Harvest, Inventory, and Stumpage Prices

Consumption Outpaces Harvest, Prices Rise Slowly

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ABSTRACT

America's appetite for timber will continue to grow, and consumption will exceed domestic harvest over the next 50 years. Imports will supply the bulk of softwood consumption growth in the next 15 years. After 2015, both domestic softwood harvest and imports will expand. Private softwood inventories will rise in all regions and will be higher by 2050 than current levels. Softwood sawtimber stumpage prices will trend upward in all regions, while pulpwood prices will rise only in the final two decades of the projection. Southern hardwood inventories will fall after 2010 with rising stumpage prices. Northern hardwood harvest and inventories will grow, yielding stable pulpwood prices but modestly rising sawtimber prices.

Keywords: economics; industry

Harvest of timber of all types from US forests has grown markedly over the past five decades as have aggregate timber inventories. From 1957 to 1996, total US roundwood harvest from all sources and for all products rose by more than half—a 30 percent increase for softwoods and nearly a doubling for the smaller hardwood component. Over roughly this same interval (1952–97), growth on US forests exceeded harvest and total inventory rose by about 35 percent—softwoods by 12 percent and hardwoods by 90 percent. On private lands alone, softwood inventories rose by 22 percent and hardwoods increased more than 80 percent. Despite the expansion in inventory, growth in demand outstripped the net change in supply, and the real prices paid for stumpage increased as a result.

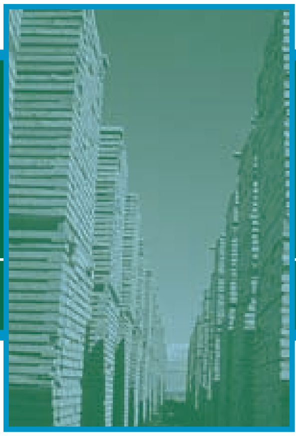
This article combines analyses of timber demand and supply to project future harvests, inventories, and timber prices in the United States. The various projections are drawn from the current Resources Planning Act (RPA) Timber Assessment (Haynes, in press).The analysis of timber supply depends on current forest inventory data, projections of future changes in timberland area, anticipated volume yields from current and future timber stands, and projections of future silvicultural investments on private lands. Economic models of private owners' harvest behavior are based on historical data and explain the interaction of prices, landowner objectives, and inventory characteristics to produce a supply of harvestable timber (Adams and Haynes 1996). Harvests from public lands of all types enter the supply-demand accounting but are derived from assumptions about future policies for management of these lands rather than models of market behavior.

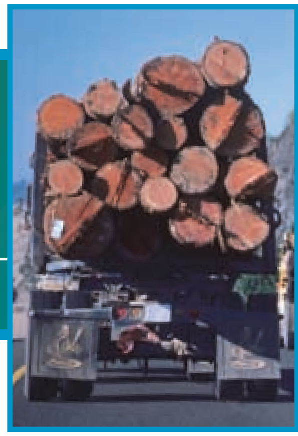
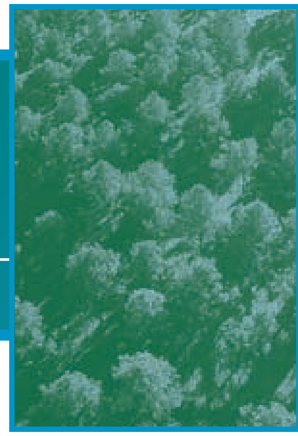
Demands on US Forests

The volume of timber that must be harvested to support US forest products consumption is the sum of roundwood use in pulp and paper, solid wood products, and fuelwood. These products may come from domestic or imported sources. Adjusting for cross-border flows and converting products to roundwood equivalents, consumption exceeds harvest from US forests, thus making the United States a net importer of roundwood *(fig. 1, p. 28).*

Current consumption of some 19.8 billion cubic feet per year requires 18.2 billion cubic feet of harvest from domestic forests, about 92 percent of consumption. The difference between aggregate consumption and harvest derives almost entirely from imbalances in softwoods. Imports and exports of hardwoods are nearly equal at present, but imports are expected to rise over the forecast period. Projected annual harvest of all species from US forests rises by some 23 percent between 1996 and 2050, or about 4.2 billion cubic feet. The largest part of this increase comes from softwoods, which increase 3.0 billion cubic feet.

Differences between roundwood harvest and consumption vary somewhat over the projection *(fig. 1).* The gap widens quickly by 2010 because of growing imports of solid wood products and reduced domestic harvest. In later decades, the gap continues to widen but at a slower rate as a result of major expansion in southern harvests. As in the past, the largest part of both near- and long-term im-



port growth comes in the form of softwood products.

