

U.S. Hardwood Fiber Demand and Supply Situation: Globalization and Structural Change

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ABSTRACT

This paper reviews demand and supply trends for hardwood fiber in the United States. The objective is to illustrate nationwide shifts in demand and supply and show how the hardwood pulpwood market reacts to those shifts at a regional level. Thus, the market situation is illustrated using an economic rationale, and trends are projected under assumptions about future shifts in demand and supply. Results indicate the market is recovering from a major structural shift in demand, a downturn over the past decade driven by economic globalization, and also by increased paper recycling since the 1980s. Another long-run demand-side influence is expansion of hardwood fiber use at oriented strandboard mills. On the supply side, hardwood timber inventories are large but timber growth rates are relatively low (compared with softwoods). Hardwood resource ownership is increasingly diverse, and investment in hardwood resource productivity is fairly limited. Investment in short-rotation hardwood fiber crops could play a larger role in the future, but that potential appears to depend on the U.S. trade outlook and future growth in pulp and paper demand. In the interim, supply-side factors such as weather and precipitation combine with business cycles on the demand side to determine short-run market behavior.

INTRODUCTION

The hardwood pulpwood market in the United States is subject to long-run and short-run shifts in demand and supply. Notable long-run shifts in demand include a structural shift in wood pulp production over the past decade, largely associated with economic globalization in recent years but also associated with increased paper recycling since the 1980s. Another long-run shift in demand is expanded use of hardwood pulpwood in oriented strandboard (OSB). Long-run shifts in supply include historical expansion of nationwide hardwood timber inventories, mostly in natural mixed hardwood forests, with relatively little investment (compared with softwoods) in intensive silviculture or productivity (such as intensively managed hardwood fiber plantations). Other long-run shifts in the hardwood resource include increasingly diversified forest resource ownership (more forest landowners) and greater attention to environmental stewardship in forest management. Short-run factors on the demand side include business cycles for pulp, paper, and OSB, characterized by fluctuations in capacity utilization, prices, and economic surplus (or profitability). Short-run market factors on the supply side include weather, which combines with environmental stewardship to limit harvesting (and supply) during periods of high rainfall.

STRUCTURAL SHIFTS IN WOOD PULP PRODUCTION

Pulpwood consumption at wood pulp mills closely follows wood pulp production, as indicated by close correlation between pulpwood receipts and wood pulp output at U.S. wood pulp mills. Figure 1 illustrates trends since 1960 in pulpwood receipts at U.S. pulp mills [1,2] and total U.S. wood pulp production, including dissolving pulp and pulp for construction paper and board (from [3,4] and Forest Service estimates¹). Given the close correlation, it is logical to project that future consumption of pulpwood at wood pulp mills will follow trends in wood pulp production. Figure 1 shows Forest Service projections of pulpwood receipts at U.S. wood pulp mills in relation to projections of U.S. wood pulp production.²

Beyond correlation between pulpwood demand and wood pulp production, the most notable aspect of the trends shown in Figure 1 are the long-run structural shifts that occurred in both wood pulp production and pulpwood receipts. Those shifts included a downward shift in growth that occurred following the so-called energy crisis of the

¹ Production of Dissolving Pulp since 1990 estimated by Forest Service at 85% of production capacity.

² Preliminary projections developed in May 2005 using the North American Pulp and Paper Model (NAPAP Model) for the Forest Service 2005 RPA Assessment Update (draft). NAPAP Model methodology is described by Zhang et al. [5].

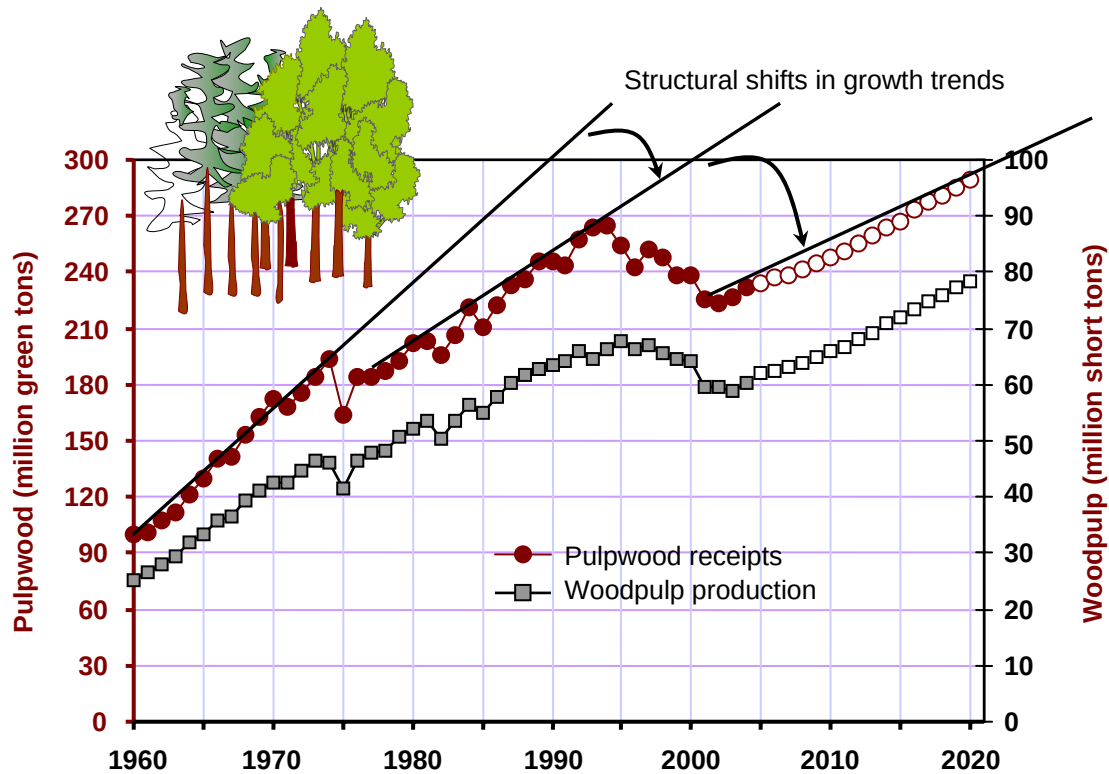


Figure 1. Pulpwood receipts at U.S. wood pulp mills, 1960–2004 [1,2], and U.S. wood pulp production, 1960–2004 (from [3,4,] and Forest Service estimates¹), with NAPAP model projections from 2005 to 2020.

early 1970s, and a larger and more prolonged downward shift in growth that occurred over the past decade following the recent peak of U.S. wood pulp output in 1995. Both downward shifts reflect broader structural changes in the overall economy. Increased recycling and more recently economic globalization were primarily responsible for the downturn in wood pulp production over the past decade, as pulp and paper production was downsized amid rising imports and foreign capacity expansion. However both wood pulp production and pulpwood consumption were on the increase again in 2004, up by over 2% [2,4]. Both are projected to continue increasing but at slower growth rates than in the past.

GLOBALIZATION AND STRUCTURAL CHANGES IN DEMAND

Hardwood pulpwood demand in the United States experienced structural changes during the past decade, primarily associated with economic globalization in recent years but also associated with other structural changes in demand such as increased paper recycling. Economic globalization contributed to a downturn in overall U.S. industrial production from 1999 to 2003 and to a related downturn in paper and paperboard production, although production was recovering by 2004. In addition, from the late 1980s to mid-1990s, significant expansion in paper recycling shifted growth in fiber demand from wood pulp to recycled fiber and contributed to a peaking of pulpwood consumption in the mid-1990s. Hardwood chip exports also experienced a significant downturn over the past decade associated with global expansion in hardwood fiber plantations. Declining exports and declining growth in pulpwood demand at wood pulp mills were partially offset by growth in pulpwood use at OSB mills. Nevertheless, the prospect of cost competition with large new pulp mills in Asia and Latin America tends to dampen prospects for growth in U.S. wood pulp production, pointing to trade assumptions as key determinants of future U.S. pulpwood demand.

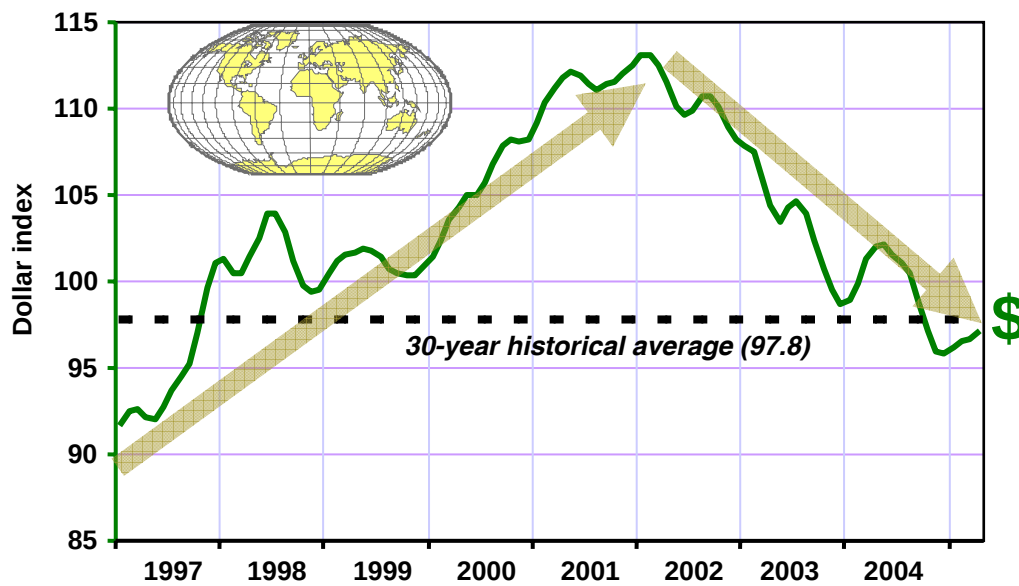


Figure 2. Real broad trade-weighted U.S. dollar index, 3-month average, 1997–2005 [6].

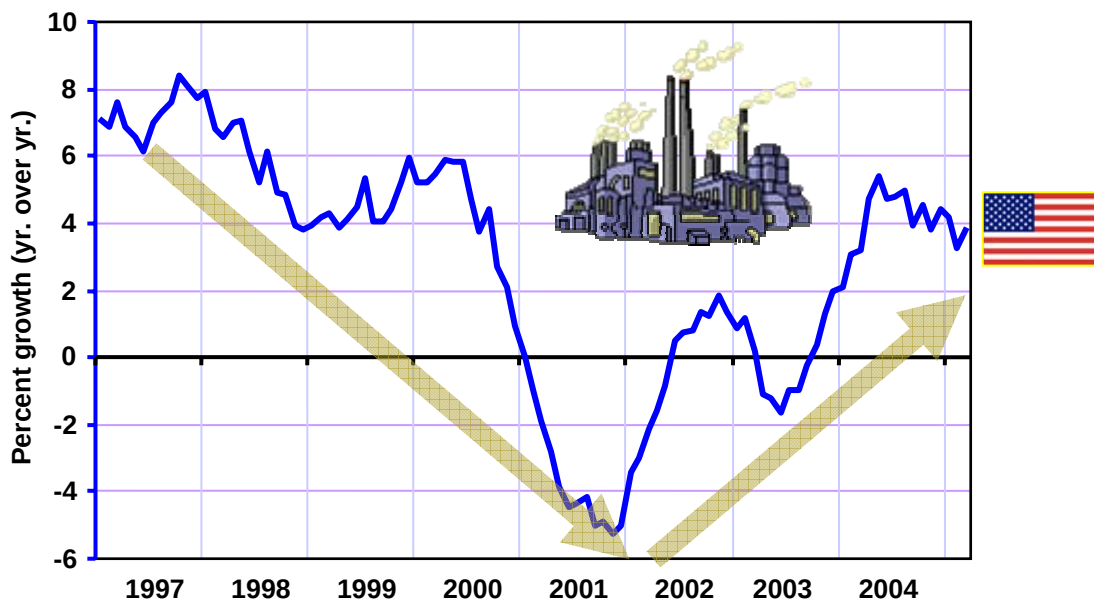


Figure 3. Growth in U.S. Industrial Production Index, monthly year-over-year basis, 1997–2005 [7].

Economic Globalization

Figures 2 and 3 illustrate some key elements and consequences of economic globalization in recent years. As shown in Figure 2, the U.S. dollar's real exchange value soared well above its historical average from 1997 into the first half of the current decade, reaching a peak early in 2002, at a time when expanding global trade was sharply influencing trends in U.S. industrial output.

As shown in Figures 2 and 3, U.S. manufacturers experienced a downturn as the exchange value of the dollar increased. An indicator of economic globalization was that growth in U.S. industrial output declined sharply as the

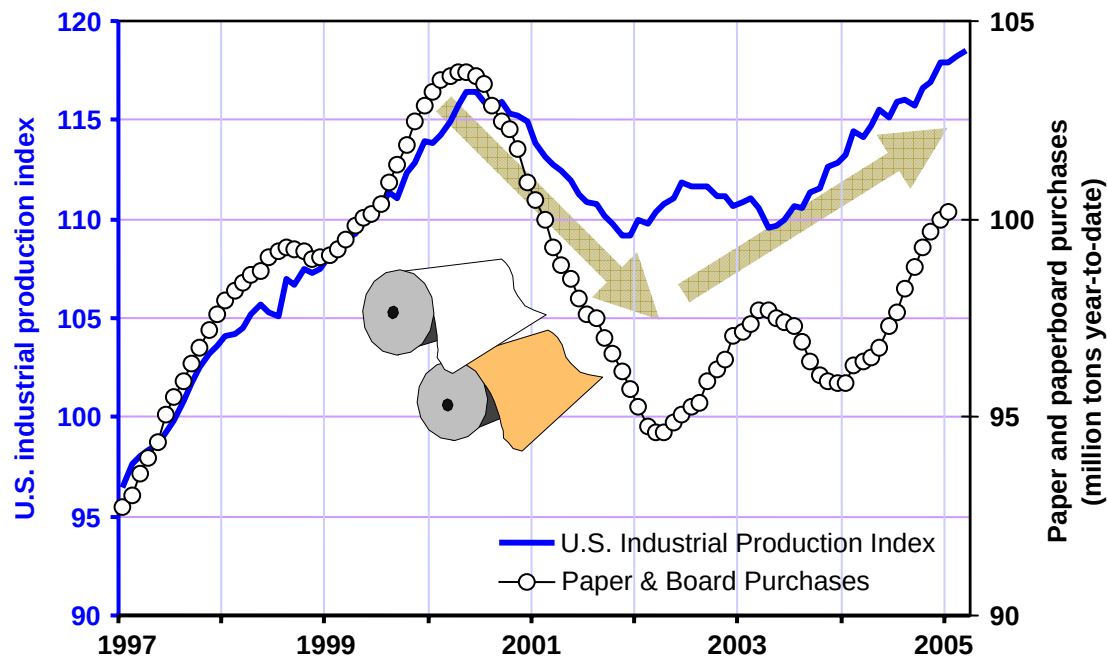


Figure 4. Trends in U.S. paper and paperboard purchases, monthly year-to-date basis [4], and U.S. Industrial Production Index, 1997–2005 [7].

stronger dollar made U.S. manufactured goods more expensive in foreign markets while attracting record imports of goods into the U.S. economy. U.S. imports and the U.S. trade deficit in goods climbed to record levels. However, as the dollar receded since early 2002, dropping below its historical average late in 2004 (Figure 2), a weaker dollar helped improve U.S. manufacturing competitiveness. Consequently growth in U.S. industrial output has more or less increased since 2002 (Figure 3).

