

---

---

# U.S. Wood Fiber Demand and Supply Outlook: The 5th RPA Timber Assessment

**Peter J. Ince**

## **Abstract**

In 2002, the USDA Forest Service completed the fifth nationwide assessment of timber resource demand and supply, as mandated periodically by the Resources Planning Act (RPA) (2). The assessment included long-range projections of pulp, paper, and paperboard production, consumption, and trade, with regional analysis of wood-fiber use, paper recovery for recycling, and projections of pulpwood demand and supply. The analysis also considered projected growth and expansion of forest plantations, such as pine plantations in the South, the market potential for agricultural fiber crops, and projected pulpwood demand for wood panel products such as oriented strandboard. This paper highlights assumptions and key findings related to the wood-fiber demand and supply outlook. A primary conclusion is that projected growth in U.S. wood-fiber demand appears at present to be economically sustainable for decades to come, taking into account ongoing shifts in product markets, international trade, and production technology, along with improvements in forest productivity. The analysis

points to a future of adequacy in domestic wood-fiber resources, not impending scarcity. This conclusion, however, should be viewed as a working hypothesis that must continue to be examined and tested periodically in the future as new data, new insights, and new market trends emerge.

## **Introduction**

This paper highlights assumptions and key findings related to the U.S. wood-fiber demand and supply outlook that was developed as part of the 5th RPA Timber Assessment. The outlook for the pulp and paper sector was based on a dynamic economic projection model, the North American Pulp and Paper (NAFAP) model, maintained by the author at the U.S. Forest Products Laboratory. The NAPAP model was integrated with a solid-wood sector model, TAMM (Timber Assessment Market Model), maintained by Professor Darius Adams at Oregon State University, and with a regional timber inventory and growth model, Aggregate Timberland Assessment System (ATLAS), maintained by John Mills and others at the Forest Service Pacific Northwest Forest and Range Experiment Station. The models were linked together in a combined forest sector modeling system, called TAMM-NAPAP-ATLAS (TNA) by Professor Adams, Adrienne VanNalts, and others at Oregon State University

---

### **Ince:**

Research Forester, Forest Products Lab. USDA Forest Service, Madison, WI

Richard Haynes of the Pacific Northwest Station coordinated the overall timber assessment effort. The wood-fiber demand and supply outlook described in this paper was described in previous publications (4,5) and is described also in the 5th RPA Timber Assessment report.

Profound changes have influenced wood-fiber markets since the late 1980s. The quantity of recovered paper consumed in recycling at U.S. paper and paperboard mills each year doubled, from 16.4 million tons in 1985 to 34.0 million tons in 1996 (4). Thus, millions of tons of used paper and paperboard materials were diverted from waste (landfill or incineration) into recycled paper and paperboard products, ultimately displacing the need for millions of tons of virgin wood fiber each year. Since 1996, there was slower expansion in use of recycled fiber, although use remained high, with recovered paper consumption peaking at 37.6 million tons in 2000 and subsiding to 35.2 million tons in 2001 (1). Upward trends in paper recycling of the 1990s and impacts on wood-fiber supply and demand were anticipated and projected fairly accurately in the last update of the RPA Timber Assessment in 1993 (5).

However, other profound developments not anticipated in the last RPA Timber Assessment have unfolded since the mid-1990s, including loss of growth in U.S. pulp, paper, and paperboard exports, a rising tide of imports, increased market volatility, and a wave of industry mergers and mill closures, with lower profits and declining production capacity. Many of the latter developments can be traced in part to globalization and extraordinary imbalances in currency exchange rates (particularly for the dollar versus currencies of other competing pulp and paper producing countries). Globalization, consolidation, and downsizing of capacity have affected the long-range outlook for wood-fiber demand.

Pulp and paper producers were quick to recognize consequences for their sector of globalization and the strong dollar in the late 1990s, but deeper impacts of currency imbalances on overall U.S. manufacturing did not become widely apparent until industrial production collapsed in the years 2000 and 2001, leading to an economic recession in the United States. Then there was a sharp downturn in domestic demands for paper and paperboard, close-

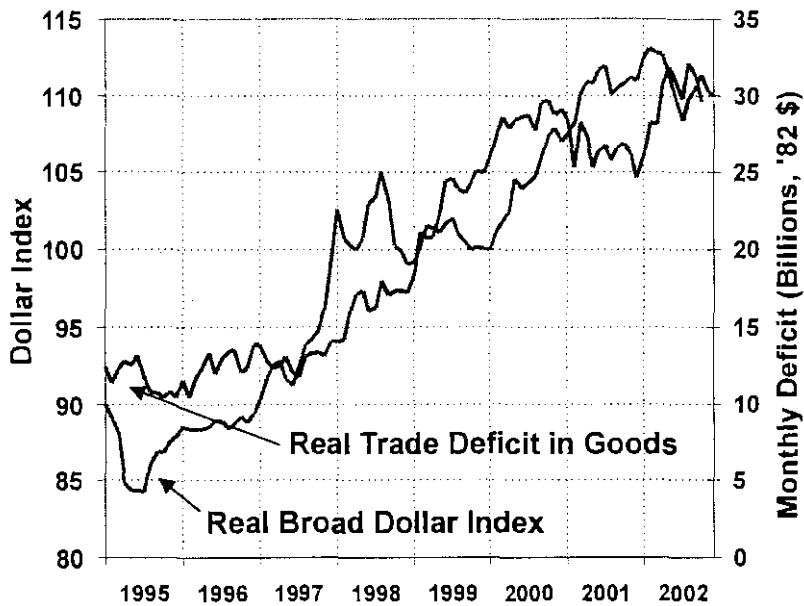
ly linked to a downturn in demands for packaging materials in industry and print media for business advertising. This followed on the heels of declining trade fortunes for pulp, paper and paperboard producers in the late 1990s. Consequently, since the mid-1990s, U.S. wood pulp production has declined by roughly 12 percent (1), while pulpwood receipts at wood pulp mills declined by 15 percent (6). On a monthly basis, paper, and paperboard production turned upward in 2002, along with industrial production, but there remained a long and likely uneven road to full recovery.