Growing Stock Inventory and Removals

The total volume of "roundwood harvest" just discussed represents all timber of all types harvested from the forest for use in products. "Removals from growing stock," on the other hand, include just the harvest of live, merchantable trees and any parts of these left as logging residue.

Softwoods. As shown in *figure 2* (p. 28), projected removals in the South-Central region and Southeast continue to be the largest flows in the United States, rising from 64 percent of softwood harvest in 1996 to 70 percent by 2050. Over the next decade, however, softwood removals in the South will depart from their historical rising trends. Cut in the South-Central region will fall below recent levels, while Southeast harvest will rise only toward the end of the decade. Harvest in western regions, which fell sharply after major reductions in public cut in the 1990s, continues at these lower levels through 2050. Harvest in the North also remains near recent levels.

In the Southeast, limited growth in aggregate removals over the next decade results from partially offsetting movements in harvests from industrial and nonindustrial private forestland (NIPF). Industrial harvest will decline to allow maturation of young stands and expansion in the merchantable timber stock. Rising softwood inventory on NIPF lands *(table 1, p. 29)* will enable a compensating increase in nonindustrial cut. After 2010, industrial inventory will have increased enough to allow a resumption of harvest growth along historical trends.

In the South-Central region, it is the NIPF ownership that faces near-term harvest restrictions, departing from its rising harvest trend of the past 35 years. Total inventory will rise on NIPF lands after 1997 *(table 1),* but only the "available" portion of this inventory can actually be harvested. The *available inventory* is the volume in stands that are old enough to have sufficient merchantable timber to warrant a commercial harvest but that is not reserved from timber production. For South-Central NIPF owners, continuing harvest at the levels of the late 1990s into the next decade would exhaust available inventory. As a result, projected cut falls to the 1990 level by 2010, recovering to near-current levels after 2030. From that point harvest will increase at a pace similar to that observed in the past. For industrial lands, with ample inventory, harvests continue to rise essentially along historical trends.

For all southern regions and owners, projected inventories in 2050 will exceed current (1997) levels. NIPF inventories will rise steadily to about 2040, then drop slightly. South-Central industrial inventory will rise (although at a decreasing rate) over the full projection, while inventories on industrial lands in the Southeast will roughly stabilize after 2025.

In the Pacific Northwest, public harvests fell sharply after 1989 and are expected to remain at these lower levels throughout the projection. Industrial harvest has declined steadily over the past three decades, as older stands of natural origin with high volumes per acre were converted to more intensively managed plantations. This declining

The annual harvest of all species from US forests will rise by some 23 percent by 2050, the largest portion of the increase coming from softwoods.

Photo credits, left to right: Pallets, Society of American Foresters Archives; paper roll, Society of American Foresters Archives; logging truck, Gerald W. Williams; aerial view, South Carolina Forestry Commission

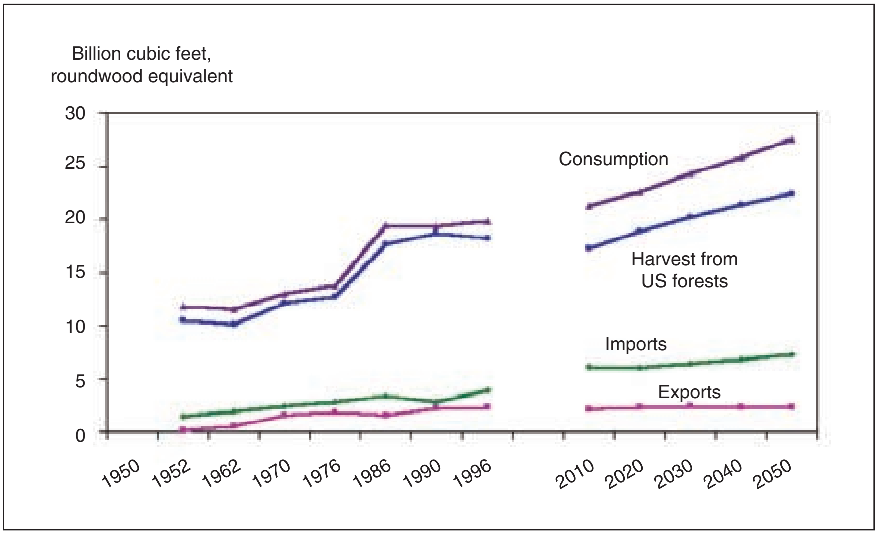


***Figure 1*. US consumption, imports, exports, and harvest of roundwood, with projections to 2050. *Note:* Estimates apply to new harvests only, excluding recycled wood and fiber.**