As economic globalization impacted U.S. industrial production, U.S. paper and paperboard demand was also impacted. As shown in Figure 4, domestic paper and paperboard purchases peaked in 2000 along with U.S. industrial production and followed a similar downward spiral, eventually leading to a gradual upturn since 2002. Paper and paperboard demand follows industrial production because a large share of paper is consumed by print advertising, catalogs, or print media, supported largely by revenues from advertising of manufactured goods, while similarly a large share of packaging paper and paperboard is consumed for packaging and shipping of manufactured goods. Thus, U.S. paper and paperboard purchases followed overall U.S. industrial production, both heavily influenced in recent years by economic globalization and shifts in the exchange value of the dollar. Since 2002, a weaker dollar, along with consolidation and higher labor productivity, helped to improve U.S. industry competitiveness, leading to an upturn in U.S. industrial output and also paper and paperboard demand, with modest improvement in the pulp and paper trade balance and an upturn in U.S. wood pulp production and pulpwood consumption after years of decline.

Receipts of both hardwood and softwood pulpwood were generally increasing prior to peaking in the 1990s, and thus hardwood pulpwood demand as well as softwood pulpwood demand experienced structural change as pulp, paper, and paperboard production peaked and wavered under the influence of economic globalization. Figure 5 illustrates trends since 1970 in receipts of both hardwood and softwood pulpwood at wood pulp mills in the United States [1,8]. It can be noted that until the mid-1990s, hardwood receipts had been increasing somewhat more rapidly than softwood receipts, rising from 21% of receipts in 1970 to 36% of receipts by the late 1990s. However, since total pulpwood receipts at wood pulp mills peaked in the mid-1990s, the hardwood share of pulpwood receipts leveled out (at 35–36%) and the hardwood share is projected to remain at roughly that level over the next couple of decades. Shifts in the hardwood proportion of receipts can be explained in part by other structural changes in fiber demand that occurred in recent years.

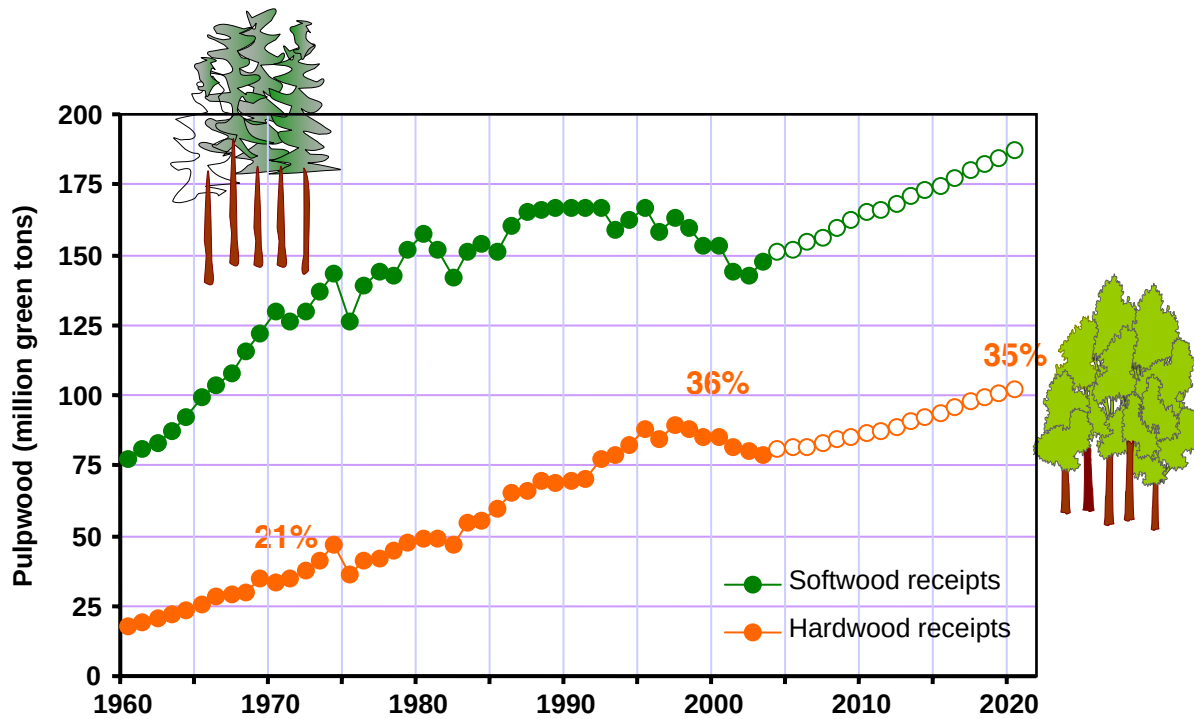


Figure 5. Hardwood and softwood pulpwood receipts at U.S. wood pulp mills, 1960–2003 [1,8], with NAPAP model projections from 2004 to 2020.

Other Structural Changes in Fiber Demand

Beyond the downsizing impacts of economic globalization since the mid-1990s, pulpwood demand was also impacted in recent decades by other long-run structural changes in demand. Those structural changes included increased paper recycling, shifts in pulp, paper and board trade, decreased hardwood chip exports, and increased production of OSB.

Increased recycling. From the mid-1980s to late-1990s, recycled fiber use expanded more rapidly than virgin fiber use, causing a decline in the wood pulp fraction of fiber consumed at U.S. paper and paperboard mills. Figure 6 illustrates trends since 1985 in virgin wood pulp and recovered paper consumption at U.S. paper and paperboard mills. Recovered paper use increased from 24% of total fiber consumed in 1985 to 36% in 1997, while the wood pulp fraction decreased from 76% to 64% of fiber consumption [2]. As total fiber consumption peaked in the late 1990s and then declined under the influence of economic globalization, the rate of growth in recovered paper consumption also declined. After climbing above 36% of fiber consumption in 1997, recovered paper consumption increased very little since the late 1990s (remaining at 37% of fiber consumption in 2004). Whereas economic globalization significantly impacted hardwood pulpwood demand since the mid-1990s, the impact of increased paper recycling was primarily a phenomenon of the late 1980s and early 1990s. The leveling out of recovered paper use since the late 1990s was associated with a leveling out of paper recovery for recycling in the United States and big increases in recovered paper export, mainly to China. Figure 7 shows historical and projected trends in the U.S. paper recovery rate (percentage of paper consumed that is recovered for recycling, both for domestic use and for export).³ The paper recovery rate increased significantly from the 1980s to early 1990s, but that increase began to moderate in the late 1990s, resulting in a characteristic sigmoid growth curve. Escalating tipping fees at landfills were a primary impetus for increased recycling in the 1980s, but escalation of tipping fees moderated by the late 1990s [9]. Another impetus was legislation passed in some states during the early 1990s promoting increased use of recycled fiber, primarily in newsprint.

³ Projection of the recovery rate derived from 2005 NAPAP Model.

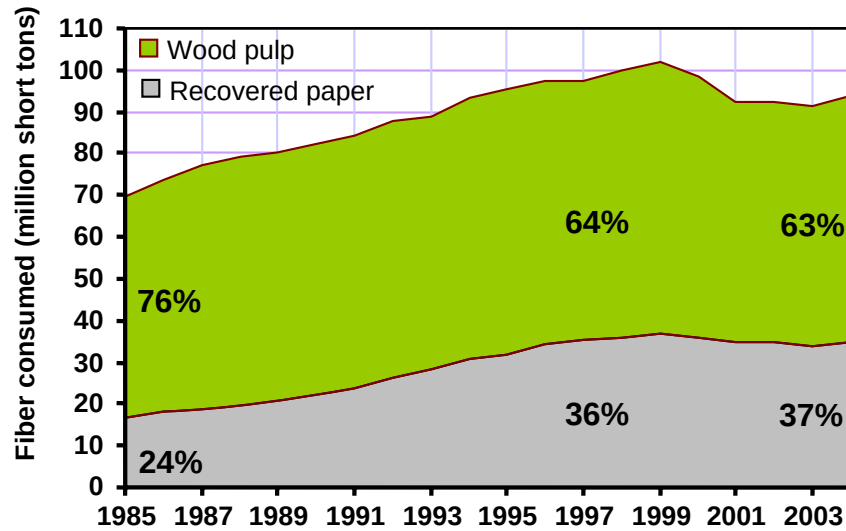


Figure 6. Fiber consumption at U.S. paper and paperboard mills, 1985–2004 [2].

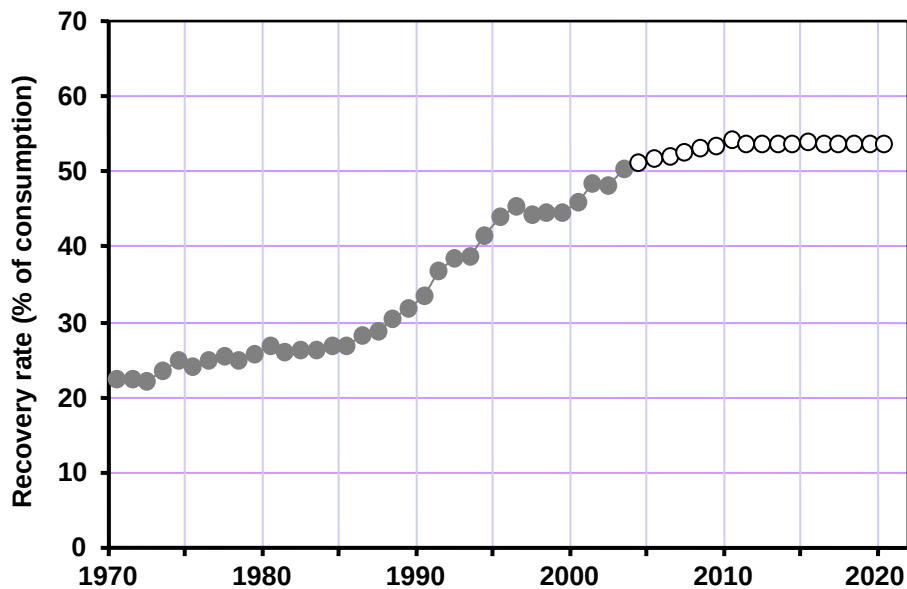


Figure 7. U.S. paper recovery rate for recycling, 1970–2003 historical [3], with NAPAP model projections, 2004–2020.

Although domestic use of recovered paper leveled out in the late 1990s (Figure 6), U.S. export of recovered paper continued to increase, particularly to China. Structural change underway in the global paper industry, particularly rapid expansion in paper production and recycling capacity in China, has driven rapid expansion in demand for recovered paper. Figure 8 illustrates historical and projected trends in U.S. recovered paper exports.⁴ The implication for hardwood fiber demand of the leveling out in the U.S. paper recovery rate (Figure 7) and continued expansion in exports of recovered paper (Figure 8) is that recycling is expected to play a smaller role in offsetting hardwood fiber demand than recycling did in the late 1980s and early 1990s (when recycling contributed to the

⁴ Projections derived from 2005 NAPAP Model.

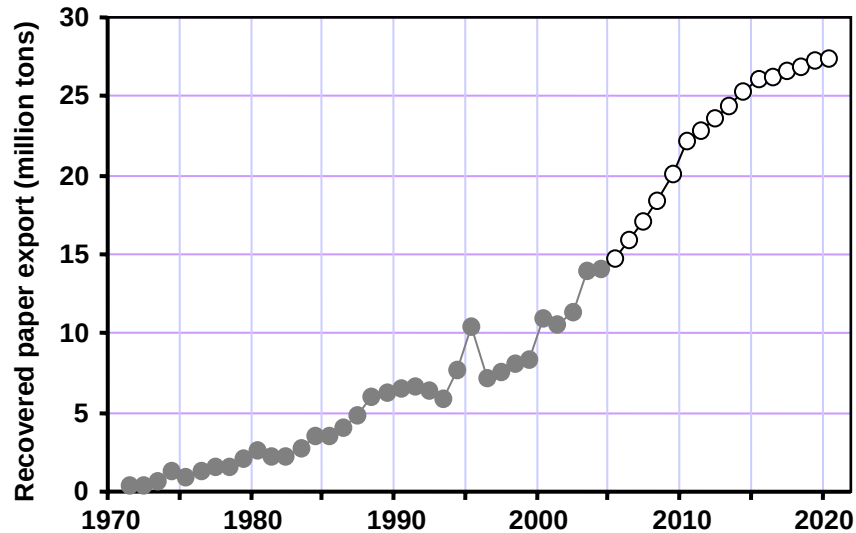


Figure 8. U.S. recovered paper exports, 1970–2004 historical [3,4], with NAPAP model projections, 2005–2020.

leveling out of woodpulp output). These trends also contribute to the projected gradual increase in pulpwood receipts at woodpulp mills (Figure 5).

