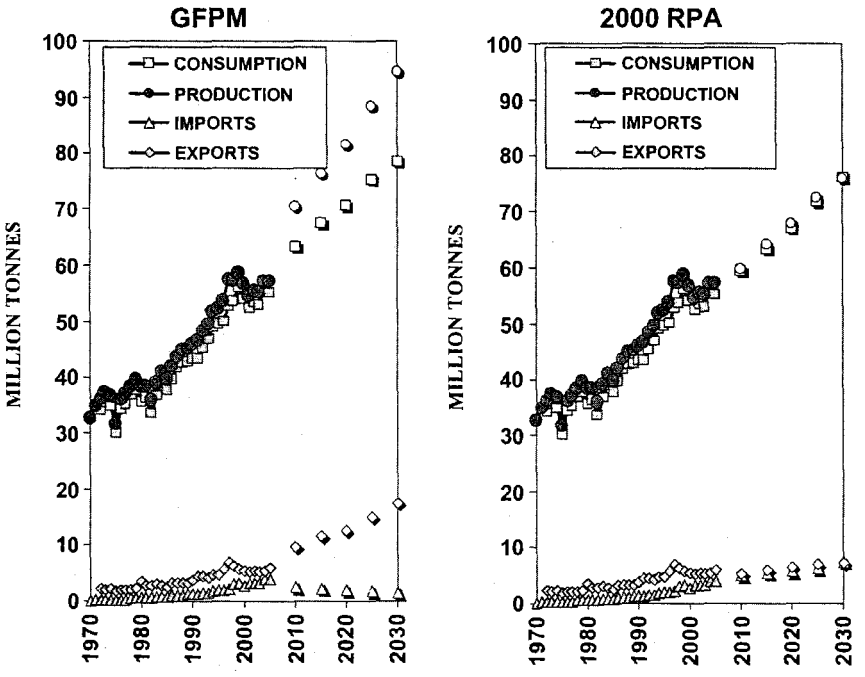

Figure 13-7. Other US paper and paperboard consumption, production, imports, and exports, 1970–2005 (AF&PA 2006), with projections from GFPM (Turner et al. 2005) and the 2000 RPA Timber Assessment, 2010–2030.

projections showed a distinct departure from those trends, taking into account the downturn and structural changes that have occurred in US printing and writing paper markets since the late 1990s.

Lastly, Figure 13-7 shows historical data from 1970 to 2005 for other paper and paperboard consumption, production and trade in the USA (AF&PA 2006), and compares the GFPM projections (Turner et al. 2005) to 2000 RPA Timber Assessment projections. The other paper and paperboard product group includes all paperboard products (used primarily for packaging), all packaging paper products, and tissue paper (used mainly for sanitary purposes). In the USA, the largest element of this broad product group is containerboard (paperboard used for corrugated boxes or shipping containers).

As for newsprint and printing and writing paper, US containerboard demand declined beginning in the late 1990s, but containerboard demand also experienced a more robust recovery in recent years, correlated with the downturn and subsequent recovery of growth in US industrial production (Fig. 13-1). In 2006, for example, US containerboard prices reached their highest levels since record peak price levels of 1995, as US demand rose modestly in line with continued strength in

industrial production, while capacity growth remained subdued (Cody 2006b). In addition, tissue paper demand has continued to grow fairly steadily, relatively unimpeded by trends in industrial production or trade (tissue paper imports and exports are relatively small compared to other paper and paperboard products). Similarly, both the GFPM projections and the 2000 RPA Timber Assessment projections show increasing consumption of other paper and paperboard products following the recent market downturn (Figure 13-7).

Nevertheless, the GFPM projections for other paper and paperboard diverge from the 2000 RPA Timber Assessment projections, with substantially higher projected production and export, and modestly higher projected consumption (Figure 13-7). The GFPM projections of US exports for other paper and paperboard are more than twice as high as the RPA Timber Assessment projections, and by 2030 the GFPM export projection reaches a level about three times as high as exports in 2005. By 2030 the GFPM projection of US production for other paper and paperboard is 24% higher than the 2000 RPA Timber Assessment projection.