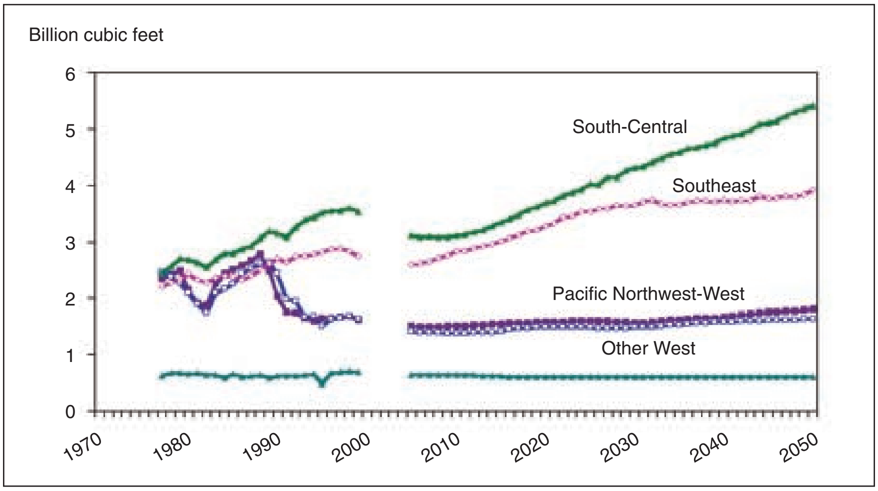


***Figure 2.* Softwood growing stock removals by US region, with projections to 2050. *Note:* Historical values are estimates.**

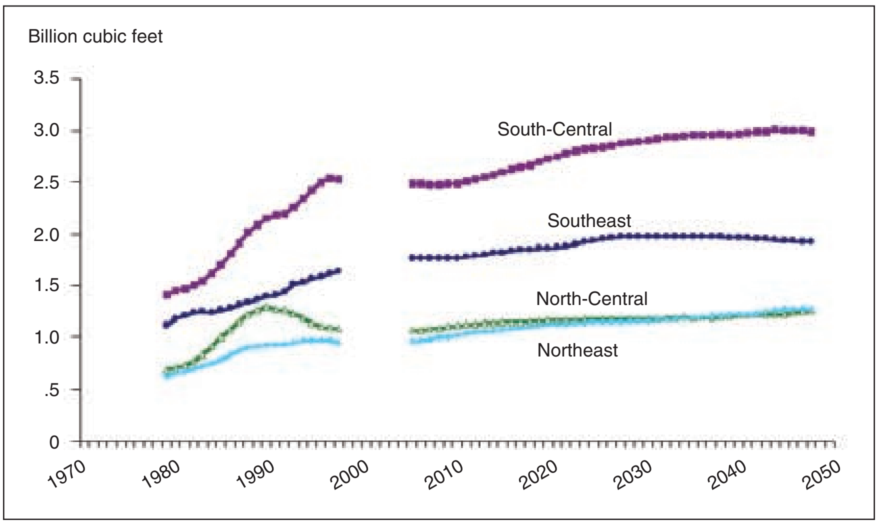


***Figure 3.* Hardwood growing stock removals in eastern US regions, with projections to 2050. *Note:* Historical values are estimates.**

trend comes to an end in the projection in the current decade (2000–10). In subsequent periods, large areas of young growth will reach the age of minimum merchantability, growth will rise rapidly, and harvest will be stable to rising. NIPF owners will face a similar inventory transition, and their harvest will also grow slowly after 2010. By 2050, projected industrial inventories will be roughly 18 percent higher than 1997 levels, and NIPF inventories will rise by 22 percent.

In the wake of changing management directions, softwood removals on public lands in the US fell from roughly 2.9 billion cubic feet per year in 1986 (about 25 percent of total US removals) to 1.1 billion cubic feet by 1996 (about 12 percent). Assuming continuation of current policy directions for all agencies, the base case projects public softwood removals to reach 1.3 billion cubic feet per year by 2050. Growth exceeds harvest for both the National Forest and other government components of the public total over the 1997–2050 projection. As a result, public softwood inventories will rise by 72 percent.

Hardwoods. Removals of hardwood growing stock for the four major producing regions in the eastern United States are shown in *figure 3*. Hardwood harvest in the South has increased steadily over the past three decades as both sawtimber and pulpwood uses have grown. In the projection there is a pause in this trend between 2000 and 2010. Harvest growth resumes after 2010 but at a reduced rate. In the North, in contrast, growth in hardwood removals has slowed in the past decade. Harvest growth resumes in the projection, more rapidly in the Northeast than in the North-Central region. By 2050, hardwood removals in the Northeast will be 33 percent higher than average levels of the 1990s, while North-Central harvest will be roughly 6 percent higher.