Pulp, paper and paperboard trade. In the U.S. pulp and paper sector, hardwood fiber tends to be used primarily in printing & writing papers, tissue papers, and corrugating medium, all of which utilize high proportions of hardwood fiber.⁵ Trade volumes for printing & writing papers, however, are much larger than trade volumes for tissue papers or corrugating medium. Thus, logically, globalization and trade exert an influence on demand for hardwood fiber in the United States via shifts in trade and demands for printing & writing paper grades (as well as trade in hardwood market pulp). Figure 9 illustrates historical and projected trends in U.S. consumption, production, imports, and exports of printing & writing paper.⁶

Not only did U.S. printing & writing paper consumption level out since the late 1990s, under the influence of economic globalization, but also exports leveled out while imports increased (trade in market pulp showed a similar pattern, with a rise in imports and decline in exports since the mid-1990s). Projections of printing & writing paper demand suggest relatively stable consumption volume, with declining per capita consumption. Trade projections suggest more modest future growth in imports under the hypothesis that the dollar will not substantially increase in value (as it did during the late 1990s), and recognizing also that the dollar has declined in recent years (Figure 2). Alternatively, under an assumption that the dollar will regain value or that foreign capacity expansion will aim to capture a larger share of the U.S. market, projected imports of printing & writing paper could increase more substantially than shown in Figure 9. The main implication is that future trends in pulp and paper trade (particularly trade in printing & writing paper or market pulp) will influence long-run hardwood fiber demand in the United States.

Hardwood chip trade. There were also significant shifts in U.S. hardwood chip trade in recent years, including a significant decline in exports from the U.S. South, along with expanded interest in importing hardwood chips from South America. U.S. hardwood chip imports increased from 0.7 million green tons in 2003 to 1.7 million green tons in 2004, with imports from Brazil accounting for over 90% of the total [10]. Those developments reflect structural changes in global sourcing of hardwood fiber, particularly expansion of competitive fast-growing hardwood fiber plantations in Latin America, Asia, and elsewhere (growing species such as eucalyptus and acacia). Such fiber plantations have expanded to tens of millions of hectares worldwide in recent decades, offsetting global demand for

⁵ Other paper and paperboard products, such as newsprint, kraft paper, kraft linerboard and bleached board utilize primarily softwood fiber (along with some hardwood fiber and recycled fiber), or utilize exclusively recycled fiber (recycled board for example).

⁶ Projections derived from 2005 NAPAP Model.

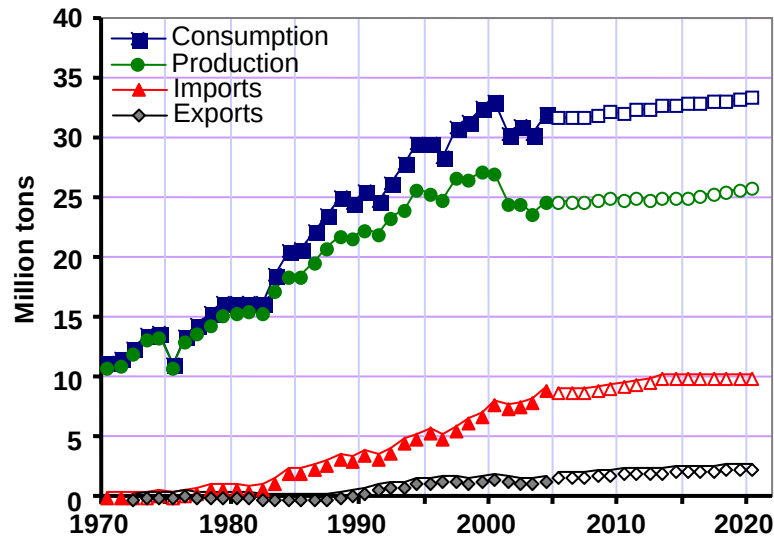


Figure 9. U.S. consumption, imports, and exports of printing & writing paper, 1970–2004 historical [3,4], with NAPAP Model projections, 2004–2020.

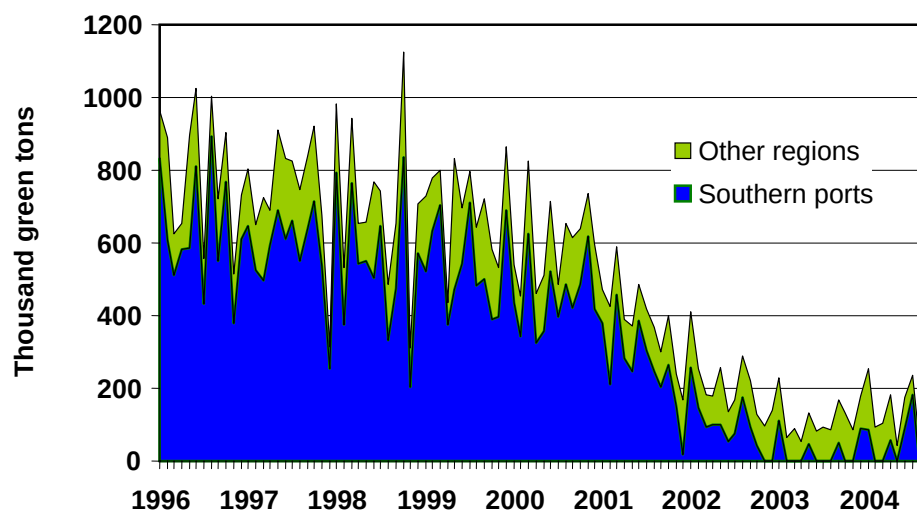


Figure 10. Monthly U.S. exports of hardwood chips from southern U.S. ports and other U.S. regions, 1997–2004 [10].

U.S. export of hardwood chips. Figure 10 illustrates the trend since the mid-1990s in monthly U.S. hardwood chip exports. Hardwood chip exports increased in the past year but are not projected to return to previous peak levels in the foreseeable future (given likely continued global expansion of hardwood fiber plantations).

Fiber demand for OSB

Finally, there has been yet another significant long-run shift in demand for hardwood fiber in the United States, namely expansion in capacity and output of OSB (and other composite panel products). Since its introduction as a structural sheathing material around 1980, OSB mill capacity and output rapidly expanded, with OSB largely displacing softwood plywood as the dominant structural wood panel in U.S. housing construction, while also being used in other engineered wood products such as structural I-joists.

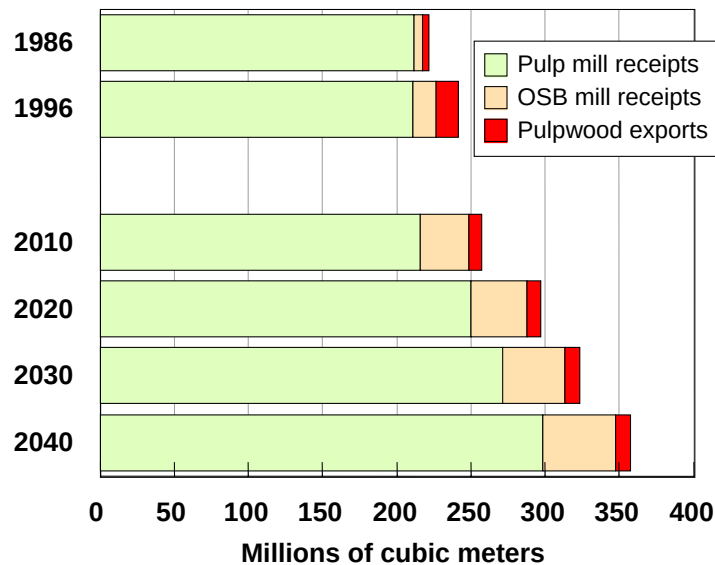


Figure 11. Historical and projected total U.S. pulpwood demand by destination, including pulp mill and OSB mill receipts and pulpwood exports, 1986 and 1996, with NAPAP model projections, 2010–2040.

Precise annual data are not publicly available on the hardwood and softwood fractions of wood use in OSB at the national level, but it is well known that many OSB mills utilize hardwood fiber, particularly lower-density hardwoods such as aspen (used heavily at OSB mills in the U.S. North), as well as softwood species (such as southern pines used at OSB mills in the South). Also, OSB mills tend to use wood raw material that is generally similar if not identical in specification to pulpwood, and thus in effect the expansion of OSB mills has resulted in expansion of pulpwood demand. However, in the past 10 to 15 years, expansion of OSB mill capacity has shifted from the U.S. North to the South and to Canada, likely shifting the growth in OSB fiber demands from low-density hardwoods to other species, including softwoods.

Figure 11 illustrates historical and projected estimates of total U.S. pulpwood demand by destination, including pulpwood receipts at U.S. wood pulp mills, receipts at OSB mills, and pulpwood exports.⁷ Fiber demand at OSB mills expanded more rapidly than fiber demand at wood pulp mills in recent years, but fiber demand for OSB is projected to remain smaller than pulpwood receipts at wood pulp mills. Nevertheless, in some regions the expansion of OSB has had notable impacts on the hardwood pulpwood market, with substantial price increases in particular for hardwood species such as aspen in the U.S. North.

SHIFTS IN PULPWOOD SUPPLY

Figure 12 is a corresponding chart with matching projections of U.S. pulpwood supply by source, including conventional hardwood and softwood pulpwood supply (roundwood from forest harvest and wood residues from wood product mills such as lumber and plywood mills) and pulpwood supply from hardwood agrifiber (an anticipated future source of fiber supply). By the year 2020, supplies of hardwood agrifiber (crops of trees such as hybrid poplars grown on agricultural land) are projected to expand in response to projected shifts in the pulpwood market situation. In the NAPAP model used in our analysis, the trigger for expansion of hardwood agrifiber supply is a projected gradual increase in hardwood pulpwood prices, leading to a point where hardwood agrifiber becomes economically feasible. As hardwood agrifiber supply expands from 2020 to 2040, it is projected to displace conventional hardwood pulpwood supply, including hardwood roundwood from forest harvest. This economic

⁷ Projections derived from 2005 NAPAP Model.

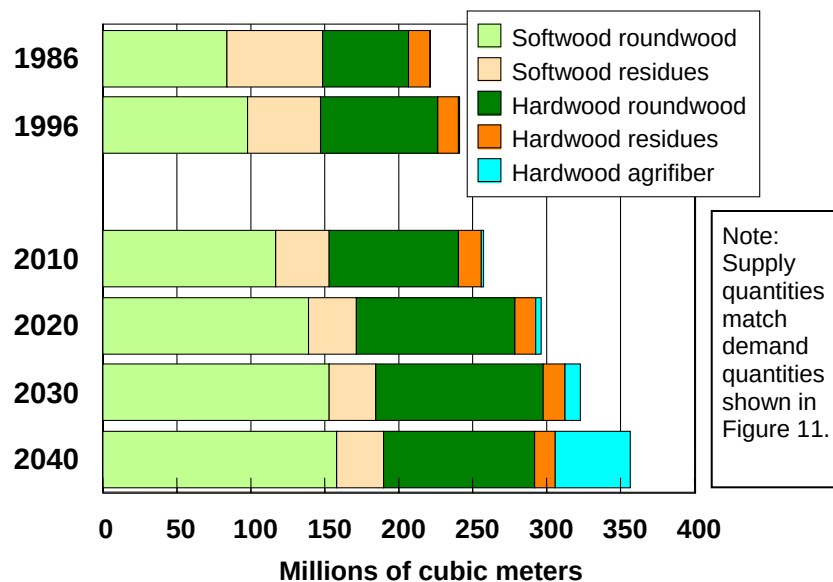


Figure 12. Historical and projected total U.S. pulpwood supply by source, roundwood and residues by species group and hardwood agrifiber, 1986 and 1996, with NAPAP model projections, 2010–2040.

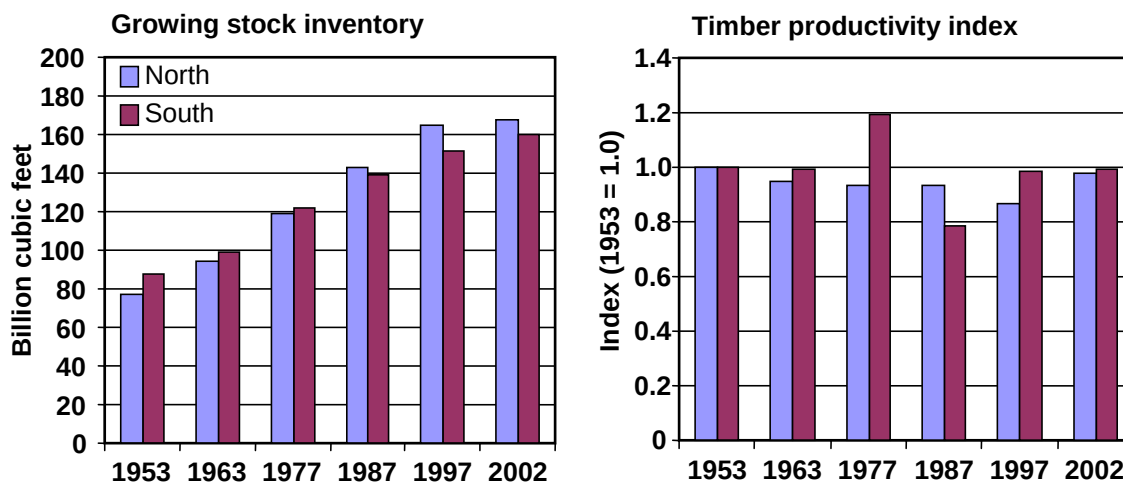


Figure 13. Historical data on U.S. hardwood timber inventory and hardwood timber productivity index (net annual growth per unit of inventory) in eastern U.S. regions, 1963–2002 [14].

outlook depends, however, on the projected market situation and supply-side circumstances that contribute to price increases over time.

Among supply-side circumstances contributing to the propensity for higher hardwood pulpwood prices and projected expansion of agrifiber supply are limited gains in hardwood resource productivity over time and ongoing declines in the area of aspen forest cover types in the U.S. North and upland hardwood cover types in the South. Figure 13 illustrates historical trends in regional standing hardwood timber inventory on commercially available timberland in the eastern United States and corresponding trends in an index of hardwood timber productivity (net annual growth of hardwood timber per unit of timber inventory).