As available supplies of wood fiber continued to expand in the interim, the recent downturn in pulpwood demand has had impacts on the overall fiber supply and demand balance, tilting toward plentiful supply. Thus, pulpwood prices generally subsided nationwide, and in the South over the past 5 years stumpage prices for southern pine pulpwood all but collapsed, falling by more than 50 percent on average from 1997 to 2002 (according to Timber Mart-South). The RPA outlook to 2050 projects gradual recovery in U.S. paper, paperboard, and wood pulp production in the current decade, followed by sustained growth in subsequent decades.

### **Globalization and the Strong Dollar**

In general, from 1996 to 2002, a surging overall U.S. trade deficit was stimulated by an exceptional increase in the trade-weighted real exchange value of the U.S. dollar. As the value of the dollar increased, U.S. goods came less cost-competitive in real (inflation-adjusted) terms and exports experienced only modest gains, while the higher dollar value attracted a flood of imported goods. Thus, U.S. imports of goods soared to unprecedented levels, reaching more than \$1.2 trillion in 2000 (more than double the previous record value of goods imported in the early 1990s). The relation between dollar value and trade in goods is illustrated in **Figure 1**, showing trends since 1995 in the Federal Reserve real broad trade-weighted dollar index and overall goods trade deficit, based on monthly data.

Until 1999, overall growth in the U.S. economy continued at a robust pace. However, in 2000 there was a collapse in overall U.S. industrial production, associated with a rising tide of goods imports and



**Figure 1.** — Relationship between real broad trade-weighted dollar index (Federal Reserve) and monthly real trade deficit in goods (Bureau of Economic Analysis).

depressed industrial commodity prices, partly a result of cheap foreign imports. The collapse in U.S. manufacturing became more pronounced in 2001, contributing to economic recession in that year. By the end of 2001 U.S. industrial capacity utilization had fallen below 75 percent [Federal Reserve]. Ultimately economic growth subsided globally, as rapid growth in U.S. imports subsided and no longer served as the global engine of economic growth. Industrial production reached a trough early in 2002, followed by a gradual and uneven upturn.

### Pulp and Paper Trends

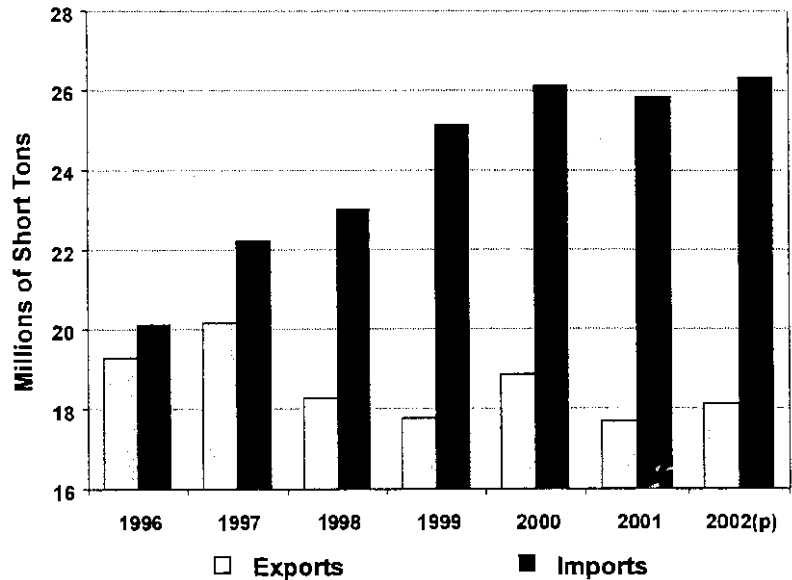
In recent decades U.S. pulp and paper markets became increasingly exposed to global cycles of trade as both the share of domestic production exported and the share of domestic consumption imported increased. For example, U.S. exports of paper, paperboard, and related products peaked in 1997 at 13.1 million tons or 13.8 percent of domestic production, whereas 20 years earlier in 1977 exports accounted for just 5.6 percent of domestic production. In 1977, U.S. imports of paper, paperboard, and related products were 7.3 million tons or 12.0 percent of apparent consumption, but in the year 2000 imports reached a peak of 18.9 million tons, accounting for 15.7 percent of apparent consumption.

By the late 1990s, U.S. paper and paperboard capacity utilization trends were following volatile

short-run trends in exports. Even though trade still accounted for a relatively small share of domestic production, exports were much more volatile than domestic demand and thus exerted a disproportionate influence on domestic capacity utilization. Since trends in domestic commodity prices generally follow trends in capacity utilization, the volatility in export markets translated into volatility in domestic prices and industry profit margins. Economic conditions in the U.S. pulp and paper sector had thus become intertwined with volatile global cycles of trade, impacting domestic market prices and industry profitability. The ultimate response to market volatility in the late 1990s was industry consolidation and downsizing of capacity growth. The relationship of trade, market volatility, and consolidation became more widely apparent in the late 1990s, as the U.S. dollar was consistently gaining strength relative to foreign currencies.