In the South, the rising harvest trend is projected to stop by 2010 on industrial lands. NIPF removals, however, continue to drift upward slowly over the next 50 years. The southern hardwood inventory is large, but hardwood species have not been managed

Table 1. Volume of growing stock inventory on private and public lands in selected regions, historical and projected to 2050.

Region and ownership*	1976	1986	1997	2010	2030	2050
			Million cubic feet			
Softwood						
South-Central						
Industry	14,430	13,515	14,231	16,088	25,779	28,113
NIPF	28,760	31,555	30,408	29,015	36,815	38,203
Public	7,010	7,924	8,347	9,451	10,190	10,548
Southeast						
Industry	9,142	10,717	10,231	14,402	16,826	16,078
NIPF	36,150	35,415	34,187	37,963	43,217	43,810
Public	5,716	6,487	7,443	9,168	11,123	12,574
Pacific Northwest-West						
Industry	21,978	20,137	17,648	17,179	17,182	20,875
NIPF	8,458	10,171	10,336	10,057	12,199	12,604
Public	63,249	53,183	61,797	75,678	96,354	115,525
US total						
Industry	74,526	72,753	66,261	68,126	81,438	92,986
NIPF	125,292	136,590	144,163	153,624	174,852	178,823
Public	267,138	243,568	273,418	327,235	404,679	470,279
Hardwood						
North						
Industry	11,012	12,265	11,974	13,451	15,684	17,404
NIPF	85,093	101,389	121,335	146,963	169,847	184,156
Public	23,053	28,766	31,596	35,183	41,018	46,013
South						
Industry	17,203	17,751	16,345	13,691	13,194	10,091
NIPF	92,314	104,958	115,131	118,045	110,325	98,570
Public	12,648	16,318	20,307	25,037	31,435	36,705
US total						
Industry	32,313	35,311	33,526	32,497	33,501	35,880
NIPF	185,653	220,674	251,870	280,009	297,794	303,521
Public	52,823	56,363	66,732	78,583	95,321	109,596

**NIPF = nonindustrial private forestland.*

intensively, and growth rates are relatively low. At the same time, the base projection envisions continued conversion of some hardwood lands to softwood types and further loss of land to nonforest uses. As a consequence, continued expansion in hardwood harvest on NIPF lands eventually leads to cut in excess of growth and therefore to declining inventories *(table 1).*

Hardwood growth rates are no higher in the North than in the South, but harvests on northern private lands have been below growth for some time, and hardwood inventories have been rising. In the base projection, driven by expansion in both sawtimber and pulpwood uses, harvests are expected to continue to climb on NIPF lands and to roughly stabilize on industrial ownerships. NIPF cut will remain below growth, constrained by an array of forces. In managing their lands, NIPF owners are increasingly motivated by objectives other than timber harvest and revenue generation. This disinclination to harvest is related in part to fractionation of the land base, the growing diversity of owner interests and backgrounds, and the declining importance of timber harvest revenues in the income of forestland owners. As a result, NIPF hardwood inventory will continue to rise *(table 1).* Industrial harvest will be at or just below growth, and inventory will rise slightly over the projection.

Hardwood removals from public lands rose between 1986 and 1996, from 0.4 billion cubic feet (about 7 percent of the US total) to 0.6 billion cubic feet (about 10 percent). The base case projection for 2050 is 0.5 billion cubic feet, assuming constant agency policies. As with softwoods, this level is below growth for both the National Forest and other government components of the public-sector total. Thus, public hardwood inventories will rise by nearly 65 percent.

Stumpage Prices

Softwood sawtimber. Stumpage prices in the United States have been highly volatile over the past three decades, as illustrated in *figure 4* (p. 30). This variability derives primarily from cycles in key end-use markets and shifts in timber supply, acting either singly or in combination. The run-up in prices to peaks in 1978–79 and the subsequent recessionary decline in the early 1980s is an example of the former, while the large price increase in 1993–94 arose both from a cyclical economic recovery and a sharp drop in public timber sales in the West. The historical portion of *figure 4* also reveals an array of transitory and permanent differences between regional prices. Prices in the South and Pacific Northwest alternately converge and diverge as produc-