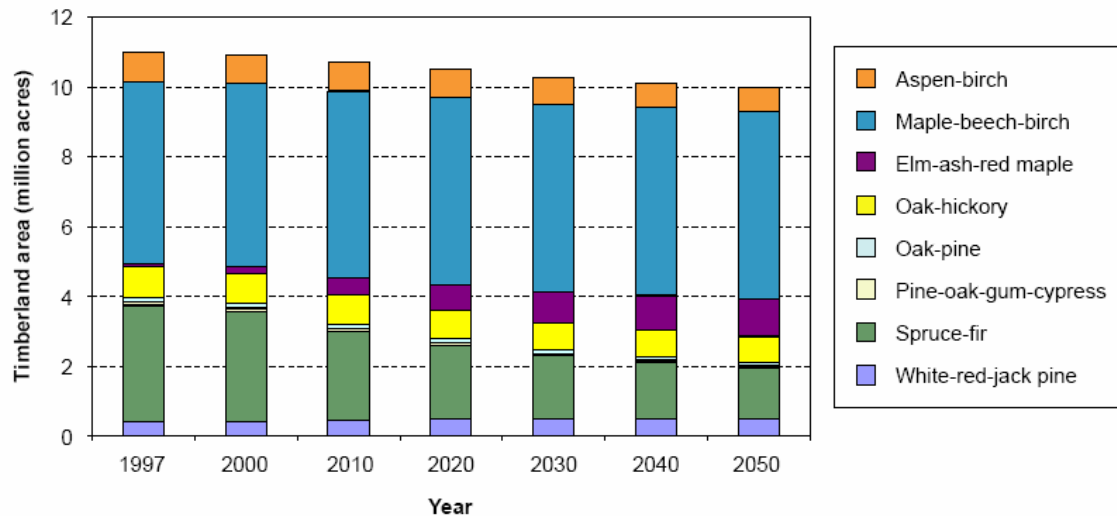


Figure 14. Projected area of forest cover types on forest industry timberlands in the Northeast, 1997–2050 [11].

Over the past 50 years or so, the volume of standing hardwood timber inventory in the eastern United States approximately doubled, not so much because of productivity gains but rather simply because of a surplus of growth relative to harvest. Productivity of hardwood timber (Figure 13) has wavered and not substantially increased. Generally, hardwood forests matured and became denser, and consequently growth leveled out. Investment in hardwood silviculture was also relatively limited compared with softwood silviculture (with more than 30 million acres of managed Southern Pine plantations).

Hardwood forest cover types account for about 80% of total forestland area in the U.S. North, and hardwoods are projected to remain the dominant cover types in the North for decades to come, in both the Northeast and North Central regions [11].

In the U.S. Northeast, hardwood cover types are projected to gain in their share of total area on both forest industry timberland and on non-industrial private timberlands, although there is some debate about whether the area of spruce–fir will actually decline [12,13]. As shown in Figure 14, hardwood forest cover types are projected to gain in area on forest industry lands in the U.S. Northeast, with notable expansion in the higher density species (such as maples), but little expansion is projected in the area of aspen–birch cover types. As shown in Figure 15, hardwood forest cover types are also projected to gain on the much larger area of non-industrial private forestland in the Northeast, but again with little expansion in the area of aspen–birch cover types. Limited regeneration of aspen–birch in the Northeast stems in part from shifts in harvesting practices, with fewer and smaller clear cuts and more partial harvesting, favoring regeneration of slower-growing and shade-tolerant hardwood species.

In the Lake States area of the U.S. North Central region, the total area of hardwood forest cover types on private timberlands is projected to remain relatively constant in the decades ahead, while the area of forest industry land with softwood cover is projected to gradually expand. However, the area of aspen–birch cover type is projected to gradually decline in the Lake States region, in continuation of a recent trend.

Figure 16 shows the projected area of forest cover types on forest industry timberlands in the Lake States, and Figure 17 shows the projected area of forest cover types on non-industrial private timberlands in the Lake States, both projected to experience declines in the area of aspen–birch cover [11].

Notable structural changes projected for hardwood resources in the U.S. North are an increase in the area of elm–ash–red maple cover in the Northeast and a decrease in the area of aspen–birch in the Lake States. The increase in

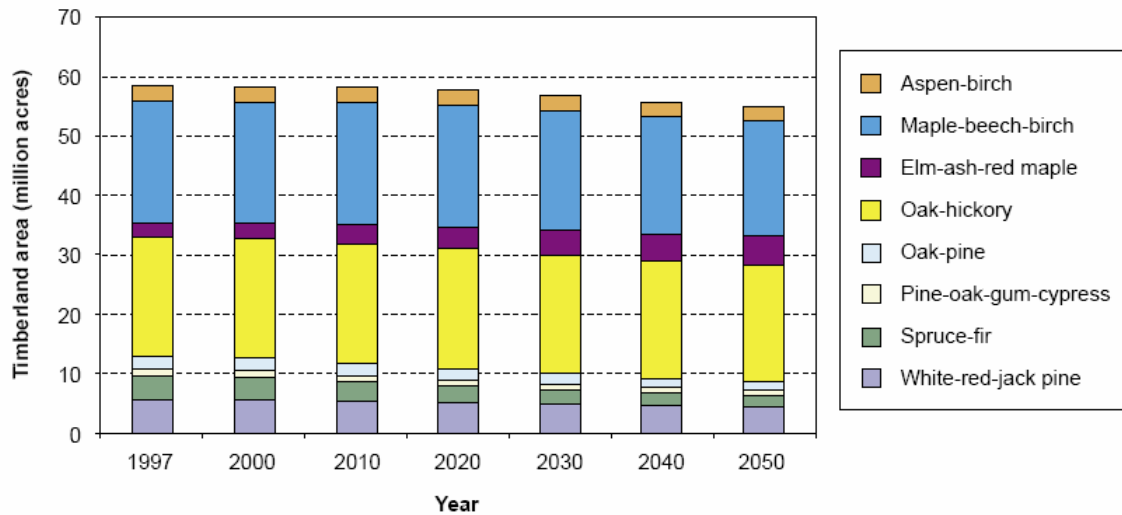


Figure 15. Projected area of forest cover types on non-industrial private forest timberlands in the Northeast, 1997–2050 [11].

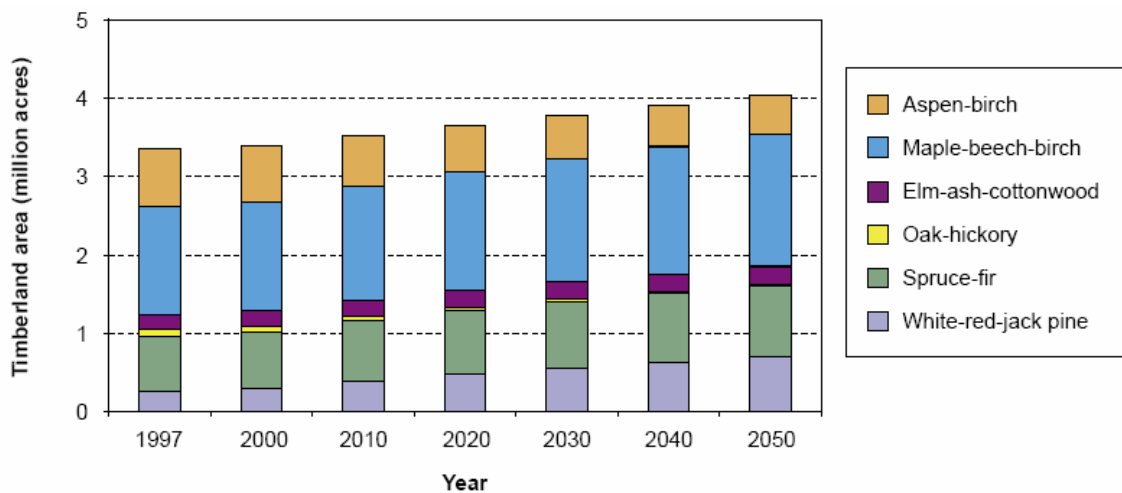


Figure 16. Projected area of forest cover types on forest industry timberlands in the Lake States, 1997–2050 [11].

elm–ash–red maple is primarily due to an influx of red maple. The loss of aspen–birch is a result of insufficient regeneration opportunities for this early-successional forest type [11].

In the U.S. South, the area of hardwood forest cover types on private timberland is projected to decline over the long run, as softwood cover types are projected to expand.

Figures 18 and 19 show projected trends in the area of forest cover types on forest industry lands in the U.S. Southeast and South Central regions. On forest industry lands across the South there is a clear dominance of planted pine, and the area of planted pine is projected to continue increasing at a moderating pace in the decades ahead, while the area of hardwood cover types decline [11]. Notable declines are projected in the area of upland hardwoods and oak types on forest industry lands across the South, in both the Southeast and South Central regions.

The area of non-industrial private timberland in the South is considerably larger than the area of forest industry timberland in the region, and it contains a much larger area of hardwood forest cover types, but the area of

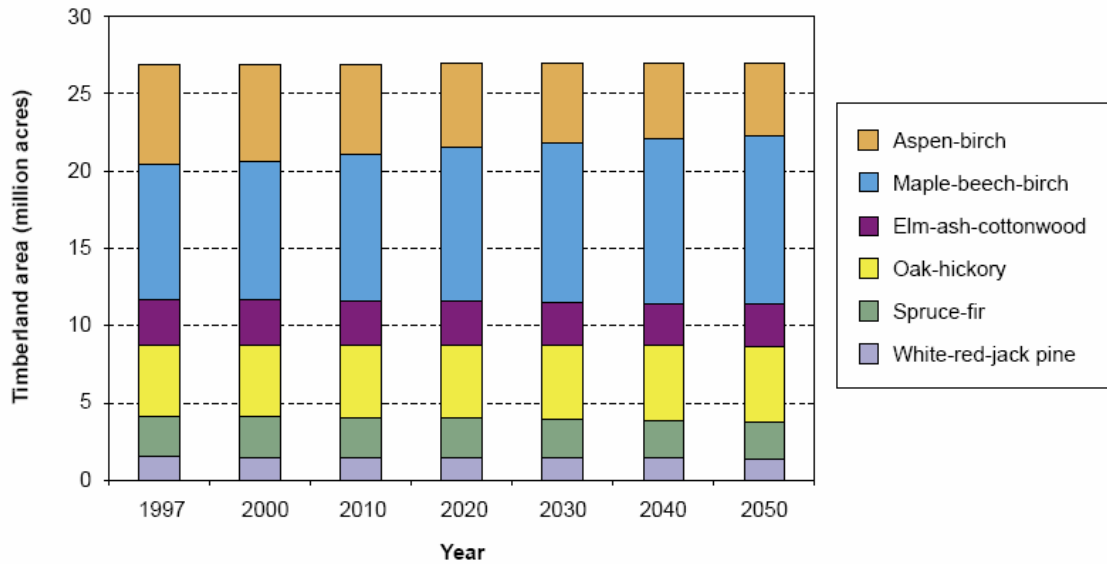


Figure 17. Projected area of forest cover types on non-industrial private forest timberlands in the Lake States, 1997–2050 [11].

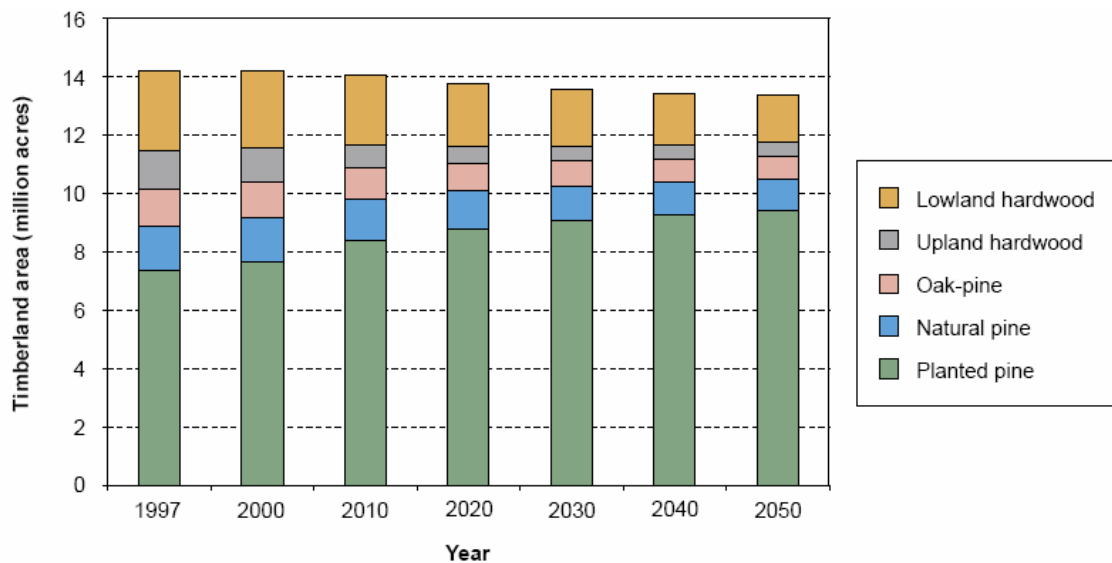


Figure 18. Projected area of forest cover types on forest industry timberlands in the Southeast subregion, 1997–2050 [11].

hardwood forest cover on other private timberland in the South is projected to continue a general declining trend in the future. Figures 20 and 21 illustrate projected trends in the area of forest cover types on other private timberlands in the U.S. Southeast and South Central regions.

Although hardwoods will continue to dominate the forested landscape in the South for decades to come, a notable structural change is the projected decline in area of upland hardwoods, a departure from historical trends in the South. A combination of factors contributes to this change: conversion to other land uses, conversion to pine plantations, and transition to other types, including oak–pine [11].