Market trends of the U.S. pulp and paper sector generally followed a pattern of adjustment similar to the adjustment in overall goods trade since the mid-1990s. The tonnage of U.S. pulp, paper, and paperboard exports reached an historical zenith in 1997 before leveling out and declining as the dollar increased in value. Attracted by the strong dollar, U.S. imports of pulp, paper, and paperboard surged in the late 1990s. In tonnage, the U.S. trade deficit

**Figure 2.** — Trends in total tonnage of U.S. pulp, paper, and paperboard product imports and exports, excluding recovered paper [Source: (4) and Commerce Dept.].



for pulp, paper, and paperboard products in total widened from less than 1 million tons in 1996 to 8 million tons in 2001. Recent trends in total tonnage of U.S. pulp, paper, and paperboard imports and exports are illustrated in **Figure 2**.

The significant adjustments of trade alone were sufficient to introduce volatility into U.S. pulp, paper, and paperboard commodity markets in the late 1990s, a period of generally volatile prices and declining industry profitability. During the so-called Asian financial crisis of 1997–1998, subsiding U.S. exports to Asia triggered a wave of market volatility, weak industry profits, and corporate mergers. However, the eventual collapse of overall U.S. industrial production in 2000 and 2001, along with the downturn in business activity and advertising, had more significant negative impacts on paper and paperboard purchases and production. Although an upturn was underway in 2002 for U.S. industrial production and for U.S. paper and paperboard purchases and production, the recent economic downturn has had profound impacts on wood-fiber markets and significant impacts on the long-range outlook for wood-fiber demand in the United States.

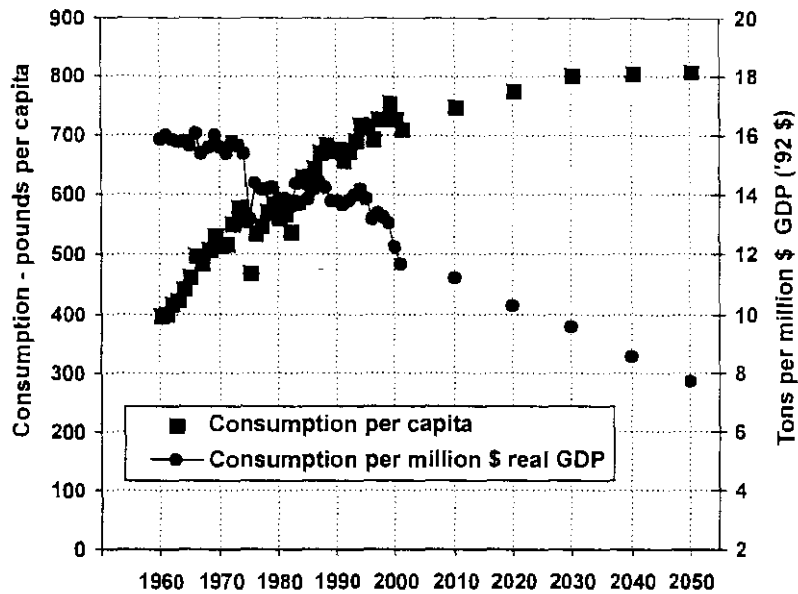
The 5th RPA Timber Assessment took into account the effects of trade imbalances and subsequent downturn in industrial production and business activity that unfolded in the U.S. economy from the late 1990s. Thus, the analysis tool into ac-

count the 12-percent decline in annual U.S. wood pulp production and 15-percent decline in pulp-wood receipts at wood pulp mills, which have occurred since the mid- 1990s. Declines of this magnitude were largely unprecedented in the 20th century (except during the Great Depression and briefly during the energy crisis of the 1970s). The RPA outlook projects gradual recovery of growth in U.S. pulp, paper, and paperboard production and wood-fiber demand in the current decade, although the recovery is projected to be slow at first, with aggregate pulp-wood demand likely to reach previous historical peaklevels (of the mid- 1990s) sometime after 2010.

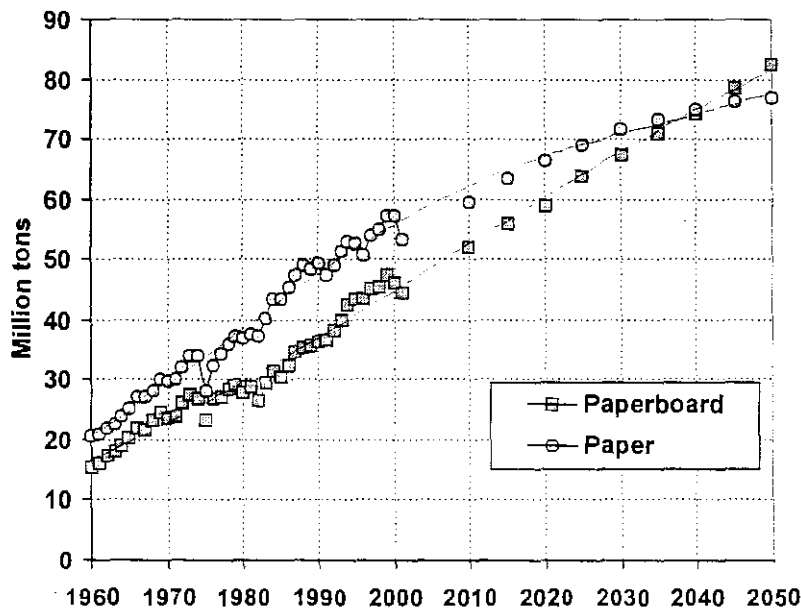
### **Paper and Paperboard Demand Outlook**

U.S. per capita consumption of paper and paperboard is projected to increase in the future but at a decelerating rate of growth, consistent with trends of recent decades and varying by commodity category. Consumption per unit of real gross domestic product (GDP) is projected to gradually decline, also consistent with trends since the 1950s. **Figure 3** illustrates historical and projected trends in U.S. per capita consumption of paper and paperboard, along with consumption per million dollars of real GDP.