In summary, when the GFPM was used recently to project US and global trade conditional on the 2000 RPA Timber Assessment projections of domestic changes in the US forest sector (Turner et al. 2005)) the GFPM projections diverged substantially from the RPA Timber Assessment paper and paperboard projections. The GFPM projection of growth in total US paper and paperboard production from 2005 to 2030 is about double the projected growth obtained in the 2000 RPA Timber Assessment, and the GFPM projection of US production in 2030 is 24% higher than the RPA Timber Assessment projection. Much of the divergence in projections stems from differences in projected paper and paperboard trade, although there were also differences in projected paper and paperboard consumption. The GFPM projection of total paper and paperboard consumption is 4% higher by the year 2030 than the RPA Timber Assessment projection, but the GFPM projection indicates that the USA will become a net exporter of paper and paperboard by 2030, while the 2000 RPA Timber Assessment projection indicated that the USA would remain a net importer by a wide margin. This divergence is significant since the USA is still the leading producer of paper and paperboard in the world, but over the past decade US output of paper and paperboard has increased very little, while global output has increased by over 100 million tonnes, an amount that exceeds total US production.

In general, the GFPM projections tend to continue trends that occurred historically from the 1970 to the 1990s for US paper and paperboard production and consumption (as illustrated in Figures 13-5, 13-6, and 13-7). In contrast, the 2000 RPA Timber Assessment projections recognized a departure from historical trends, and in general the 2000 (and 2005) RPA Timber Assessment largely attributed that departure to structural changes in demands and shifts in trade associated with economic globalization. The RPA Timber Assessment projections indicate only modest future growth in overall US paper and paperboard exports, while the GFPM projections indicate much more robust growth in exports (particularly for other paper and paperboard).

As mentioned earlier, a principal reason cited for the recent downturn in the US pulp and paper sector was the exceptional strength of the US dollar over a period from the mid-1990s to 2004, when the value of the dollar remained above its historical average for a number of years. The strong dollar reduced competitiveness for US manufacturers and stimulated higher imports of goods, contributing to a downturn of growth in US manufacturing as well as a downturn in paper and paperboard production (Figure 13-1). Given the strong role of currency exchange rates in recent years, a relevant question is what happens to projected US trade flows for commodities such as paper and paperboard when adjustments in currency exchange rates are introduced into GFPM?

13.6 EFFECTS OF EXCHANGE RATES IN GFPM

Currency exchange rates were important elements of trade assumptions in Assessment System models such as TAMM and NAPAP. However, instead of focusing on the need for explicit treatment of exchange rates, past GFPM applications have mostly assumed that relative purchasing power of currencies remains constant over the long run. A pass-through of exchange rates to forest product prices and hence trade was demonstrated by Uusivuori and Buongiorno (1991). However, currency exchange rates have diverged from long-term averages for multi-year periods. As noted earlier, the US dollar recently went through such a period, when its trade-weighted exchange value rose well above the historical average from the mid-1990s to a peak in 2002, and then subsided in value. The value of the dollar remained

above average for nearly eight years from 1997 to 2004, with notable impacts on overall US trade and growth in US industrial production.

In a recent experiment at FPL, the effects of shifting currency exchange rates were introduced into GFPM and the effects on projected US trade were observed. An earlier version of GFPM was used to project global trade from 1997 to 2010, with and without shifts in currency exchange rates. The results were compared with actual trends in US trade, over the period 1997–2004. The exchange rate data for the currencies of all countries that are important to US agriculture trade were obtained from the USDA ERS (2004). Annual real exchange rates were derived by multiplying the nominal exchange rates by the ratio of the US CPI to the local (foreign) currency CPI. The derived real exchange rate data were then used to compute annual shifts in real currency exchange rates, and those shifts were then introduced into GFPM for the historical period 1997–2004.