Implications for long-run hardwood fiber supply can be roughly inferred from recent and projected long-run structural shifts in hardwood resources in the United States. About 90% of the standing hardwood timber inventory

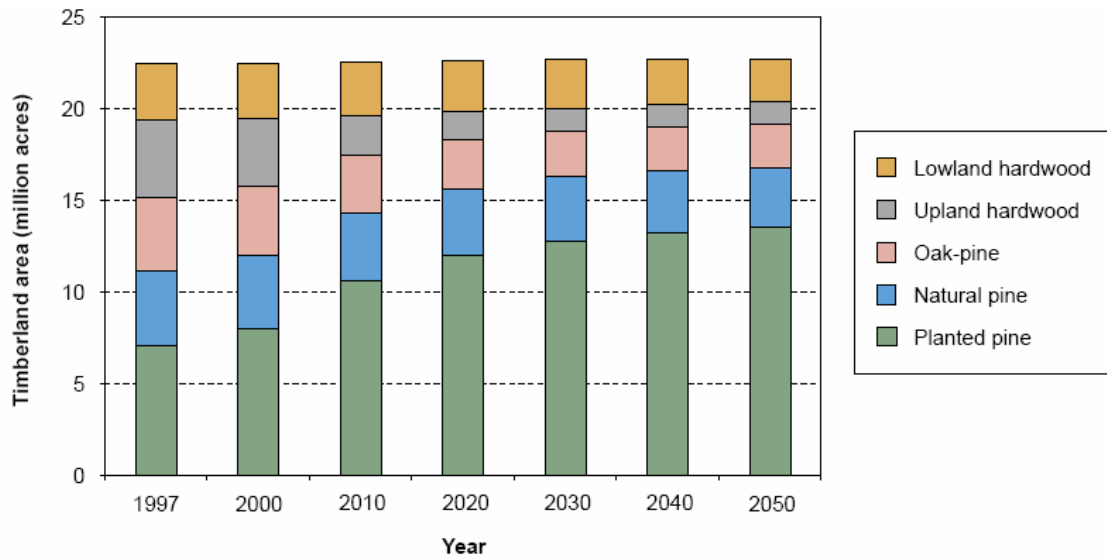


Figure 19. Projected area of forest cover types on forest industry timberlands in the South Central subregion, 1997–2050 [11].

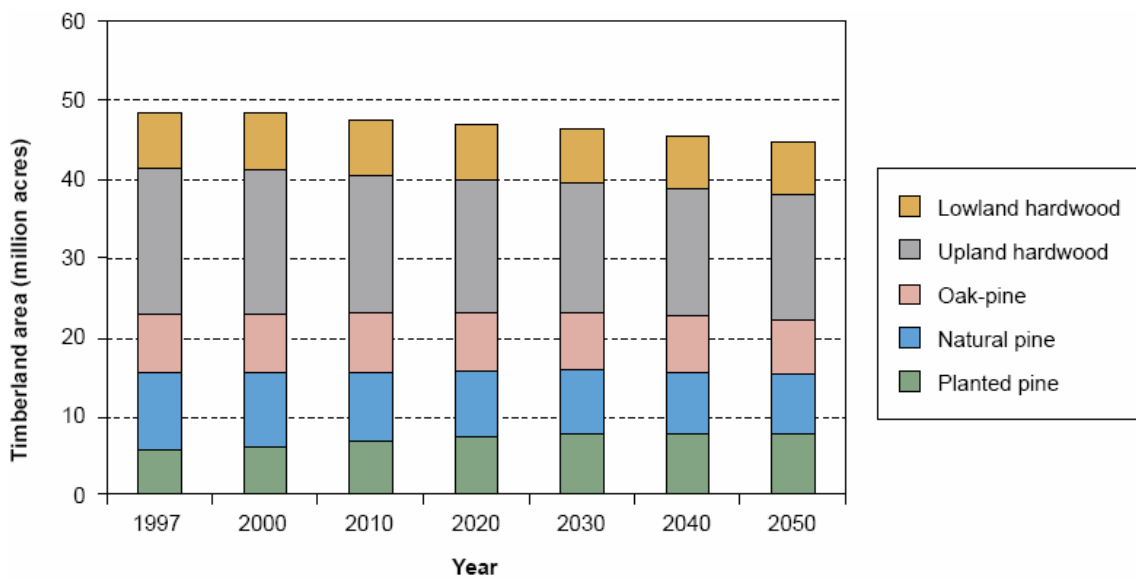


Figure 20. Projected area of forest cover types on other private timberland (non-industrial timberlands, excluding miscellaneous corporate) in the Southeast region, 1997–2050 [11].

of the United States is in the eastern United States (North and South regions combined), while only 10% of the hardwood resource is in the West and tends there to be more scattered and utilized less as a fiber resource [14]. Thus, the hardwood resource trends of the North and South regions are primarily indicative of hardwood fiber supply trends in the United States.

The declining area of aspen–birch cover types, particularly in the Lake States region of the North, along with a relatively flat trend for aspen–birch cover in the Northeast, tends to suggest rather clearly that the supply of aspen–birch fiber will be limited over the long run, a trend that reflects limited regeneration opportunities for the early successional aspen–birch cover type. Waves of aspen and birch regeneration will no doubt continue to mature and enter the fiber market, creating temporal cycles of abundance and scarcity, but the total area of aspen–birch forest cover is declining and becoming more dispersed, and thus the supply of aspen–birch fiber will likely decline or

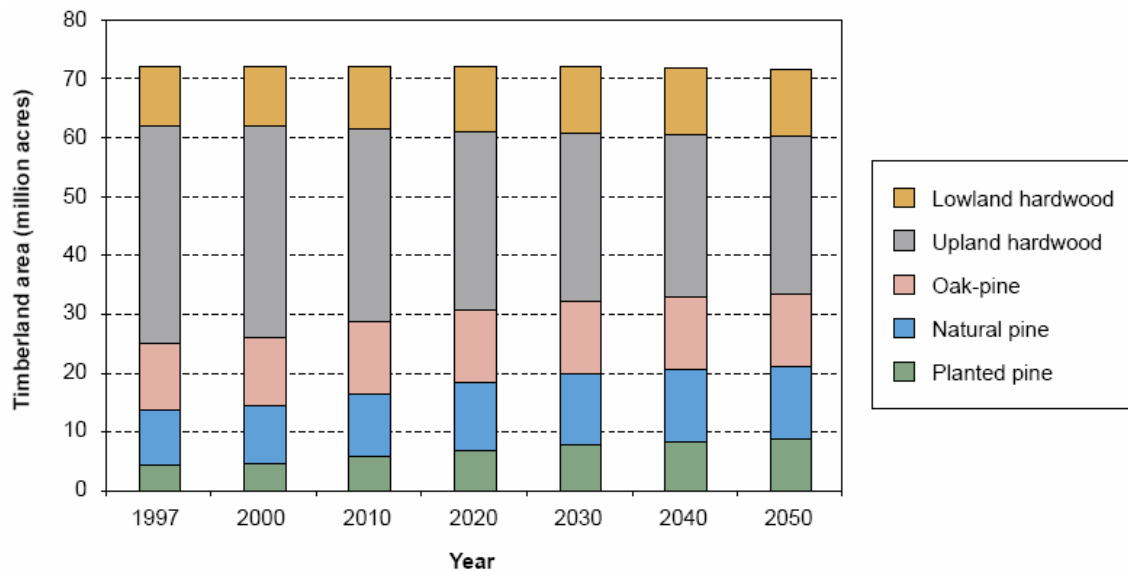


Figure 21. Projected area of forest cover types on other private timberland (non-industrial timberlands, excluding miscellaneous corporate) in the South Central subregion, 1997–2050 [11].

become more expensive over the long run. Indeed, relatively high prices in recent years for aspen pulpwood in the Lake States region suggest that loss of aspen–birch forest cover has already begun to impact the market on the supply side.

The declining area of hardwood cover types in the South, notably the upland hardwoods, similarly tends to suggest that the supply of hardwood fiber in the South will be more limited and gradually more expensive over the long run, particularly given a lack of notable gains in productivity of hardwood resources in the South (Figure 13). Without substantial gains in hardwood resource productivity and with ongoing declines in the area of hardwood forest cover types in the South, it is not surprising that in recent years hardwood pulpwood prices have gained relative to softwood pulpwood prices in the South [15]. By contrast, the relatively high productivity and yield of Southern Pine plantations in the South has contributed to relative abundance in softwood fiber supply. Consequently, whereas decades ago hardwood pulpwood was much cheaper in the South than softwood pulpwood, the prices per unit volume for hardwood have increased and roughly matched softwood prices at times in recent years, and hardwood pulpwood prices (per cord) are currently higher in the South than softwood pulpwood prices on a delivered-to-mill basis [16].

Shifts in Forest Ownership and Management

Private forests in the United States have also experienced increasingly diversified ownership (more forest landowners, with increasingly parceled ownership and thus more diversified land management objectives). As an example, it was determined recently that the number of forestland owners in Wisconsin (270,000) had doubled in just the past 40 years [17]. Similar trends in diversification of ownership have been noted across the eastern United States, with terms like “fragmentation” or “parcelization” used to describe forest ownership trends. Characteristics of the ownership trend include an expanding rural population, more primary and secondary residential development, and increasing numbers of new ex-urban residents. Forest parcelization has been more concentrated in lands that have high amenity value, such as along lakeshores, riparian areas, or near recreational areas. Conservation easements, a growing practice in some areas such as the Northeast, have to some extent counteracted parcelization, as conservation groups have purchased forestland development rights while landowners retain rights to manage the forestland for timber.

Another major structural change in forest ownership underway in the United States is the divestiture of many large tracts of forestland by forest product industry firms, selling industrial forestland to so-called timberland investment management organizations (TIMOs) or real estate investment trusts (REITs). Timberland owned by the forest

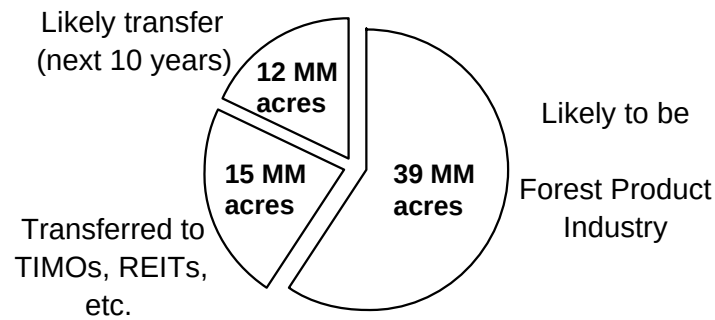


Figure 22. Approximate distribution of U.S. forest industry land ownership in 2003, taking into account recent and likely land transfers (over next decade) to TIMOs, REITs, and other timberland investment organizations.

product industry declined for the first time in the United States between 1989 and 1999, with the rise of TIMOs and REITs [18]. Sales of forest industry lands in recent years often followed corporate mergers, as part of a general consolidation process often associated with corporate mergers. Industry mergers, consolidation, and land sales to financial institutions have resulted in estimated net transfers of more than 15 million acres of industrial forestland in recent years, with a further 12 to 15 million acres expected to transfer out of industry ownership over the next 10 years or so [19]. Figure 22 illustrates the approximate distribution of forest industry land ownership as of 2003, including land that has been transferred to “other corporate owners” (that is, TIMO and REIT ownership) and projected transfers of forest industry land ownership over the next decade.

Financial institutions are typically involved in transfers of timberland ownership to TIMOs or REITs [19]. A TIMO offers an economic tax advantage over industrial timberland ownership in that timber sale income is taxed only once, whereas industrial timber income is usually taxed twice—at the corporate level and again at the shareholder level. The REIT pays no tax on income but is required to distribute 90% of its net proceeds. These relatively new institutions typically own timberland as part of an investment portfolio for clients and presumably will sell timber or land in an economically optimal manner in the future. At the present time, much of the former industrial forestland continues to be managed primarily for timber production, in many cases by contractual arrangement with the former timber industry owners, but in some cases timberland is being developed, fragmented into parcels, and sold to other owners.

As ownership of the hardwood forest resource becomes increasingly diversified or fragmented into smaller parcels with expanding residential construction, it can be expected that timber management will become a secondary priority among many timberland owners. Ultimately timber supply may be negatively impacted, potentially resulting in less fiber available for market or higher fiber prices, even though standing timber inventories may continue to increase. That outcome is perhaps already partially evident in hardwood pulpwood market trends in recent years. It can be noted for example that hardwood pulpwood consumption dipped in recent years (Figure 5) and hardwood timber inventories increased (Figure 13). These trends in demand and supply would ordinarily suggest downward pressure on hardwood pulpwood prices, yet hardwood pulpwood prices have actually increased sporadically, leading to a suggestion that the market is already reacting to more restricted availability of hardwood timber supply from landowners whose forest ownership and management priorities are changing.

Environmental Stewardship and Sustainability

More diversified ownership, expanding rural development, and forestry initiatives such as sustainable forest management efforts or environmental certification of products appear to be generally associated with greater attention to environmental stewardship in forest management in recent years. A number of states have also adopted forestry practices regulations or so-called best management practices (BMPs) for logging and forestry operations. Resource sustainability is promoted also by environmental product certification programs and related initiatives, which help wood products to maintain market share and consumer acceptance, and also by government policies or initiatives of various non-governmental organizations (NGOs). Thus, two broad timberland management strategies

appear to be evolving together in the forest sector: an evolving strategy of resource sustainability along with a traditional cost-competitiveness strategy. Cost-competitiveness reflects primarily the interest of private forest sector enterprises in maintaining product competitiveness and profitability.

Sustainable forest management is increasingly a necessary condition for product certification, product marketing, and broader policy reasons, but evidence also suggests that sustainable forest management alone is not a sufficient strategy, because decisions have been made to close U.S. mills and sell timberlands because of cost considerations even in cases where managers had achieved environmental certification standards or had collaborated with NGOs in environmental protection initiatives. Mill closures and global capacity growth reflect a process that the economist Joseph Schumpeter termed “creative destruction,” the continuous process of replacing older and less competitive technologies and production facilities with more efficient ones. This process is increasingly a global process, as forest sector capital investments are being directed increasingly toward global regions that offer lower labor costs or less expensive fiber. The prospect of cost competition with large new hardwood pulp mills in Asia and Latin America thus tends to dampen the long-run outlook for growth in U.S. hardwood pulpwood demand.

Another long-run issue related to sustainability of hardwood pulpwood supply is the availability of sufficient logging capacity. In some regions, such as the Northeast, many loggers have quit the logging business as a result of regional declines in pulp and paper production, and variable demand for pulpwood. Modern mechanized logging equipment tends to be quite expensive, and thus the maintenance and build-up of adequate logging capacity is a relevant supply-side factor.