Although projected per capita consumption of paper and paperboard levels out beyond 2030 and consumption per unit of real GDP continues to decline (**Fig. 3**), both U.S. population and per capita



**Figure 3.** — Historical and projected U.S. paper and paperboard consumption per capita and per million dollars of real GDP ('92 \$), 1960 to 2050.

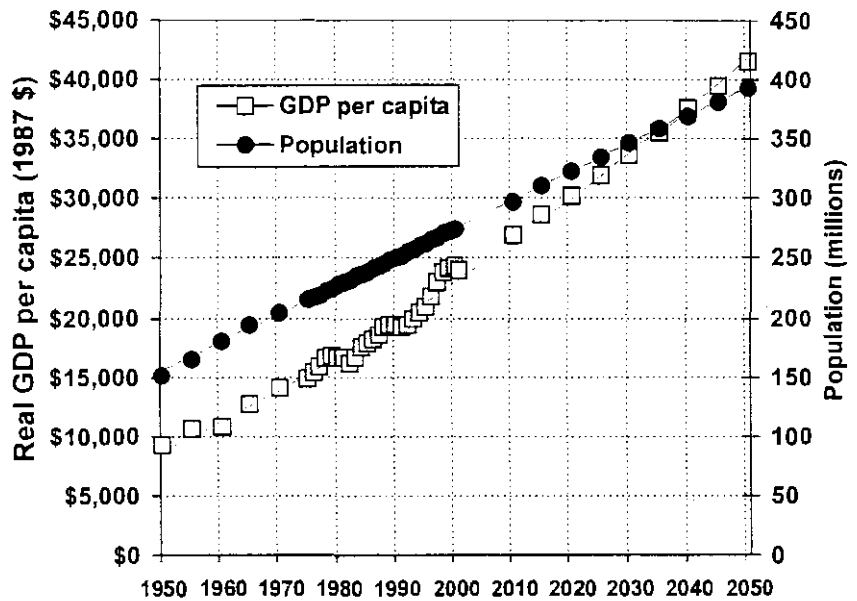


**Figure 4.** — *Historical and projected tonnage of paper and paperboard consumption in the United States, 1960 to 2050 [Historical data: (3); Projections: (2)].*

GDP are projected to increase. Thus, the overall tonnage of paper and paperboard consumption is projected to increase substantially, as shown in **Figure 4**. Paperboard consumption is projected to increase more steadily than paper consumption in the long run, as electronic media are projected to gradually make inroads on markets for communication paper grades.

In recent decades, paperboard consumption increased more rapidly [in percentage terms] than pa-

per consumption, a trend projected to continue beyond the current economic slowdown. Per capita paperboard consumption rose from 243 pounds in 1980 to 337 pounds in 1998, but consumption relative to GDP in 1998 was nearly the same as 1980, at 6.0 tons per million dollars of real GDP (in 1992 dollars). Paperboard demands weakened in the recent economic downturn, but economic recovery is projected to propel paperboard consumption to 350 pounds per capita by 2010 (5.2 tons per million dol-

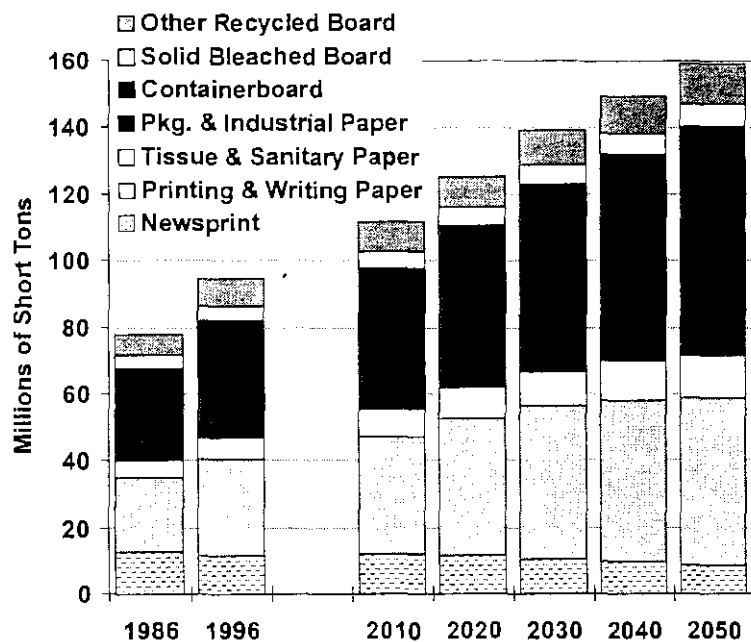


**Figure 5.**— Historical and projected U.S. population and GDP per capita, 1950 to 2050 (2).

lars of real GDP) and 418 pounds per capita by 2050 (4.0 tons per million dollars of real GDP). Per capita paper consumption (excluding building paper) rose from 326 pounds in 1980 to 407 pounds in 1998, but consumption relative to real GDP declined during that period, from 8.0 to 7.3 tons per million dollars of real GDP. Per capita paper consumption receded during the current economic slowdown but consumption is projected to recover to 401 pounds in 2010 and gradually rise to a peak at 414 pounds around 2030, at 4.9 tons per million dollars of real GDP. Paper consumption is then projected to decline slowly to 391 pounds per capita in 2050, at 3.7 tons per million dollars of real GDP.

Domestic demands were analyzed and projected for all categories of paper and paperboard products, such as newsprint, printing and writing paper, tissue and sanitary paper, packaging paper, containerboard, bleached board, and recycled paperboard. Basic growth assumptions for economic determinants of population and per capita GDP are illustrated in **Figure 5**. Domestic demand relationships vary among different commodities with respect to population and GDP, with varying potential for product substitution by electronic media or plastics (7). Thus, projected demand trends vary widely among individual paper and paperboard products.