The results showed that estimates of US forest products trade derived from GFPM became significantly more accurate in tracking actual US trade flows over the historical period when shifts in real exchange rates were included, particularly for higher value-added products such as pulp, paper, and paperboard. For example, US wood pulp exports declined from 1997 to 2004, but without the inclusion of shifts in exchange rates, GFPM projected that US wood pulp exports would increase during that period. However, after the introduction of historical shifts in exchange rates, the GFPM projection of US wood pulp exports showed a realistic decline and closely tracked the actual historical trend in US wood pulp exports.

Likewise, without the shifts in currency exchange rates, the GFPM projected very little expansion in US imports of paper and paperboard from 1997 to 2004, although in reality US imports surged during that period when the dollar increased in value. When the shifts of currency exchange rates were taken into account, the GFPM projection of US paper and paperboard imports showed a significant increase, and much more closely tracked the historical trend. Notably, the period from 1997 to 2004 was the period that encompassed the recent decline of output for the US pulp and paper sector, a period when the dollar was above average in value, and the US trade balance was negatively impacted.

In this experiment, only the effects of shifts in exchange rates on manufacturing costs and transportation costs were included (not effects on supply or demand). The GFPM also allows shifts of supply

and demand in response to shifts in exchange rates, but the process has not been tested yet, so that task is left for future experiments. However, because manufacturing costs are a large component of the price of products such as paper and paperboard, we were able to observe fairly large and empirically useful responses to exchange rate shifts.

The results of the experiment suggest that shifts in currency exchange rates are an important determinant of global trade flows. With appropriate assumptions, GFPM can provide a useful tool in the RPA modeling context for evaluating how global economic conditions, including currency realignments, will influence the US forest product sector and regional timber markets. The experiment with GFPM showed also that including just the shifts in exchange rates for the major currencies were sufficient to significantly improve accuracy of US trade projections. It will be implausible to project exchange rates for all countries included in GFPM, but certainly it seems plausible to develop broad assumptions about likely trends in the value of major currencies, especially for countries that are expanding consumers of forest products, such as China.

13.7 CONCLUSIONS AND PLANNED APPLICATIONS OF GFPM

Experience with the GFPM has led to recommendations for future forest sector modeling in the RPA context. For example, Turner et al. (2005) suggested an approach that would combine regional RPA Timber Assessment models and GFPM. The GFPM would provide an international context (US import and export levels consistent with global developments), while the Assessment System could feed the GFPM with information on US trends likely to affect competitiveness worldwide. This would increase the likelihood that RPA Timber Assessment projections fully reflect the complex links of the US forest sector with the rest of the world through trade in an increasingly global economy.

In the interest of linking the RPA Timber Assessment to a global model, work has begun on a modeling system for future RPA Timber Assessments that will link the assessment of regional US timber market trends to global changes. The approach is to build an expanded

US forest products module within GFPM. Whereas the USA is represented as one region in the current GFPM, the ongoing work aims to expand the number of US production and supply regions and the number of products, creating an element within GFPM that is called the "US Forest Products Module" (or USFPM).

USFPM is designed to operate within GFPM as part of the global model. Within USFPM, there will still be one single US region for product demands, and product trade flows will connect to that demand region as in the current GFPM, but USFPM will also have three US subregions (North, South, and West) to represent regional forest product production and regional timber supply and demand. Figure 13-8 compares the regional structure of the USA in the current GFPM to the regional structure as designed in USFPM.

