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## **PULPWOOD AND TIMBER TRENDS: OUTLOOK TO 2000 AND BEYOND**

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### **ABSTRACT**

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Regional fiber supply, technological change, and product demands will shape regional timber supply and demand, determining the role of wood yards for pulpmills of the future. An economic model was developed recently to project competitive evolution of fiber markets and technological changes throughout the North American pulp and paper sector. The model simulates evolution of paper recycling and other technological changes among various product grades and regions. This paper describes long-range projections of relevant national trends and Southern timber markets to the year 2000 and beyond. The model projects evolution of supply and demand for pulpwood, roundwood and residues, for both hardwood and softwood. Implications are drawn regarding wood yards of the future.

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### **DISCUSSION**

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), the National Forest Management Act of 1976 (NFMA), and the Forest and Rangeland Renewable Resources Research Act of 1978 require the USDA Forest Service to develop comprehensive long-range assessments of supply and demand for timber and other forest resources in the United States. The RPA Assessment reports include long-range projections of timber market trends (regional supply, demand, and prices), forest product demand, domestic production, and technological changes in major forest product sectors of the U.S. economy (including the pulp and paper sector). The timber analysis component of the RPA Assessment follows a long tradition of Federal timber outlook studies, dating back to the late 19th century (for bibliography of such studies, see Preface to Forest Service 1982). The most recent RPA Assessment report was completed in 1989 (Forest Service 1989a), accompanied by publication of a more detailed long-range analysis of the timber situation in the United States (Haynes 1990). The analysis presented here was developed in support of the 1993 RPA Assessment Update (1993 Update).

The 1993 Update is intended to reflect analysis of

important issues currently related to long-range forest resource trends, and particularly issues that have remained important since the 1989 Assessment. Certainly trends in paper recycling have remained an important timber resource issue, given that a significant historical upturn in U.S. paper recycling rates has been taking place since the mid-1980s (API 1992).

This report summarizes an economic assessment of future trends in pulp and paper technology and future impacts on timber markets in North America. Projections extend five decades into the future, to the year 2040. Two recently developed scenarios are discussed, a 1993 "Base" scenario and a "Waste Reduction" scenario. In the 1993 Base scenario, projected market conditions favor increases in U.S. paper recycling rates through the 1990s, followed by more gradual increases in subsequent decades. Increased recycling expands fiber supply and extends timber resources in the United States. Indexes of real prices for delivered Southern pulpwood are projected to remain relatively stable for softwoods and increase gradually for hardwoods, and roundwood pulpwood consumption is projected to increase in the United States.

Although pulpwood supplies will be adequate, the study indicates that the United States faces future supply problems for sawtimber, although increased recycling will help ameliorate sawtimber supply problems to some extent. An important element of the analysis is that National Forest timber harvest levels are assumed to decline in the future, while demand for sawtimber is projected to increase. Consequently, price indexes for sawtimber in the United States are projected to increase substantially in the decades ahead, despite increases in paper recycling. The index of real stumpage prices for softwood sawtimber in the South, for example, is projected to nearly double between 1990 and 2020.

In the alternative "Waste Reduction" scenario, much more rapid increases in recycling and lower future per capita paper and paperboard consumption levels are projected. Projected roundwood pulpwood consumption levels and pulpwood price indexes are substantially less than in the Base scenario. However, softwood sawtimber prices are still projected to increase in the decades ahead, at a somewhat slower rate of increase than projected in the Base scenario.

### **METHODS**

As in past RPA Assessments, the approach of this study was to start with basic assumptions about future economic and population growth in the United States and to develop partial equilibrium forest product sector models to provide resource supply and demand projections based on those assumptions. Intrinsic assumptions included the assumption that competitive free markets will

prevail as the primary mechanism by which wood and fiber resources will be allocated in the North American forest product sector, and that competitive economics will determine the allocation of capital and technological resources over time within that sector. Model constraints and shifts in fiber supply and demand are introduced to simulate potential government policies related to recycling.