Per capita newsprint consumption peaked historically at 113 pounds in 1987 and declined to 89 pounds in 1996. Newsprint consumption picked up recently [to around 96 pounds in 1999] but then declined again during the recent economic downturn. Newsprint consumption is projected to be 81 pounds per capita in 2010 and 43 pounds by 2050, reflecting gradual long-run substitution by electronic media. On the other hand, per capita consumption of printing and writing paper has increased, rising from 142 pounds in 1980 to 232 pounds in 1999, boosted by complimentary demands for computer printers, office copiers, and print media. Printing and writing paper consumption is projected to increase but at a decelerating rate of growth, climbing above 250 pounds per capita by 2020 and reaching a peak above 260 pounds around 2030, with gradually declining consumption relative to real GDP. Tissue, toweling, and sanitary paper products increased in per capita consumption from 38 pounds in 1980 to just over 50 pounds in 1999, and consumption is projected to increase modestly throughout the projection period, reaching more than 60 pounds per capita by 2050. Consumption of unbleached kraft packaging paper is projected to gradually recede, reflecting continued substitution of paper by plastic bags, although not declining so rapidly as in the past 2 decades.



**Figure 6.-** Historical and projected U.S. consumption of paper and paperboard by principal commodity category, excluding building paper [Historical data: (4); Projections: (2)].

For paperboard commodities growth trends are more consistently upward. Per capita consumption of containerboards [linerboard and corrugating medium] climbed from 166 pounds in 1980 to 246 pounds in 1999 (+48%). Per capita consumption of all other grades of paperboard [other recycled paperboard and bleached paperboard] plus building paper was at 101 pounds in 1999, slightly above consumption levels of the 1980s but slightly below consumption levels of the 1960s and 1970s. With projected economic expansion in the base scenario, per capita containerboard consumption is projected to reach 256 pounds by 2010 and 324 pounds in 2050, while consumption relative to real GDP is projected to gradually recede over the projection period. Other paperboard and building paper consumption is projected to remain at around 100 pounds per capita throughout the projection period. **Figure 6** illustrates projected consumption of paper and paperboard in total and by commodity category.

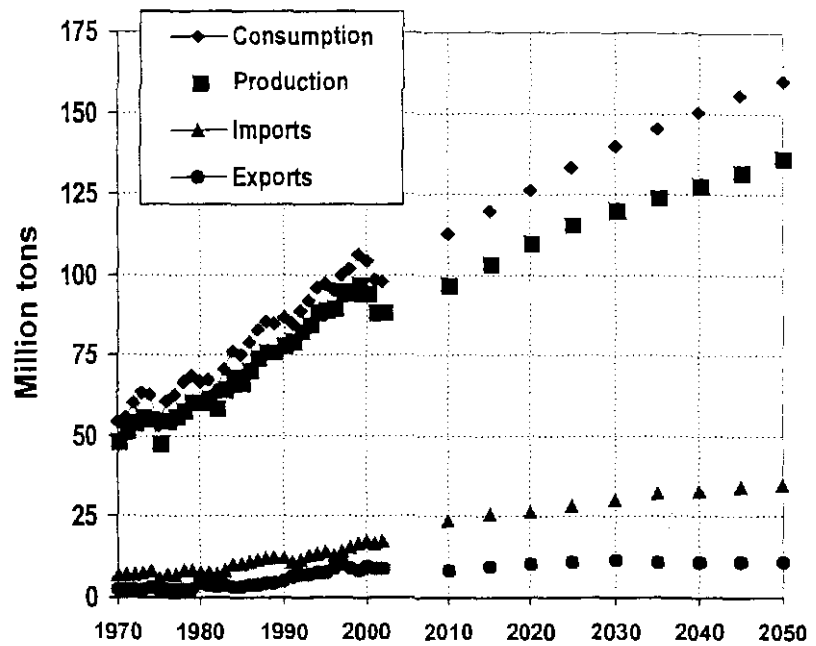
It can be noted that total U.S. paper and paperboard consumption (including building paper) peaked recently in the year 1999, at 104 million tons, and consumption then receded over the next 2 years, to approximately 97 million tons by 2001. Following the current economic slowdown, U.S. paper and paperboard consumption is projected to reach 113 million tons in 2010 and 160 million

tons by 2050, alongwith projected increases in U.S. population and per capita GDP. Population, economic growth, and end-use assumptions drive the demand projections. However, because of decelerating demand growth and a higher base level of demand, the projected annual increase in tonnage over the next 50 years is just 0.8 percent, less than one-third the average growth rate from 1960 to 1999 (2.8%).

### Production and Trade Outlook

U.S. production of paper and paperboard peaked along with consumption in the year 1999, and by 2001 production had declined by 8 percent on an annual basis. Production is projected to recover in the current decade and increase in the decades ahead. However, trade consequences of currency imbalances are projected to persist. **Figure 7** shows projected trends in U.S. paper and paperboard production, consumption, and trade.

As of early 2003 the dollar was still exceptionally high in value relative to the broad spectrum of global currencies (although weakening relative to the euro). Global economic growth had slowed appreciably, yet the U.S. economy was in the early stages of recovery and was generally expected to lead in global economic recovery during the current decade. Nevertheless, U.S. paper and paperboard capacity