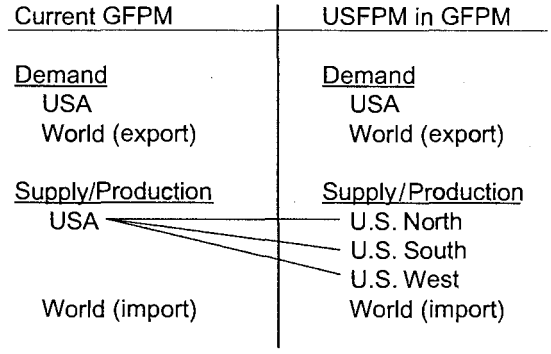

Figure 13-8. Regional structure of demand and supply for the USA in GFPM and in the planned US Forest Products Module (USFPM) within GFPM.

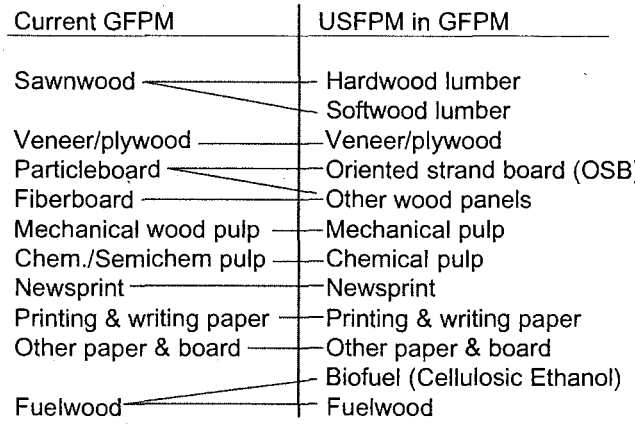

Figure 13-9. Forest product commodity groups in GFPM compared to commodity groups represented in planned US Forest Products Module (USFPM) within GFPM.

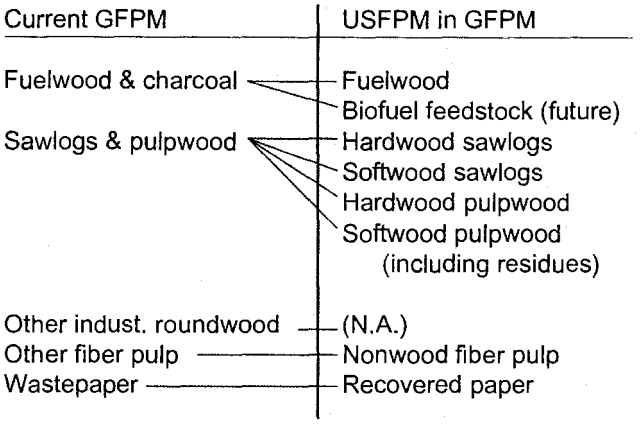

Figure 13-10. Wood and fiber raw material groups in GFPM compared to corresponding groups represented in planned US Forest Products Module (USFPM) within GFPM.

USFPM will also add more product detail for the USA than in the GFPM (Figure 13-9). For example, the USFPM hardwood lumber and softwood lumber commodity groups will be aggregated for US export into the larger GFPM commodity group called "sawnwood", while US imports of sawnwood will be disaggregated into corresponding USFPM commodity groups, hardwood and softwood lumber. The GFPM commodity structure will be preserved in other countries and in global trade.

Lastly, USFPM is designed with greater detail than GFPM in terms of timber and wood fiber raw material commodity groups. Figure 13-10 shows the commodity groups for wood and wood fiber raw materials represented in GFPM, compared to the corresponding and somewhat more detailed commodity groups in USFPM.

Observations of changes in US forest product markets and past experience with the Timber Assessment Projection System and GFPM leads to the conclusion that global trade and global economic development now play a large role in determining the US timber supply and demand outlook, even at the regional level analyzed in the RPA Timber Assessments. As exemplified by changes in the US pulp and paper sector, shifts in currency exchange rates, trade and related structural changes in US demand can change the direction of trends and the overall outlook for future forest sector development. The USFPM/GFPM framework can provide a model for future RPA Timber Assessments that will incorporate many features of the existing Assessment System, such as regional timber markets and product detail, while also

expanding the context of the Assessment System to encompass global developments.

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