The basic assumptions include assumptions about future population and economic growth in the United States. The same basic growth assumptions were applied in all economic models and supporting studies of the 1993 RPA Assessment Update. Growth assumptions are nearly identical to those that were used in the 1989 RPA Assessment and related studies (Forest Service 1989b). RPA growth assumptions were used in this study for years after 1993; actual data and near-term projections were used through 1993.

Economic models were developed to simulate competitive evolution of supply and demand for fiber resources and technology throughout the pulp and paper sector and to project future impacts on timber harvest and timber prices. The North American Pulp and Paper Model (NAPAP Model) was developed to project competitive evolution of fiber markets and technology in the pulp and paper sector (Ince et al. 1993). The model simulates evolution of process technology (for using recycled fiber and virgin wood fiber) in all primary paper and paperboard products. Modeling methods were based on established principles of economic theory, with application of econometrics, regional market modeling techniques, and capital investment theory applied to technology forecasting. The NAPAP Model was linked by iterative solution to other updated Forest Service timber analysis models, including the TAMM model, which encompass solid wood products (lumber and plywood, etc.), fuelwood demand, stumpage markets, and timber growth and inventory. The modeling framework is designed to explore different economic scenarios. Thus, this study was based on a comprehensive economic modeling framework designed to assess the entire forest and forest product sector.

Data assumptions and detailed projections by region and product are provided in a background research report (Ince 1993). As explained in the background report, the 1993 Update Base scenario was largely unconstrained by government policies (except for assumed increases in recovered paper supply in the 1990s, in line with historical trends). In contrast, in the "Waste Reduction" scenario several assumptions were introduced concerning potential impacts of recycling and waste reduction policies. Some assumptions may be regarded as "extreme" or unlikely, but they were adopted in the "Waste Reduction" scenario to examine the possible timber supply and demand impacts of substantial adjustment in recycling trends. The specific assumptions in the "Waste Reduction" scenario included the following: (1) An additional 5 percent

per year positive shift in recovered paper supply was assumed in all U.S. regions for all recovered paper commodities from the mid-1990s to the end of the projection period, and maximum feasible recovery rates of 80 percent were assumed for ONP, OCC, mixed papers, and certain categories of high grade deinking. These assumptions were intended to simulate extreme possibilities associated with intensification of paper collection policies and recovery programs in the decades ahead, along with substantially greater restrictions on landfilling and incineration of waste materials. (2) A 20-percent Federal investment income tax credit was assumed for investment in processes capable of utilizing recovered paper, simulating potential government economic policy intervention to promote recycling. Limited investment tax credits for recycling facilities have already been introduced by some states. (3) A one percent per year negative shift in U.S. demand growth for all paper and board commodities was assumed from 1995 to the end of the projection period, simulating potential impacts of waste reduction policies and initiatives. Such policies and initiatives could include public education aimed at reducing material use and waste volumes, disposal fees, and material efficiency improvements in product end use.

## RESULTS

Results include projections of paper and board consumption, recycling rates, pulpwood consumption, pulpwood harvest, and delivered pulpwood markets obtained from the NAPAP Model. Results also include projections of lumber production, total timber harvest, and sawtimber markets obtained from the TAMM/ATLAS model. Selected results are illustrated in charts that include historical data trends since 1952. The charts compare projections from the 1993 Update Base scenario and the "Waste Reduction" scenario.

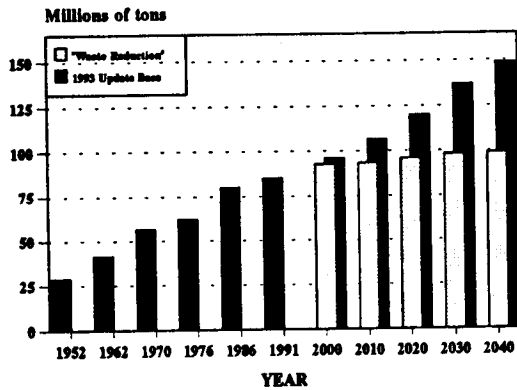
### Paper and Board Consumption

In the '93 Base scenario, paper and board consumption in the United States is projected to reach nearly 100 million tons in the year 2000 and nearly 150 million tons by the year 2040. Thus, the Base projections indicate increasing aggregate demand for paper and board products. Growth projections are generally in line with historical trends (Fig. 1).