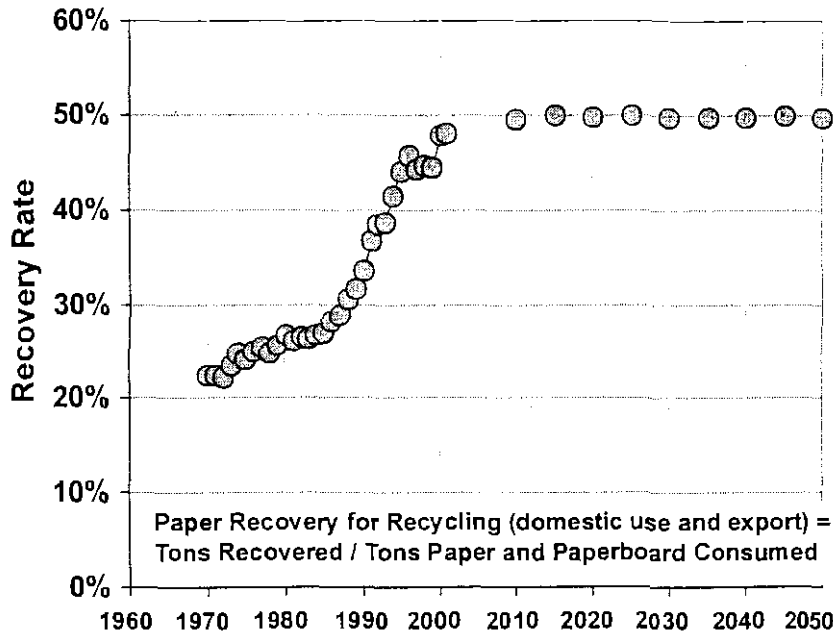
**Figure 7.** —Historical and projected U.S. paper and paperboard consumption, production, and trade, including building paper [Historical data: (4); Projections: (2)].

was receding with numerous mill closures and substantially reduced levels of capital investment. Meanwhile significant expansion was underway in overseas paper and paperboard production capacity, particularly in Asia and also in Europe. In the 2001 RPA outlook, imports of paper and paperboard were assumed to continue gaining market share while only modest growth was anticipated for U.S. paper and paperboard exports, with the bulk of U.S. production continuing to serve domestic consumption (**Fig. 7**).

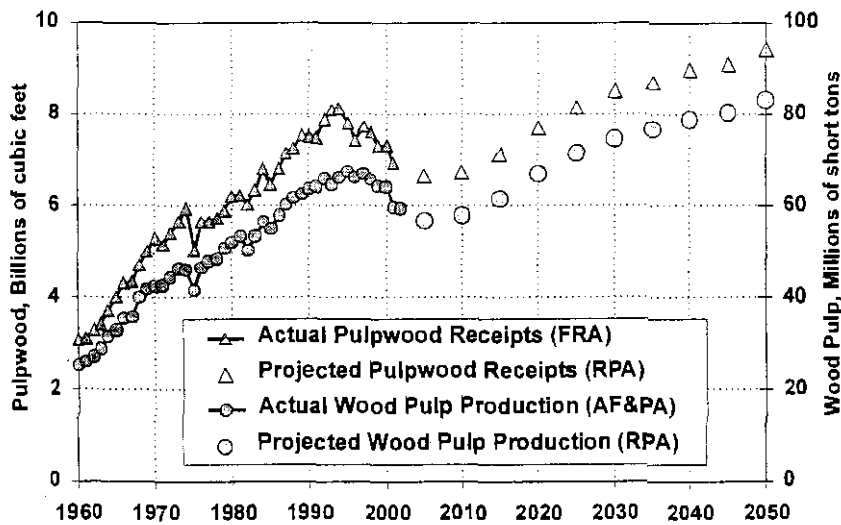
It should be recognized, however, that currency exchange rates and globaleconomic trends are notoriously difficult to anticipate, and thus the assumed trend in paper and paperboard imports is speculative and mainly reflects current and anticipated near-term conditions in competitiveness and trade. The intervention of unforeseen events [such as a significant depreciation in the broad trade-weighted value of the dollar] could significantly alter projected trends (possibly reducing projected annual import levels by 10 million tons or more). Scenarios with such lower import assumptions were run earlier using the RPA assessment models; however, overall results of analysis in terms of pulpwood demand were not significantly different. Reduced imports result in increased domestic production, but the bulk of increased fiber input for production is

met by increased use of recycled fiber (with the projected recovery rate of paper for recycling going up from 50% to near 55%). Thus, lowering of projected imports would not result in substantially higher projected demand for pulpwood. Figure 8 shows RPA projections of the U.S. paper recovery rate for recycling, indicating a leveling off at around 50 percent recovery.

As noted earlier, U.S. production of wood pulp and pulpwood receipts at U.S. wood pulp mills both peaked in the mid-1990s) with slower growth partly the result of rapid increase in recycled fiber use. More recently, since the mid-1990s, the leveling out of pulp, paper, and paperboard exports and the broader economic downturn in 2000 and 2001 impacted wood pulp production and pulpwood receipts. By 2001, U.S. wood pulp production was down by roughly 12 percent since the peak of the mid-1990s (1), while pulpwood receipts at wood pulp mills were down by 15 percent (6). Although downward trends in wood pulp production and pulpwood receipts are projected to turn around in this decade, along with the projected upturn in paper and paperboard output, recovery is projected to be gradual for wood pulp production and pulpwood demand, with modest future gains in paper recycling. **Figure 9** shows historical and projected trends



**Figure 8.**— Historical and projected US recovery rate of paper and paperboard for recycling [Historical data (3), Projections].