SHORT-RUN SUPPLY AND DEMAND INFLUENCES

At a local level, hardwood pulpwood and chip markets are influenced in the short run by weather phenomena. Wet weather combines with environmental stewardship to limit timber harvesting and supply, as forestry BMPs in many states now limit harvesting during wet conditions to protect against excessive erosion or damage to forest sites. Wet and muddy conditions also drive up harvest costs. Thus, it has been observed in recent years that wet weather is a short-run inhibitor of supply, which tends to push pulpwood prices up at times, while at the other extreme hurricanes in the U.S. South sometimes push excessive supplies of material into the market from clean-up operations, which tends to depress prices [20].

On the demand side, short-run shifts in pulp and paper markets or OSB markets tend to exert cyclical influences on the hardwood pulpwood market. The past couple of years, for example, have seen a fairly robust OSB market, owing to low interest rates and high levels of housing construction. The upturn in pulp and paper output since 2002 also contributed to an elevation of hardwood pulpwood demand.

In May and June of 2005, an extensive labor dispute in Finland led to the shutdown of most pulp and paper production capacity in that country. By the end of June the labor shutdown in Finland was beginning to influence global paper supply, particularly supply of printing & writing papers, ordinarily heavily produced and exported by Finland. The loss of output from Finland will no doubt cause a shift in demand to other countries, and perhaps until the labor dispute is settled it may exert a short-run demand-side influence on hardwood fiber in the United States, particularly in those regions that predominantly produce printing & writing paper (such as in the U.S. North).

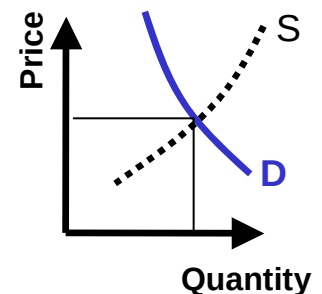
Short-run cycles of supply and demand are reflected for example in the following brief chronology of quarterly short-run shifts that were observed to occur in the Northeastern U.S. hardwood pulpwood market (from New Hampshire Timberland Owners Association, *Timber Crier Hardwood Pulpwood Market Comments*):

<u>Quarter</u>	<u>Comments on Hardwood Pulpwood Market</u>
Summer 2000	Delivered prices strong due to low inventories caused by wet weather
Fall 2000	Markets strong
Spring 2001	Start of economic downturn; high inventories and slowdown have reduced demand
Summer 2001	High demand
Fall 2001	Hard to get quotas from mills; prices dropping
Winter 2001-2	Prices low due to high inventories; lowest prices since the 1980s

Spring 2002	Mill production at low levels; pulpwood market extremely poor
Summer 2002	Wet spring, poor low-grade markets, decreased logging capacity
Fall 2002	Strong demand but a reluctance for prices to increase
Spring 2003	Strong demand, level prices
Fall 2003	Highest prices in over 10 years, due to wet spring/summer and reduced logging capacity
Winter 2003-4	Market very strong due to bad weather and reduced logging capacity
Spring 2004	Strong market; paper industry slowly improving, low inventories at mills
Summer 2004	Pressure for price reduction at mills, but strong demand due to a cold, wet, long spring
Fall 2004	Continued downward pressure on prices, but high demand due to bad weather
Winter 2004-5	Market for hardwood pulp wide open; warm, wet December slowed logging

MARKET TRENDS AND ALTERNATIVE FUTURES

Following an economic rationale, the market equilibrium quantity and price for pulpwood are expected to be determined by the intersection of supply and demand at any point in time, but elements of both supply and demand are continuously shifting over time (as discussed in previous sections), resulting in both short-run and long-run shifts of market equilibrium over time. In recent years, nominal hardwood pulpwood prices have fluctuated, but long-run real prices (after adjusting for inflation) have been relatively stable.



Hardwood pulpwood prices in just the past couple years have generally increased more in the U.S. North than in the U.S. South. One likely reason for this regional difference is because hardwood species in the North include species such as aspen that are used heavily for OSB as well as for wood pulp (for printing & writing paper), while OSB mills in the South use primarily Southern Pine. Thus, via OSB, the recent strong housing market has begun to influence the hardwood pulpwood market in the North. Also, as noted previously, the area of aspen–birch forest cover type in the North and area of upland hardwoods in the South are receding. As discussed in the following sections, these and other notable shifts in supply and demand are reflected in the historical and projected behavior of the U.S. hardwood pulpwood market.

U.S. Hardwood Pulpwood Market Behavior

Figure 23 shows regional price trends for hardwood pulpwood (delivered to mill), illustrating the general behavior of the U.S. hardwood pulpwood market in response to various shifts in demand and supply in recent years. The trends in the North and South both show a notable decline in nominal and real prices for hardwood pulpwood after peaking in the mid-1990s, although nominal pulpwood prices have been on the upswing over the past several years (since around 2002). The pattern of behavior (the decline followed by recent upturn) appears to reflect primarily the trend in pulpwood receipts at wood pulp mills and trend in U.S. wood pulp production, declining after peaking in the mid-1990s and recently on the upturn (Figure 1). The behavior also reflects the rise and eventual leveling out of recycled fiber use (Figure 6). Thus, the behavior of the hardwood pulpwood market in recent years appears to be correlated with shifts in pulpwood demand at wood pulp mills, influenced predominantly by structural changes in fiber demand, including economic globalization, increased paper recycling, and increased export of recovered paper.

Alternative Future

In considering an alternative future scenario for the hardwood pulpwood market, primary consideration was given to alternative trends in globalization and recycled fiber use because of the apparently predominant roles of globalization and recycling in influencing hardwood pulpwood market behavior in recent years. Thus, the results of two scenarios are presented here, in which the NAPAP model was used to project trends in the hardwood pulpwood market with two different sets of assumptions about global trade and recovered paper demand. The first scenario is called the “current” scenario and is already reflected in the various economic projections shown previously (for example, Figures 1, 5, 7, 8, 9, 11, 12).

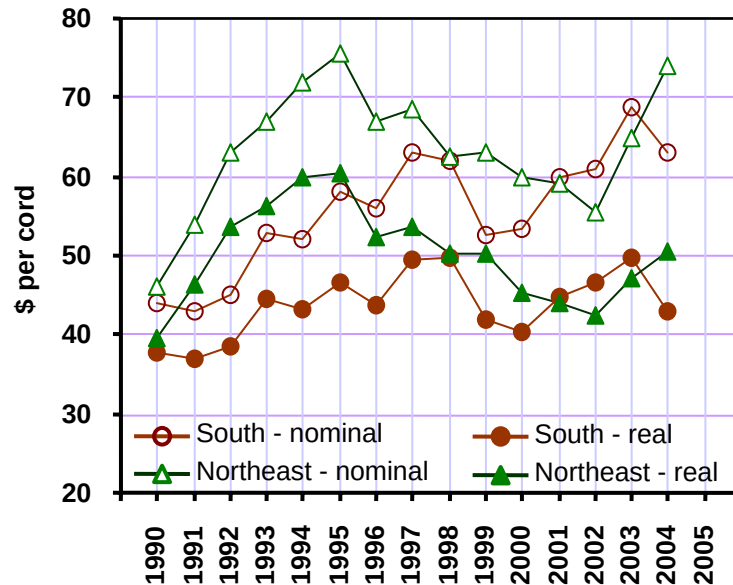


Figure 23. Regional U.S. price trends for hardwood pulpwood, delivered to mill [16,21]. Real prices deflated using U.S. Producer Price Index (1982 = 100).

The current scenario projects a future in which growth will resume in wood pulp production and pulpwood receipts, although at a slower pace than in the past, following the significant structural shift in pulpwood demand over the past decade (Figures 1 and 5). Paper recovery for recycling will peak and level out at just under 55% (Figure 7), while recovered paper exports, primarily to China, will continue to increase (Figure 8). Printing & writing paper, a principal consumer of hardwood fiber in the United States, is projected to remain relatively stable in consumption, production, and trade, with notably less projected growth in imports than in recent years (Figure 9). Pulpwood demand for OSB is projected to increase but remains relatively small compared to pulpwood demand at wood pulp mills (Figure 11), while pulpwood exports are not projected to increase substantially. Under this scenario, hardwood agrifiber production is projected to become economically feasible, with rising real hardwood pulpwood prices, and hardwood agrifiber supply is projected to significantly increase beyond the year 2020 (Figure 12).

The second scenario is from the 2001 RPA timber assessment [22], which had some divergent assumptions about trade and recovered paper demand relative to the current scenario. Among the divergent assumptions, projected U.S. imports of printing & writing paper were much higher and U.S. exports of recovered paper much lower, in effect reflecting a view that the exchange value of the dollar would remain relatively high (and not substantially decline from its recent peak). Because the dollar has in fact declined from its peak since 2002, the higher dollar scenario is viewed as an alternative relative to the current scenario (which recognizes trade effects of a declining dollar). In the “alternative” scenario, the higher U.S. dollar was assumed to attract much higher imports of printing & writing paper, projected to reach 15 million tons per year by 2020 and 20 million tons by 2040, instead of leveling out at around 10 million tons by 2020 as projected in the current scenario (see Figure 9). Thus, in the higher dollar alternative scenario, growth in U.S. wood pulp production and demand for hardwood fiber was partially offset by much higher projected imports of printing & writing paper. Also, with a higher dollar value, U.S. recovered paper is more expensive in global markets and less attractive for export, and thus in the alternative scenario, U.S. recovered paper exports were projected to be only about 15 million tons per year by 2020, instead of climbing to well over 25 million tons by 2020 as projected in the current scenario (see Figure 8). Lower projected exports of recovered paper in the higher dollar alternative scenario leaves more recovered paper available to the domestic market for paper recycling, which also tends to offset projected demands for hardwood fiber. Thus, in summary, the higher dollar alternative scenario projected much higher printing & writing paper imports and lower recovered paper exports, resulting in generally lower projected growth in hardwood fiber demand.

Not surprisingly, in the higher dollar alternative scenario, the NAPAP model projected lower hardwood pulpwood prices than in the current scenario, and fairly negligible expansion in hardwood agrifiber supply. Figure 24 shows

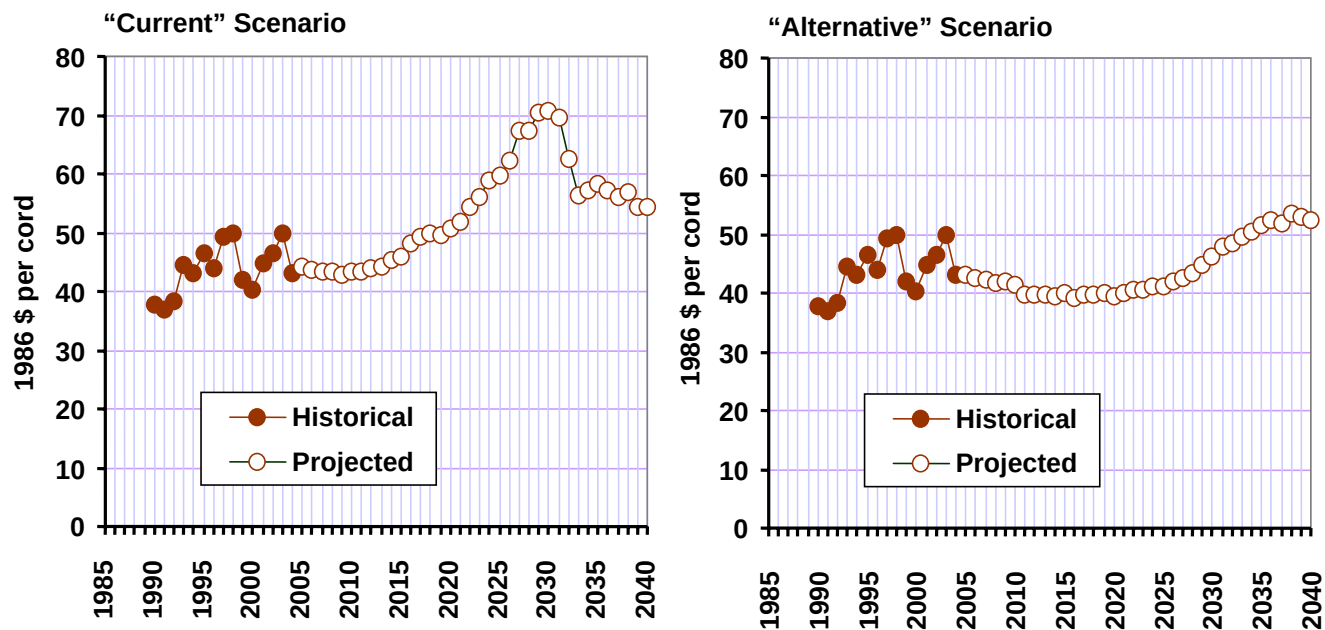


Figure 24. NAPAP model projections of real prices (1986 dollars, deflated using U.S. Producer Price Index as in Figure 23) for delivered hardwood pulpwood in U.S. South for “current” and higher dollar “alternative” scenarios.