The alternative "Waste Reduction" scenario incorporates an assumption that policies and initiatives aimed at reducing volumes of waste (via more efficient product use, public education, disposal fees, etc.) would result in a compounded negative 1 percent per year shift in demand growth

beyond the year 2000 (relative to the '93 Base scenario). The result is a relatively flat projection of paper and board consumption beyond the year 2000 in the "Waste Reduction" scenario (Fig. 1).

**Fig. 1--Paper and Board Consumption in the United States**

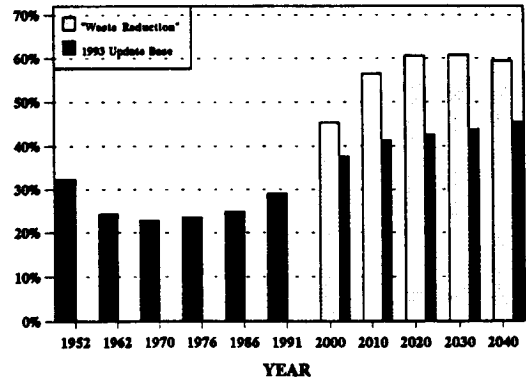


**Recovered Paper Utilization Rate**

The recovered paper utilization rate measures the rate of paper recycling in the United States. It is the ratio of recovered paper consumption in paper and board mills to paper and board production. In the United States, the recovered paper utilization rate declined in the 1950s and 1960s. However, beginning in the 1970s there was a gradual upturn in the utilization rate, and since the mid-1980s there has been a very substantial increase in the recovered paper utilization rate (Fig. 2). The recovered paper utilization rate in the United States approached 30 percent in 1992. The '93 Base projections indicate that it will reach approximately 40 percent before the year 2010 and 45 percent by the year 2040. Some industrialized countries, Germany and Japan for example, have achieved domestic recovered paper utilization rates in the range of 45 to 50 percent, which are slightly higher than rates projected for the United States in the '93 Base scenario.

The "Waste Reduction" scenario assumed that increased recycling would be further stimulated by investment tax credits for recycling facilities, and by continued increases in the intensity of collection programs for recovered paper. Under that scenario, the utilization rate would climb to 60 percent in the next century (Fig. 2).

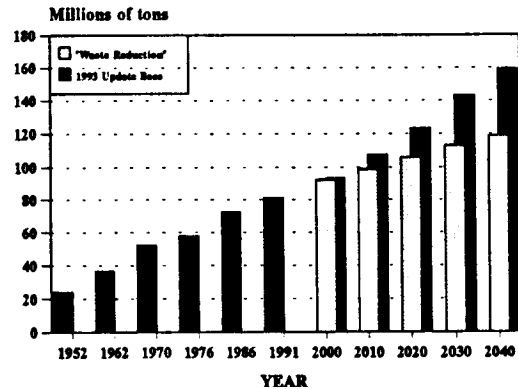
**Fig. 2--Recovered Paper Utilization Rate in the United States**



**Paper and Board Production**

Projections of U.S. paper and board production were derived after factoring in projected trends in fiber product demand, imports, exports, and projected technological changes in the pulp and paper sector. The '93 Base projections indicate that U.S. paper and board production will grow to nearly 95 million tons in the year 2000, and nearly 160 million tons in 2040 (Fig. 3). In the future, a larger share of production will be for export, while demand for domestic consumption will grow more slowly.