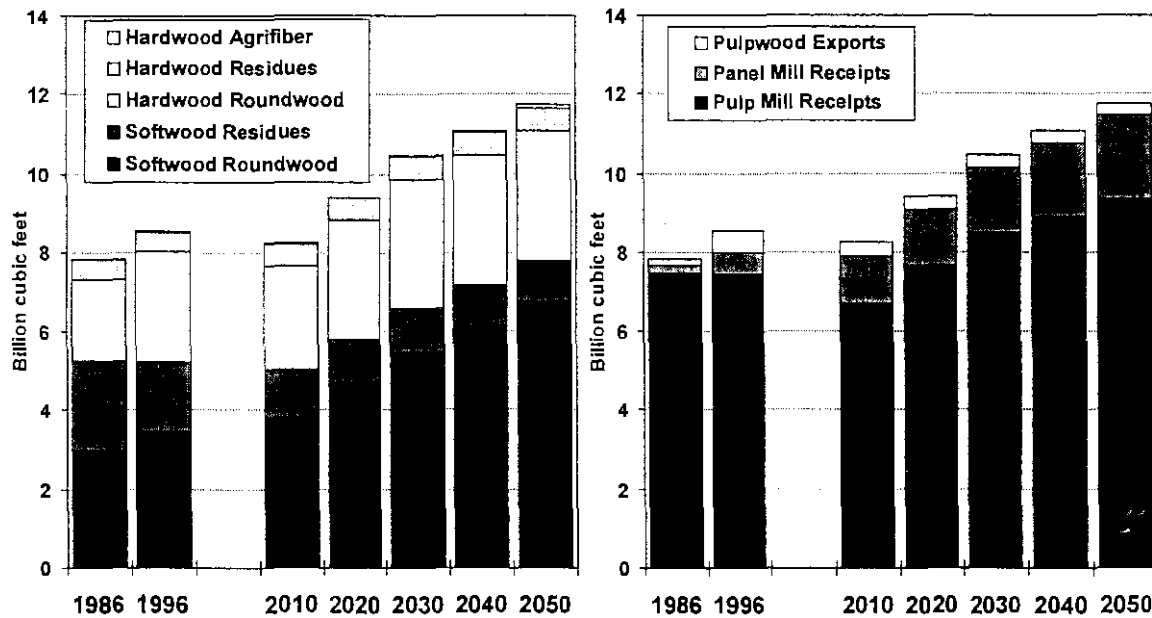
**Figure 9.**— Historical and projected U.S. pulpwood receipts at wood pulp mills and wood pulp production [Historical data: (5) for pulpwood receipts and (3) for wood pulp production; Projections: (2)].

in U.S. wood pulp production and pulpwood receipts at wood pulp mills.

### Fiber Demand and Supply Outlook

The fiber demand and supply outlook was determined by projected market equilibrium between fiber demands and fiber supply, with underlying forest management assumptions such as trends in the area of managed plantations, timber productivity, and overall area of forestland available for timber harvest, by ownership: and by region. Recycled

fiber supply, pulpwood trade, and potential future fiber supply from agricultural short-rotation woody crops were included with conventional pulpwood supply in the projected market equilibrium. In general, the analysis indicated that projected future expansion of paper and paperboard production would be based primarily on increased supplies of fiber from softwood pulpwood [primarily Southern pine] and increased use of recycled fiber from recovered paper (although the rate of recovery is projected to level off).



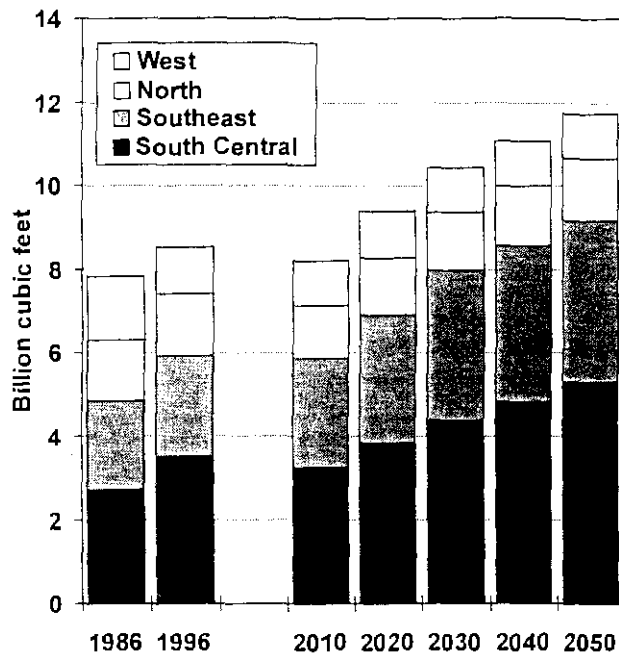
**Figure 10.**— U.S. pulpwood supply and demand balance, including roundwood and residue receipts at wood pulp mills, roundwood receipts at wood panel mills, and exports.

**Figure 10** illustrates the projected balance between nationwide supply and demand for pulpwood, including roundwood and residue used at wood pulp mills and roundwood used at composite wood panel mills such as oriented strandboard (OSB) mills. The significant role of softwood roundwood can be observed on the supply side, where softwood roundwood (primarily southern pine from managed pine plantations) accounts for the bulk of projected increases in pulpwood supply. Mill residues are projected to continue declining in supply, with projected gains in lumber and plywood recovery efficiency and expansion of wood panel products (such as OSB) that do not generate wood residues. Fiber from short-rotation tree crops on agricultural land such as hybrid poplars (hardwood agrifiber) is not projected to make significant inroads on nationwide pulpwood supply until the very end of the projection period.

On the demand side, the impact of the downturn in pulpwood receipts at wood pulp mills since the mid-1990s is apparent, although partly compensated by increases in roundwood demand at OSB mills. Pulpwood exports were projected to remain lower than historical peaks of the 1990s, as overseas pulpwood plantations expand. Pulpwood imports

are a negligible share of domestic receipts, and imports were not projected to increase in the future. It was recognized that pulpwood can be grown at low cost in other regions (such as in eucalyptus plantations of Latin America for example), but transportation cost differentials favor alternative domestic supply sources (e.g., hardwood agrifiber), and thus pulpwood trade was not projected to play a significant role in pulpwood demand or supply (although pulp and paper product imports were projected to increase).