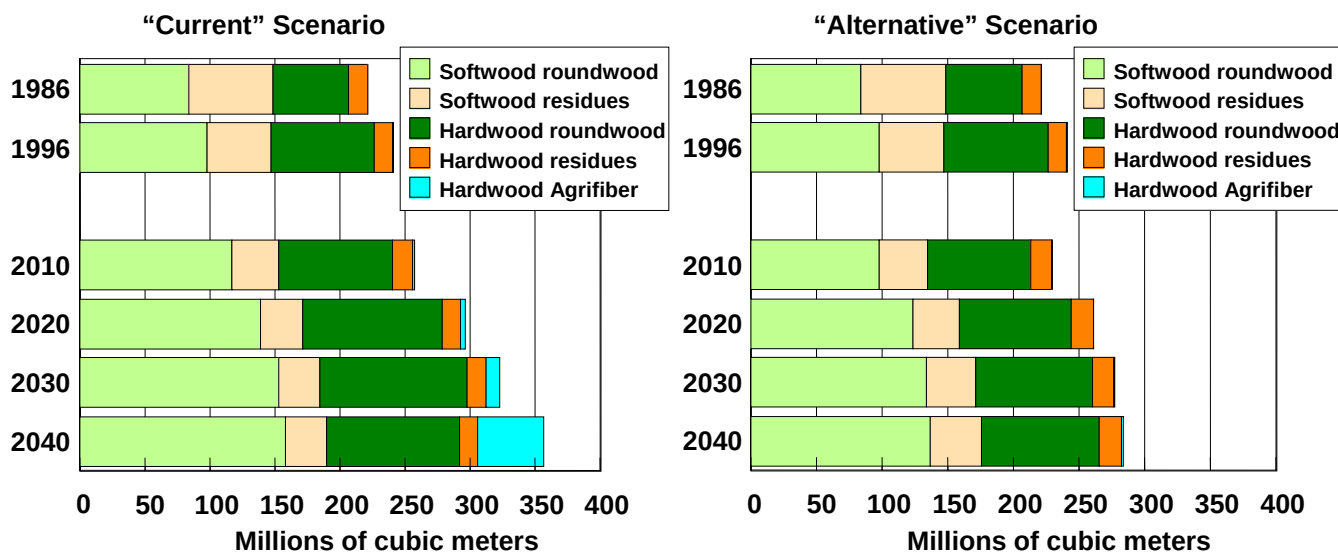


Figure 25. NAPAP model projections of U.S. pulpwood supply by source (including supply to wood pulp mills, OSB mills, and export) for “current” and higher dollar “alternative” scenarios.

for comparison projections of real prices for delivered hardwood pulpwood in the U.S. South for the current scenario and the higher dollar alternative scenario. Figure 25 shows also for comparison projections of total pulpwood supply by source for the current scenario and the higher dollar alternative scenario. In the higher dollar scenario, projected hardwood pulpwood prices were lower, overall pulpwood supply and demand were lower, and unlike the current scenario, there was very little projected expansion in hardwood agrifiber supply prior to 2040 (because hardwood

pulpwood prices were not projected to reach levels that could support significant expansion of supply under current agrifiber production cost and productivity assumptions).⁸

Results of this analysis indicate some potential for future expansion of hardwood agrifiber supply. However, future trends in domestic hardwood pulpwood markets and the potential for hardwood agrifiber development depend on the U.S. trade outlook and overall demand for hardwood fiber in the U.S. pulp and paper sector. Expansion of fast-growing hardwood fiber plantations in Latin America, Asia, and elsewhere could contribute alternatively to increased U.S. imports of hardwood pulp, paper products such as printing & writing paper, or hardwood chips, a resource topic that invites further research and analysis.

CONCLUSIONS

Over the past decade, economic globalization and structural change in the pulp and paper sector have exerted long-run demand-side impacts on the hardwood pulpwood market. Structural changes such as downsizing of U.S. pulp and paper capacity and increased paper recycling have reduced the growth in U.S. hardwood pulpwood demand. Hardwood pulpwood and chip trade also experienced significant structural change, with a substantial decline in U.S. hardwood chip exports since 1996. Among principal drivers of economic globalization are long-run cycles of fluctuation in currency exchange values, such as the historic escalation of the broad trade-weighted exchange value of the dollar from 1996 to 2002. Since 2002, a weaker dollar, industry consolidation, and higher productivity have helped improve U.S. competitiveness, leading to modest improvement in the pulp and paper trade balance as well as an upturn in hardwood pulpwood demand. At a local level, hardwood pulpwood and chip markets are influenced in the short run by weather phenomena (wet weather inhibiting supply and pushing prices up at times). Other influences on the supply side include shifts in forestland ownership and management intentions.

In recent years, hardwood pulpwood prices have increased sporadically, but more so in the U.S. North than in the South, in part because hardwood species in the North include species such as aspen that are used heavily for OSB as well as for wood pulp (for printing & writing paper). Overall, the U.S. hardwood pulpwood demand and supply situation is evolving under the influence of globalization, structural change, and other influences on demand and supply. Hardwood resource ownership is increasingly diverse, and investment in hardwood resource productivity is fairly limited. The area of hardwood forest cover is declining in the South, while the area of aspen–birch forest cover is declining in the North. Investment in short-rotation hardwood fiber crops (for example, hardwood agrifiber crops such as hybrid poplars) could play a larger role in the future, but that potential appears to depend on the U.S. trade outlook and future growth in hardwood fiber demand.

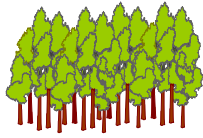
⁸ Agrifiber could expand earlier if tree farmers anticipate future price increases, for example, as projected in the “current” scenario (Fig. 24).

REFERENCES

1. "Annual Pulpwood Statistics Summary Report, 1999-2003," Forest Resources Association, Rockville, Maryland, 37 p. (2004).
2. "Fiber Consumption, 45th annual survey, 2004-2007," American Forest & Paper Association, Washington, DC (2005).
3. "Statistics of Paper, Paperboard and Wood Pulp" (annual statistics report), American Forest & Paper Association, Washington, DC, 57 p. (2004 and earlier years).
4. "Paper, Paperboard & Wood Pulp, A Monthly Statistical Summary" American Forest & Paper Association. Washington, DC, vol. 83, nos. 01 and 05 (2005 and earlier issues).
5. Zhang, D., Buongiorno, J., and Ince, P.J., "A recursive linear programming analysis of the future of the pulp and paper industry in the United States: changes in supplies and demands, and the effects of recycling," *Annals of Operations Research*, 68:109-139 (1996).
6. "H.10 Foreign Exchange Rates," U.S. Federal Reserve Board, Washington, DC, online data at <http://www.federalreserve.gov/releases/H10/summary/> (2005). Accessed April 2005.
7. "G.17 Industrial Production and Capacity Utilization," U.S. Federal Reserve Board, Washington, DC, online data at http://www.federalreserve.gov/releases/g17/table1_2.htm (2005). Accessed April 2005.
8. Ingram, C.D., Ince, P.J., and Mehlburg, R., "United States Pulpwood Receipts," U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, WI, Gen. Tech. Rep. FPL-GTR-115, 34 p. (1999).
9. Repa, E.W. "NSWMA's 2005 Tip Fee Survey," National Solid Wastes Management Association, Washington, DC, NSWMA Research Bulletin 05-3, 4 p. (2005). (Available at <http://wastec.isproductions.net/webmodules/webarticles/articlefiles/478-Tipping%20Fee%20Bulletin%202005.pdf>.)
10. "Interactive Tariff and Trade Dataweb," U.S. International Trade Commission, Washington, DC, online database at: <http://dataweb.usitc.gov/> (2004). Accessed April 2005.
11. Alig, R.J., and Butler, B.J., "Area Changes for Forest Cover Types in the United States, 1952 to 1997, with projections to 2050," U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR, Gen. Tech. Rep. PNW-GTR-613, 106 p. (2004).
12. Sendak, P.E., Abt, R.C., and Turner, R.J., "Timber Supply Projections for Northern New England and New York: Integrating a Market Perspective," *Northern Journal of Applied Forestry*, 20(4):175-185 (2003).
13. Luppold, W.G., and Sendak, P.E., "Analysis of the Interaction Between Timber Markets and the Forest Resources of Maine," *Northern Journal of Applied Forestry*, 21(3):135-143 (2004).
14. Smith, W.B., Miles, P.D., Vissage, J.S., and Pugh, S.A., "Forest Resources of the United States, 2002," U.S. Department of Agriculture, Forest Service, North Central Research Station, St. Paul, MN, Gen. Tech. Rep. NC-GTR-241, 137 p. (2004).
15. Siry, J.P., Harris, T.G., Baldwin, S., Null, D., and Gonzalez, J., "Southern U.S. Forest Products: How Competitive?" *Solutions! for People, Processes and Paper*, 88(5):34-37 (2005).
16. "Timber Mart-South," Center for Forest Business, Daniel B. Warnell School of Forest Resources, The University of Georgia, Athens, GA (1990-2005).

17. "Changes in Wisconsin's Land Use and Forest Ownership," Atwood, S. (ed.), Wisconsin Department of Natural Resources, Madison, WI, proceedings of the Governor's Conference on Forestry, November 9-10, 2004, Madison, WI (in preparation).
18. Conner, R.C., and Hartsell, A.J., "Forest Area and Conditions," chapter 16, pp. 357-401, in D.N. Ware and J.G. Greis (eds.), Southern Forest Resource Assessment, U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC, Gen. Tech. Rep. GTR-SRS-53, 635 p. (2002).
19. Stanturf, J.A., Kellison, R.C., Broerman, F.S., and Jones, S.B., "Productivity of Southern Pine Plantations, Where Are We and How Did We Get There?" *Journal of Forestry*, 101(3):26-31 (2003).
20. Ince, P.J., "The Hardwood Chip Market in 2004: Up in the North/Down in the South," *Hardwood Market Report*, January 2005:75-79 (2005).
21. "International Woodfiber Report," Paperloop, Inc., San Francisco, CA (2005 (Vol. 11, No. 3) and earlier issues).
22. Haynes, R.W. (tech. coord.), "An Analysis of the Timber Situation in the United States: 1953 to 2050," U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR, Gen. Tech. Rep. PNW-GTR-560, 254 p. (2003).

U.S. Hardwood Fiber Demand and Supply Situation: Globalization and Structural Change



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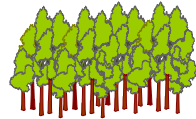
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2005 TAPPI Engineering, Pulping, Environmental Conference
Philadelphia, Pennsylvania, August 28-31

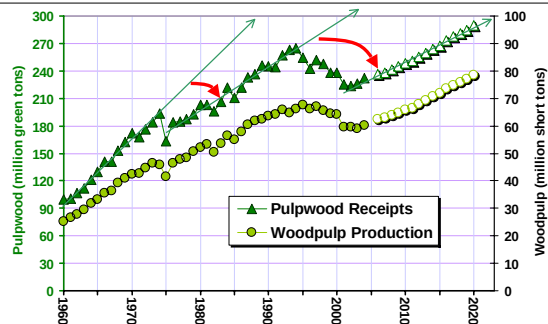


Topics:

- Ongoing shifts in fiber demand & supply
- Reaction of hardwood pulpwood market
- Alternate scenarios for hardwood fiber, including hardwood agrifiber (SRWC)



Pulpwood and woodpulp have experienced some major structural changes – during the energy crisis of the 1970s, and during the past decade with increased recycling and economic globalization:



Sources: AF&PA (historical wood pulp); FRA (historical pulpwood); NAPAP Model (projections, May 2005)

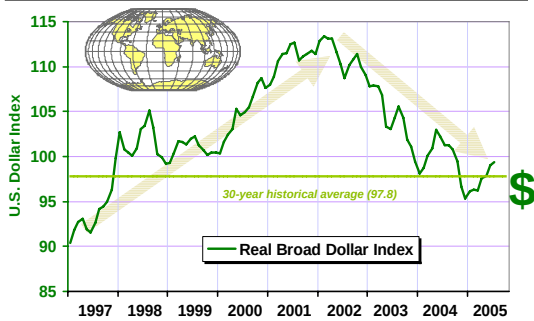
Globalization and Long-run Shifts in US Fiber Demand



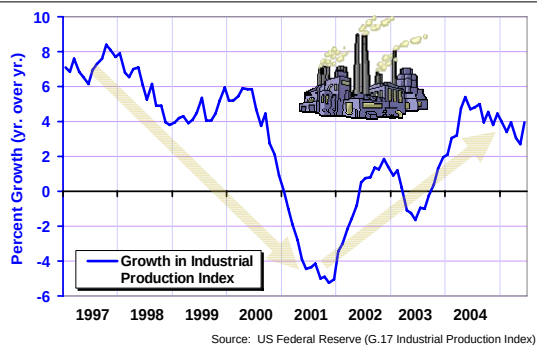
Key trend:

- US paper and board output slowly recovering after significant downturn

Structural changes were accelerated in US manufacturing over the past decade, as US competitiveness was challenged by an above-average dollar exchange value:



Growth in US industrial production plunged as the dollar soared, and conversely, with a weaker dollar growth is recovering, but recovery is more gradual and stepwise than previous recoveries:



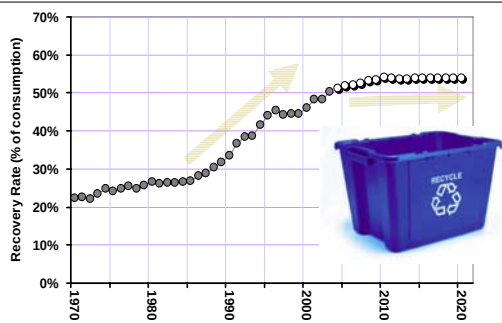
Recycling and Long-run Shifts in US Fiber Supply



Key trends:

- Paper recovery for recycling reaching plateau
- Domestic use of secondary fiber limited
- Massive expansion in secondary fiber exports
 - ➔ Woodpulp demands likely to increase as paper & board output expands

Current Scenario: Increased paper recovery for recycling was a big structural shift of the late 1980s and 90s, but paper recovery is approaching a maximum practical recovery rate (~55%):



Sources: AF&PA (historical data); NAPAP Model (projections, May 2005)

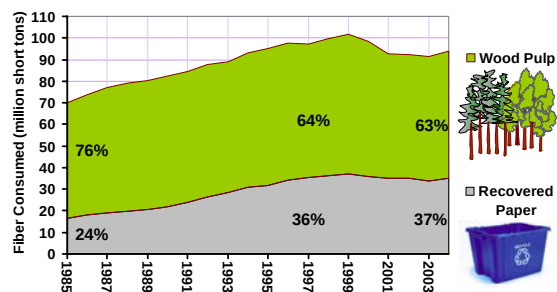
“Among the current concerns of recycling mills, the deteriorating quality of incoming fiber is the largest . . . generally the result of single-stream or commingled collections.”

--The Paper Stock Report, July 25, 2005

The shift to single-stream collection is of concern to US paper recyclers, while labor for hand sorting is cheap in Asia, favoring export of recovered paper.