**Fig. 3--Production of Paper and Board in the United States**



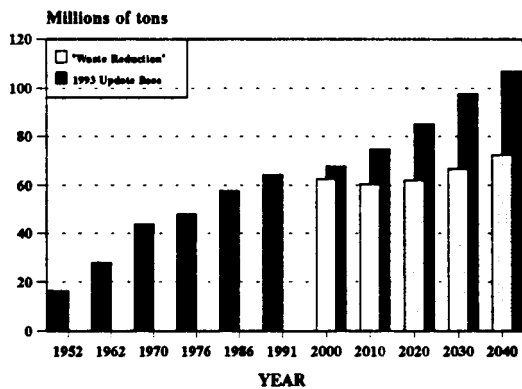
Even in the "Waste Reduction" scenario, U.S. paper and board production is projected to increase, but production reaches only around 120 million tons in 2040. Projections indicate a somewhat slower growth in production in the 21st century. However, projected levels of production remain roughly in line with historical trends, and projections still indicate substantial growth in U.S. paper and board production in the decades ahead,

even under the extreme "Waste Reduction" scenario. Increased fiber supply as a result of increased recycling helps facilitate projected growth in paper and board production.

### Woodpulp Production

In the '93 Base scenario, woodpulp production is projected to grow very slowly in the 1990s, as secondary (recycled) fiber is utilized at much higher rates (Fig. 4). However, beyond the year 2010, woodpulp production would grow more

**Fig. 4--Production of Woodpulp in the United States**

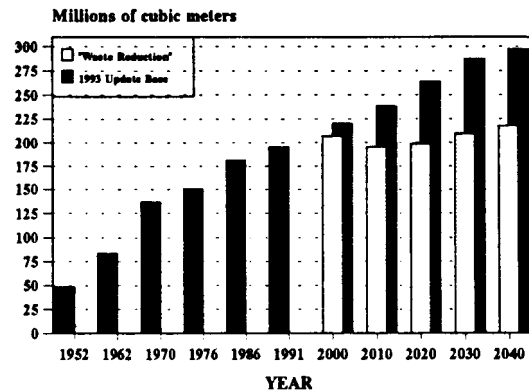


closely in tandem with growth in paper and board production, as the recovered paper utilization rate stabilizes at around 45 percent. Projected growth in woodpulp exports contributes to projected growth in woodpulp production. In the "Waste Reduction" scenario, woodpulp production is projected to remain relatively flat into the next century.

### Total Pulpwood Supply

Total pulpwood supply of the United States, including domestic consumption and exports, will increase according to the '93 Base projections (Fig. 5). In the Base scenario, total pulpwood supply increases from nearly 200 million cubic meters per year in 1991 to nearly 300 million cubic meters per year in 2040. In the "Waste Reduction" scenario, total pulpwood supply remains relatively flat at around 200 million cubic meters per year well into the next century.

**Fig. 5--Total Pulpwood Supply of the United States (incl. mill residues)**



### Softwood Roundwood Pulpwood Supply

The supply of softwood roundwood pulpwood (softwood pulpwood harvest) in the United States is projected to grow at a modest pace in the '93 Base scenario (Fig. 6). Increased use of recycled fiber, increased use of hardwood, and increased supplies of mill residues result in relatively modest projected growth in harvest of softwood pulpwood. In the "Waste Reduction" scenario, softwood pulpwood harvest is projected to decline gradually, and then increase beyond the year 2010.