Regionally, pulpwood demand and supply is projected to expand primarily in the South, and primarily on the basis of softwood roundwood supply from southern pine plantations, although even in the South it will take at least a decade to fully recover from the recent downturn in pulpwood demand. **Figure 11** shows projected pulpwood demand and supply by region. Only modest increases in demand and supply are projected in the North (Northeast and North Central regions combined) and in the West, where pulpwood supply and demand has receded since the 1980s. The projected minimal expansion in production capacity for wood pulp and OSB in the West implies only very limited potential for expansion of chip and pulp log markets in that



**Figure 11.** — U.S. regional pulpwood demand and supply, including roundwood and residue receipts at wood pulp mills, roundwood receipts at wood panel mills, and exports.

region. Millions of acres of densely overstocked timber stands in the United States are in need of thinning to reduce fire hazard, particularly on public lands in the West, but accumulating volumes of small-diameter timber dwarf regional capacities to expand harvest and use of such timber.

Looking toward the future, only modest expansion in the area of managed timber plantations is sufficient to meet the bulk of projected growth in U.S. wood-fiber demands for decades to come. In the RPA outlook, managed pine plantations in the South are projected to increase from around 25 million acres in mid-1990s to 40 million acres by 2050, yet managed plantations are projected to occupy just a small fraction of timberland area (less than 10% nationwide and about 20% southwide by 2050). The projected expansion in timber output from managed plantations exceeds projected growth in total U.S. timber demand.

The analysis projected that equilibrium stumpage prices for pulpwood will remain in real terms at levels in the vicinity of 2002 price levels for several decades, substantially lower than real price peaks of the mid-1990s. A gradual upturn in real prices for pulpwood stumpage is projected beyond 2020, particularly for hardwood pulpwood, as hardwood prices are eventually projected to exceed peak levels of the mid-1990s. Hardwood agrifiber (short-rot-

tion wood fiber crops on agricultural land) is projected to become commercially feasible, but only limited expansion of supply is projected beyond 2030. Real stumpage prices for softwood pulpwood were not projected to return to historical peak levels of the mid-1990s, and are projected to remain closer to historical lows of the mid-1980s.

### Summary and Conclusions

Profound changes have affected U.S. wood-fiber markets since the late 1980s including substantial increases in paper recycling, weakened competitiveness in global pulp and paper markets with exceptional currency imbalances, mill closures and capacity reductions with industry consolidation, and most recently a broad downturn in U.S. industrial production, business activity and advertising, with associated declines in demands for paper and paperboard. An upturn in U.S. industrial production appeared underway in 2002 along with an upturn in paper and paperboard production, but the upturn was likely to be gradual and uneven, as the global economy was experiencing a generalized economic slowdown. The 5th RPA Timber Assessment projected gradual recovery for paper and paperboard demand and production in the current decade, based on population and economic growth assumptions, although the recent downturn has profoundly im-

pacted the wood-fiber supply and demand outlook U.S. wood pulp production and domestic pulpwood receipts at wood pulp mills are not expected to fully recover to mid-1990s peaks until 2010 or later.

A primary conclusion at present is that projected growth in U.S. wood-fiber demand appears to be economically sustainable for decades to come, taking into account recognized shifts in product markets, international trade, and production technology, along with improvements in forest productivity. The bulk of future increases in timber harvest come from a relatively small share of timberland area, which consists of managed plantations, accounting for less than 10 percent of the projected timberland area nationwide by 2050 (and about 6% of total forestland area when parks, wilderness reserves, and non-commercial forest land areas are taken into account). The analysis thus points to a future of adequacy in domestic wood-fiber resources, not impending scarcity, a sustainable future in terms of wood use, in which the vast majority of forestland area will not experience significant increases in intensity of timber harvest. This conclusion, however, should be viewed as a working hypothesis that must continue to be examined and tested periodically as new data, new insights, and new market trends emerge. Future research in this

area should focus on the context of economic modeling on the issues of demands for paper and paperboard products, competitiveness and trade, and new fiber needs and supply options.

### References

1. American Forest & Paper Association (AF&PA). 2001. Statistics of Paper, Paperboard & Wood Pulp. AF&PA: Washington DC. 82 p. [and Monthly Statistical Summary].
2. Haynes, Richard W., tech coord. 2003. An analysis of the timber situation in the United States: 1952-2050. Gen. Tech. Rep. PNW-GTR-560. Portland, OR: USDA, Forest Service, Pacific Northwest Research Station. 254 p. <http://www.fs.fed.us/pnw/pubs/gtr560/>.
3. Ince, Peter J. 1994. Recycling and Long-Range Timber Outlook. USDA Forest Service. Gen. Tech. Report RM-242. Rocky Mountain Forest and Range Experiment Station: Fort Collins, Colorado. 23 p.
4. Ince, Peter J. 2002. Pulpwood Supply and Demand. Journal of Forestry. Society of American Foresters: Bethesda, Maryland. 100(2):20-Z5.
5. Ince, Peter J. 2002. U.S. wood fiber supply: Steady and secure. Solutions! for People, Processes and Paper (TAPPI). Technical Association of the Pulp and Paper Industry: Atlanta, Georgia. June pp. 40-44.
6. Forest Resources Association. 2002. Annual Pulpwood Statistics Summary Report. Forest Resources Association: Rockville, Maryland. Report 02-A-4. 38 p.
7. Zhang, Ybing. 1995. Analysis of Demands for Paper and Paperboard Products in the United States. Ph.D. Dissertation. Univ. of Wisconsin, Department of Forestry: Madison, Wisconsin.

Ince, Peter J. 2003. U.S. wood fiber demand and supply outlook. In: The long-term outlook for U.S. timber and forest products, findings and implications from the USDA Forest Service 5th RPA Timber Assessment. Madison, WI: Forest Products Society: 17-28.