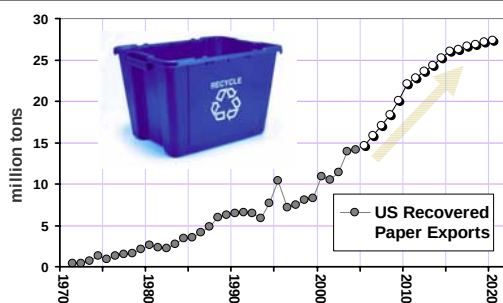


Utilization of recovered paper expanded in the 1980s and 90s, but since 1997 recovered paper's share of fiber consumed at US pulp, paper and board mills has stagnated (at 36-37%):



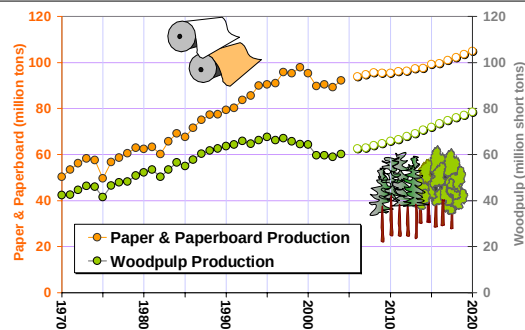
Source: AF&PA (45th Fiber Consumption Survey, 2005)

Meanwhile, there is a massive ongoing expansion of recovered paper exports (mainly to Asia) that will continue to be favored in the current scenario by a weaker dollar:



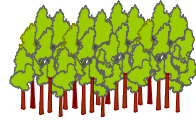
Sources: AF&PA (historical data); NAPAP Model (projections, May 2005)

Current Scenario: Massive expansion in recovered paper exports plus limited expansion in US paper recovery & use = more wood pulp output as paper & board output expands:



Sources: AF&PA (historical data); NAPAP Model (projections, May 2005)

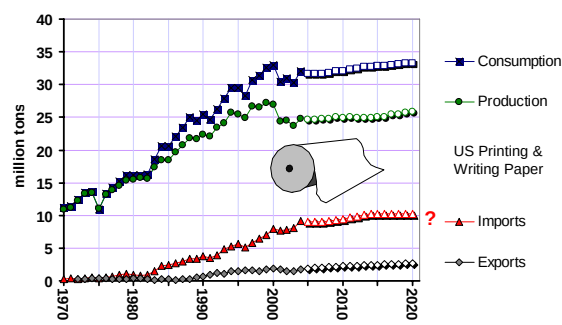
Other Long-run Shifts in Hardwood Fiber Demand



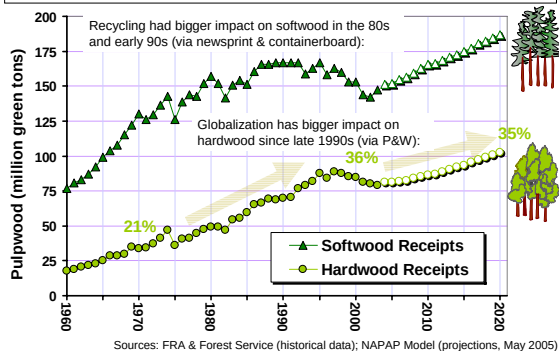
Key trends:

- Printing & writing paper output leveling out
- No gain in hardwood % of pulpwood receipts
- Declining hardwood chip exports
- Expanding fiber use in OSB (but that includes softwood too)

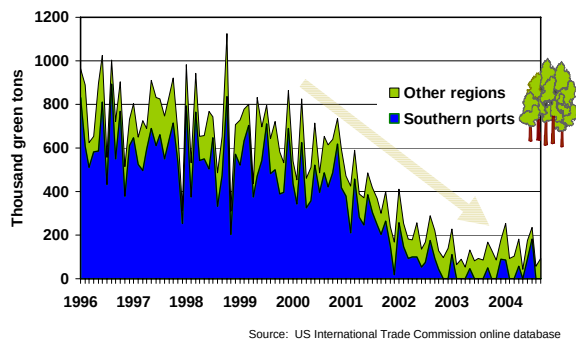
Current Scenario: Globalization had big impacts on US outlook for printing & writing paper (principal consumer of hardwood fiber) . . . Imports might expand, depending on dollar value:



Current Scenario: With increased wood pulp output, pulpwood receipts at pulp mills are projected to increase, but no increase is projected in the hardwood share of total receipts:



Also, with global expansion of hardwood fiber plantations, US hardwood chip exports have declined, particularly exports from the US South, a trend that is not expected to be reversed:



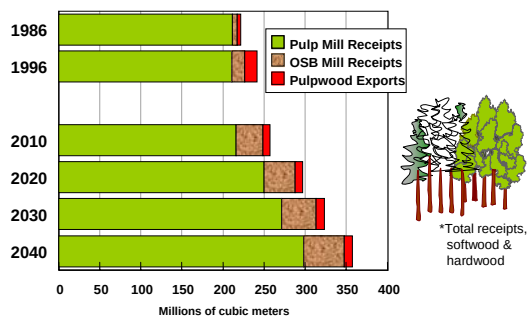
Beyond wood pulp, the next largest (and growing) share of US wood fiber consumption is oriented strand-board (OSB) for wood panels and other engineered wood products:



OSB has about 60% of the total US structural panel market, and is expected to reach 80% within the next decade (RISI).

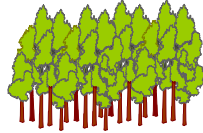
In the US North, OSB uses hardwood species (such as aspen), but OSB capacity growth has shifted in recent years to the US South (using Southern pines) and to Canada.

Current Scenario: Wood fiber receipts at OSB mills are projected to increase*, but remain smaller than pulp mill receipts, while pulpwood exports are projected to remain relatively small:



Source: NAPAP Model (projections, May 2005)

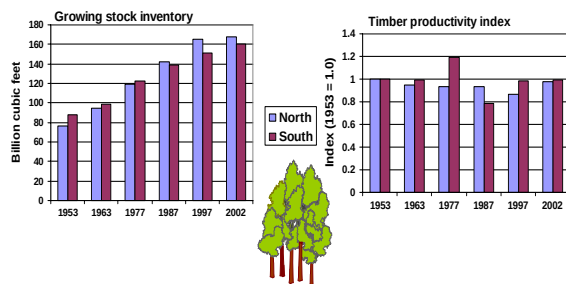
Long-run Shifts in Hardwood Fiber Supply



Key trends:

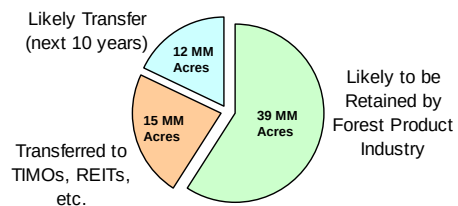
- Expanding hardwood timber inventory, but . . .
 - No gains in hardwood timber productivity
 - Fragmentation of forest industry ownership
 - Key hardwood cover types projected to decline
- ➔ Tighter supply in the long run

US hardwood growing stock volume (standing hardwood timber inventory) has increased, but hardwood timber productivity (growth per unit volume) has not increased:



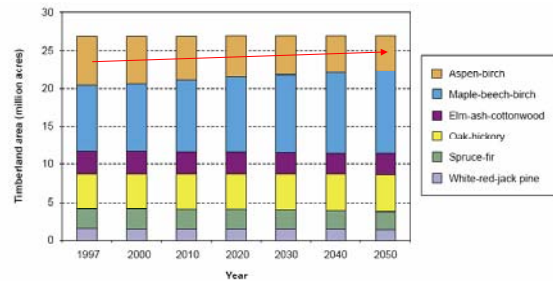
Source: USDA Forest Service, "Forest Resources of the United States"

Furthermore, millions of acres of forest industry timberland are being transferred to other owners, and in general forest landowners are becoming more diversified in their objectives.



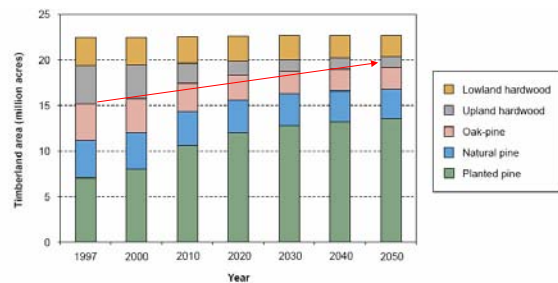
Source: Stanturf et al. 2003, Journal of Forestry. 101(3):26-31.

Hardwoods will remain the dominant forest cover types in the US North, but the area of aspen-birch is projected to decline on non-industrial private lands in the Lake States region:



Source: Alig and Butler, 2004, General Tech. Report PNW-GTR-613.

Meanwhile, the area of upland hardwoods in the South is also projected to decline (while planted pine expands), as shown for forest industry lands in the South Central region:



Source: Alig and Butler, 2004, General Tech. Report PNW-GTR-613.

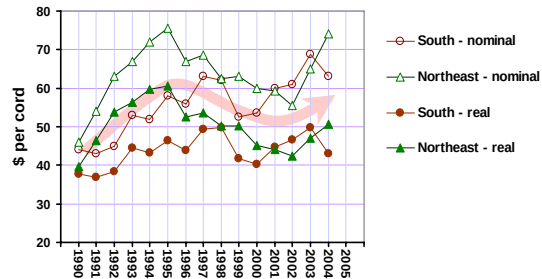
Market Impacts of Fiber Demand & Supply Trends



Key trends:

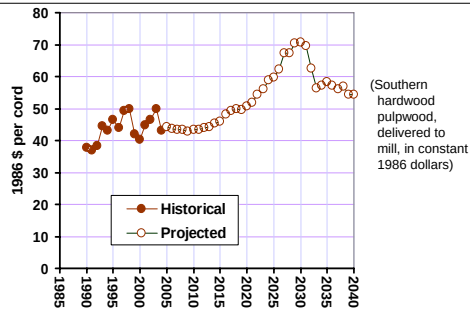
- Hardwood pulpwood market reflects fiber demand recovery & tighter supply
- Long-term real price appreciation projected under “current scenario”
- Future feasibility of hardwood agrifiber (SRWC) emerges if prices increase

Real prices reported for hardwood pulpwood (delivered to mill) indicate that the market has reacted as expected to the downturn in fiber demand of the past decade and recent upturn:



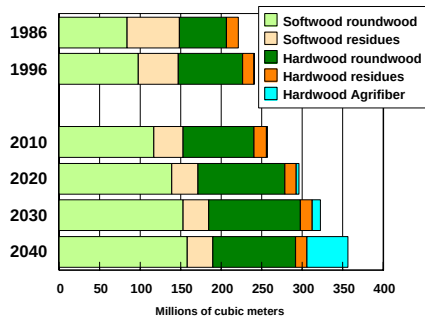
Sources: Timber Mart-South and International Woodfiber Report, deflated using PPI

Current scenario: Our economic model projects gradual real price appreciation for hardwood pulpwood, with growth in fiber demand and tighter hardwood supply in the long run . . .



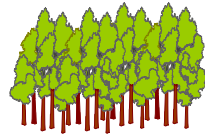
Sources: Timber Mart-South (historical data); NAPAP Model (projections, May 2005)

Current scenario: With real price appreciation for hardwood pulpwood, hardwood agrifiber (SRWC) gradually becomes feasible, and is projected to expand by 2020 and beyond . . .



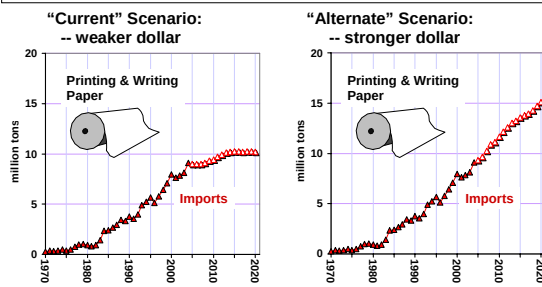
Sources: NAPAP Model (projections, May 2005)

Alternate Scenario: Higher pulp & paper imports



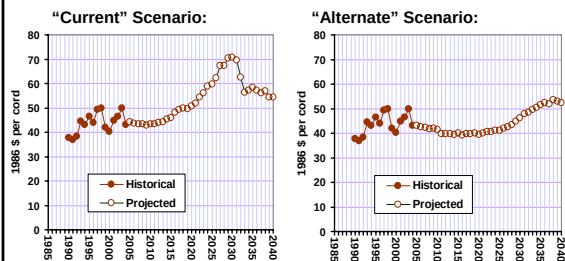
- Higher US imports (stronger dollar scenario)**
- ➔ Less growth in US hardwood fiber demand
 - ➔ Less long-term real price appreciation
 - ➔ Feasibility of hardwood agrifiber diminishes

Whereas the “current” scenario recognizes effects of a weaker dollar (with a leveling out of product imports), the “alternate” scenario is based on a stronger dollar hypothesis, with higher product imports (and lower exports of recovered paper):



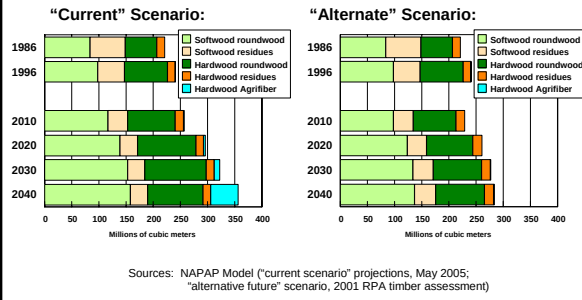
Sources: NAPAP Model (“current scenario” projections, May 2005; “alternative future” scenario, 2001 RPA timber assessment)

With higher pulp & paper imports in the “alternate” scenario, there is much less projected growth in fiber demand, and less projected appreciation in real hardwood pulpwood prices:

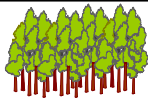


Sources: Timber Mart-South (historical data); NAPAP Model (“current scenario” projections, May 2005; “alternative future” scenario, 2001 RPA timber assessment)

The “alternate” scenario, with higher pulp & paper imports, results in lower overall fiber demand, diminishing the future feasibility (and projected expansion) of hardwood agrifiber:



Conclusions



- Structural changes affect fiber market
- Slow & stepwise recovery ongoing
- Hardwood chip exports down; OSB up
- Hardwood fiber market reflects upturn
- Long-run real price appreciation likely
- Expanded investment in hardwood agrifiber potentially feasible, but . . .
- Market depends on global trade outlook

In: 2005 TAPPI Engineering, Pulping, Environmental Conference; Atlanta, Ga. .; Tappi Press, CD-ROM ISBN: 1595100954