### Hardwood Roundwood Pulpwood Supply

The supply of hardwood roundwood pulpwood (hardwood pulpwood harvest) in the United States

**Fig. 6--Softwood Roundwood Pulpwood Supply of the United States**

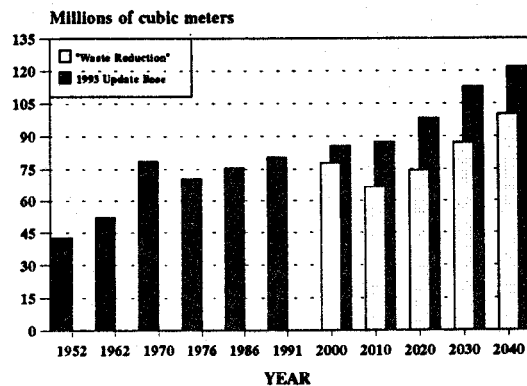
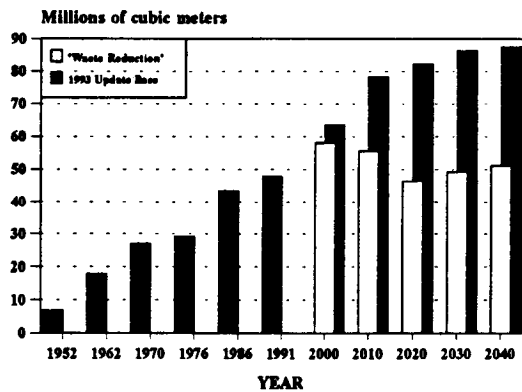


Fig. 7--Hardwood Roundwood Pulpwood Supply of the United States

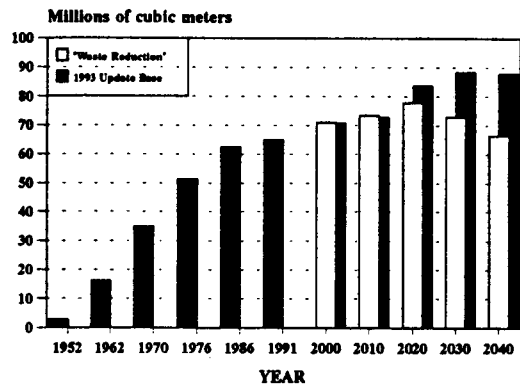


is projected to grow substantially over the next couple of decades, and then grow at a much more modest pace in the '93 Base scenario (Fig. 7). Although technological changes in the pulp and paper sector will accommodate increased use of hardwoods, hardwood roundwood pulpwood supplies are assumed to become more constrained in the South beyond the year 2000, because of projected declines in hardwood timber inventories in the South. In the "Waste Reduction" scenario, hardwood pulpwood harvest is projected to decline in the next century.

#### Pulpwood Residue Supply

Supplies of pulpwood in the form of mill residues (sawmill and plywood mill residues) are projected to increase rather modestly in the '93 Base scenario (Fig. 8). Pulpwood residue supply projections are in line with historical trends, and take into account projected growth trends and projected conversion efficiencies in lumber and plywood production. The '93 projections indicate that pulpwood residue supplies will level out and gradually decline in the next century, owing in part to efficiency improvements in lumber and wood panel production that will reduce residue outputs from lumber and plywood mills.

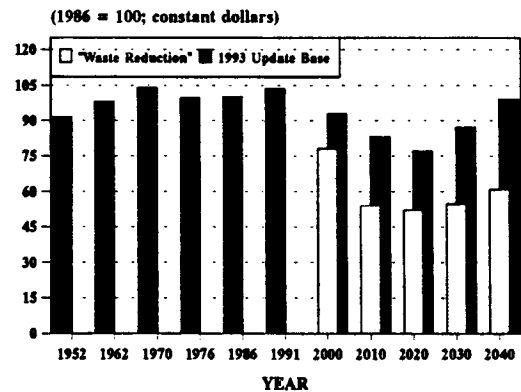
Fig. 8--Supply of Pulpwood Residues (mill residues) in the United States



#### Southern Softwood Pulpwood Price Index

Projected trends in supply and demand for pulpwood have significant impacts on projected pulpwood markets. Looking at trends in the U.S. South as an indicator of U.S. pulpwood supply and demand, the '93 Base projections show a decline in the delivered softwood pulpwood real price index for the next several decades (Fig. 9). This projected trend is associated with increased recycling and projected relative abundance of fiber supplies in North America. Toward the end of the

Fig. P-Softwood Pulpwood Price Index in the U.S. South

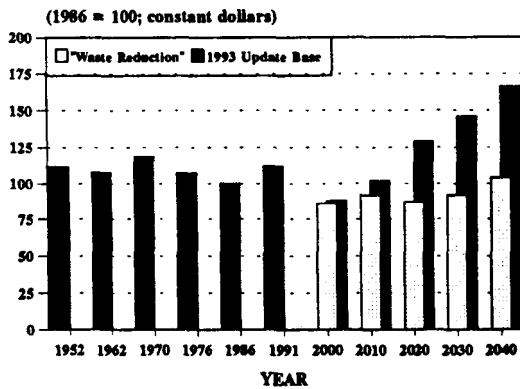


projection period, the softwood pulpwood price index is projected to climb gradually as paper recycling rates stabilize and consumption of virgin fiber increases more rapidly. However, throughout the projection period, the softwood pulpwood price index is projected to remain below its 1986 level. In the "Waste Reduction" scenario, the softwood pulpwood price index is projected to decline even more substantially.

### Southern Hardwood Pulpwood Price Index

In contrast to the softwood pulpwood price index, the hardwood pulpwood price index for the U.S. South is projected to increase in the long run. With increased recycling, the hardwood pulpwood price index is projected to decline by the year 2000, but then increase throughout the remainder of the projection period (Fig. 10). The projections reflect a view that hardwood pulpwood supplies in

**Fig. 10--Hardwood Pulpwood Price Index in the U.S. South**

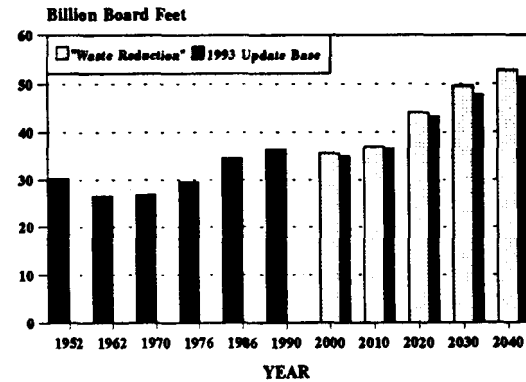


the South will be significantly constrained beyond the year 2010 as hardwood timber inventories are projected to decline. Part of the projected decline in hardwood timber inventories is attributable to continued conversion of timberland to softwood (i.e. Southern pine plantation;) in the South.

### Softwood Lumber Production

In conjunction with projected increases in paper recycling rates and paper and board production, the TAMM model projects increases in demand for "solid-wood" products, such as lumber and structural panels, plywood and oriented strand board (OSB). Softwood lumber production in the United States is projected to increase at a pace that is generally in line with historical trends, although sawtimber supply constraints in the next couple of decades limit domestic softwood lumber production (Fig. 11). Increased recycling rates in the "Waste Reduction" scenario result in extended

**Fig. 11--Softwood Lumber Production in the United States**

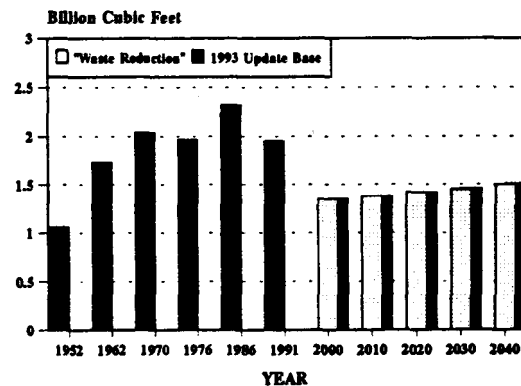


timber supplies and a modest increase in projected lumber production relative to the Base scenario.

### National Forest Timber Harvest

The '93 RPA Update assumes substantially lower annual National Forest timber harvest levels in future decades than in recent decades (Fig. 12; harvest levels shown in Fig. 12 are draft

**Fig. 12--U.S. National Forest Timber Harvest**



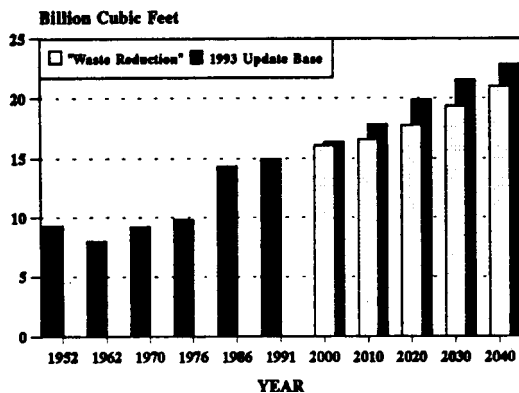
assumptions which may be revised before final publication of the '93 Update). In fact, timber harvest levels on the National Forests have already declined in recent years, in the process of resolving many issues related to management of forest resources on the National Forests, protection of endangered species, and so forth. Thus, current projections of much lower timber harvest on the National Forests reflect realities of the substantially reduced National Forest timber harvest levels of recent years.

Most reduction in timber harvest levels on the National Forests is in the form of reduced softwood sawtimber harvest in the West. In recent decades, pulp and paper mills in the West have relied primarily on pulpwood in the form of softwood mill residues from lumber and plywood mills. In the future, pulpwood residue supplies in the West will be constrained by reduced softwood sawtimber harvests on National Forests. Most of the future growth in U.S. pulp, paper and board production capacity is projected to occur in the eastern part of the United States, and primarily in the South.

### U.S. Private Forest Timber Harvest

Although National Forest harvest levels are assumed to be substantially lower in the future, timber harvest is projected to increase on private forest lands (forest industry and other private

**Fig. 13--U.S. Forest Industry and Other Private Timber Harvest**

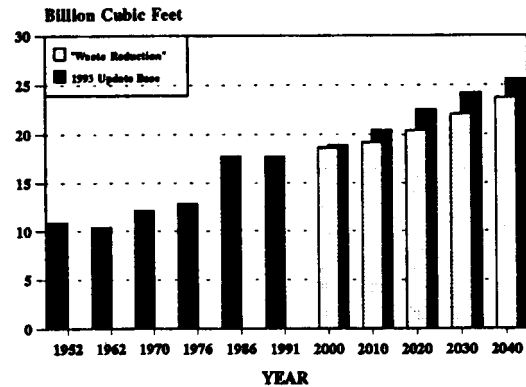


forest lands) in the United States (Fig. 13). However, projected timber harvests on private forest lands are now generally less than projected in the earlier 1989 RPA Assessment, largely because of projected increases in recycling.

### U.S. Timber Harvest (All Owners)

Overall, U.S. timber harvest is now projected in the '93 Update to grow at a relatively modest rate in line with historical trends (Fig. 14). Several key factors contribute to the modest projected growth in U.S. timber harvest. Among the most significant factors are the revised outlook on paper and board consumption, woodpulp production, and paper recycling rates. Also important are other

**Fig. 14--U.S. Timber Harvest (All Owners)**

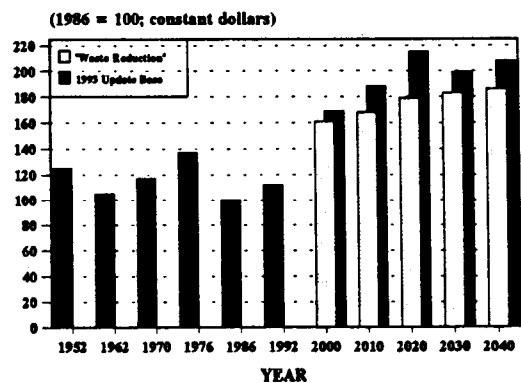


adjustments which have been made in the timber supply outlook. The National Forest timber harvest outlook was reduced relative to historical harvest levels, and future hardwood timber supplies are now projected to be somewhat less abundant. The "Waste Reduction" scenario results in slower projected growth in U.S. timber harvest, but U.S. timber harvest levels are still projected to increase.

### Southern Softwood Sawtimber Stumpage Index

In the '93 Base scenario, the real stumpage price index for softwood sawtimber in the South is projected to increase (Fig. 15). In contrast to

**Fig. 15--Softwood Sawtimber Stumpage Index in the U.S. South**



pulpwood, the stumpage price index for softwood sawtimber is projected to increase substantially in the next couple of decades largely because of near-term constraints on sawtimber supply in the South and reductions in National Forest timber harvest levels. The stumpage price index gradually levels

off in the next century because of the combined effects of increased recycling and maturation of pine plantations in the South. National Forest timber harvest levels are projected to be much lower, and demand for lumber, plywood, and panel products in housing are projected to be somewhat higher in the future. Although increased paper recycling will extend timber resources to some extent, it is not likely to avoid projected increases in the softwood sawtimber price index. Even under the extreme "Waste Reduction" scenario, the stumpage price index for softwood sawtimber is projected to increase substantially in the near term, although higher recycling rates contribute to more stable projected stumpage prices in the long run.

## CONCLUSIONS

In the future, the balance of fiber supply and demand in the United States will shift toward much greater use of secondary (recycled) fiber. Assuming competitive evolution of markets and technology, the recovered paper utilization rate in the United States will reach upwards of 45 percent in the 21st century. Under a more extreme "Waste Reduction" scenario, it is possible that the utilization rate could reach nearly 60 percent toward the middle of the next century.

Increased paper recycling and slower growth in paper and board consumption contribute to relatively modest growth in timber harvest, but overall timber harvest levels continue to increase. Increased paper recycling will help to extend timber supply of the United States and might eventually lead to reduced pulpwood harvests, but overall timber harvest levels are not expected to decline substantially relative to current levels.

Indexes of real prices for delivered pulpwood in the South are projected to be somewhat lower for softwood pulpwood, although the hardwood pulpwood price index is projected to increase in the next century because of constraints on hardwood timber supplies. Overall fiber supply will be adequate to facilitate substantial increases in pulp, paper, and paperboard production in the United States and substantial increases in product exports.

On the other hand, softwood sawtimber supplies will be constrained due in large part to reductions in National Forest timber harvest levels. Increased demand for lumber and wood panels coupled with limited sawtimber supplies will put pressure on

sawtimber prices. Thus, the real stumpage price index for Southern softwood sawtimber is projected to increase substantially in the next couple of decades.

## IMPLICATIONS

Results suggest some strategic implications for wood yards of the future. Increased recycling and other developments are not projected to substantially diminish the task of roundwood pulpwood handling and processing in the foreseeable future. The 1993 Base projections indicate that both softwood and hardwood roundwood pulpwood consumption will increase in the future, along with increased recycling (Figs. 6 and 7). Under an extreme "Waste Reduction" scenario, there could be a modest temporary decline in softwood pulpwood harvest and a longer term decline in hardwood pulpwood harvest. However, under the assumptions discussed here, there is not projected to be a substantial decline in roundwood harvest relative to 1991 levels. Real price indexes for delivered pulpwood in the South (Figs. 9 and 10) are not projected to increase and are actually projected to decrease in conjunction with increased recycling. On the other hand, sawtimber stumpage price indexes are projected to increase in the near future (Fig. 15). The projected supply and demand situation suggests opportunities to capitalize on wood yard designs and wood-handling schemes that can recover higher volumes of sawlogs. Also, there will likely be greater economic incentive in the future for expansion of production capacity using technologies that can substitute pulpwood-type raw material for sawtimber (e.g. oriented strand board, particleboards, other composite products, small-log sawmills, and small-log plywood mills).

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