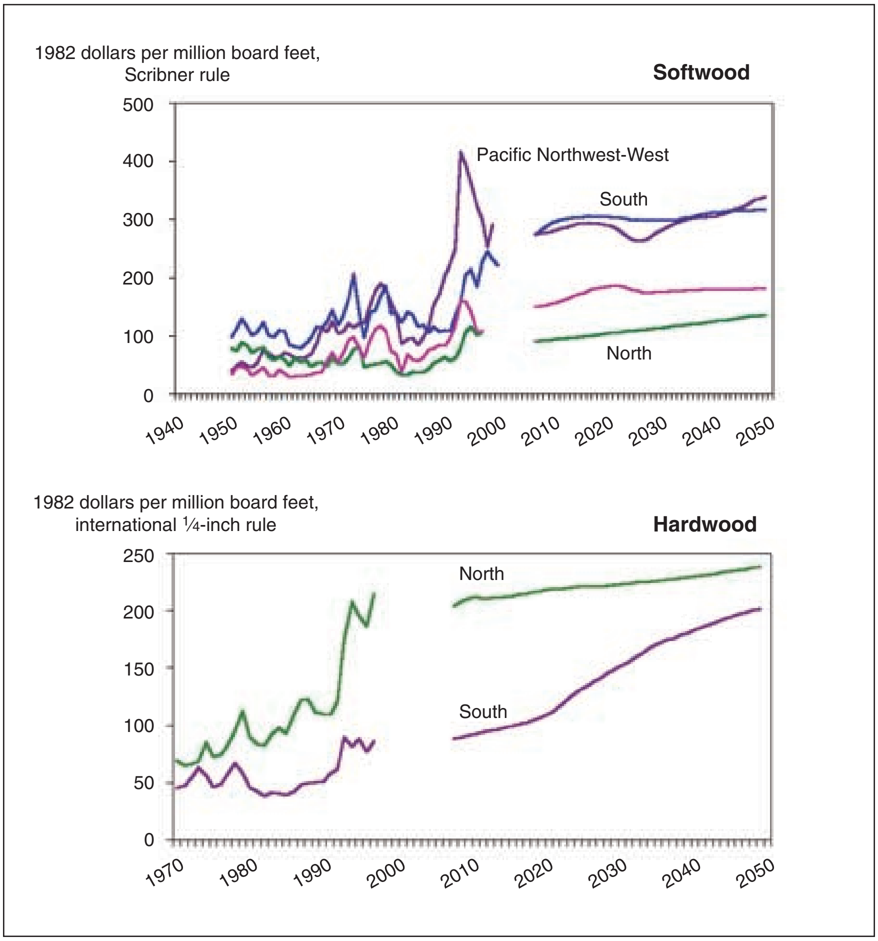


Figure 4. **Deflated prices of sawtimber stumpage in the United States by region and species group, with projections to 2050.**

tion cost, timber supply, and product output conditions change between the regions. Since the mid-1990s they have been converging once again, as the effects of declining public timber supply are worked out through reductions in solid wood processing capacity in the West and growth in lumber capacity and output in the South. Prices in the Interior West and North have generally remained below those in the Pacific Northwest and South as a result of cost and product price differences.

In the projections, real softwood sawtimber prices in the South and Pacific Northwest move around each other, as they have in the past, rising at a trend rate of about 0.4 percent per year from 2005 to 2050 (trend price growth rates within the projection are 0.4 percent in the Pacific Northwest, 0.4 percent in the South, 0.9 percent in the North, and 0.7 percent in the Interior West). Prices will rise about 25 percent above recent peak levels in the Interior West, then roughly stabilize after 2020. The price cycles in the West and South centered around 2020 reflect adjustments to declining imports of Canadian softwood lumber. Northern prices will also show a steady trend, as growing demand pulls them back into their historical relation with western and southern prices.

In the South, continued expansion in hardwood harvest on NIPF lands will lead to cut in excess of growth, and therefore to declining inventories.

In effect, sawtimber stumpage prices in all regions shifted up in the 1990s and remain at these higher levels in the projections. At the same time, trend growth in softwood sawtimber prices is limited in the long term because expansion in demand is largely offset by growth in domestic supply, increased product imports, and reduced exports.

Hardwood sawtimber. The past decade saw a dramatic separation in hardwood sawtimber prices between North and South, as northern private supply conditions tightened and quality differences between the regions widened *(fig. 4).* This price gap narrows in the projections. As noted in the previous discussion, long-term supply-side conditions are expected to be less liberal in the hardwood sawtimber market than is likely to be the case for softwoods, particularly in the South. As a result, even modest increases in sawtimber harvest will generate some growth in real sawtimber stumpage prices. In the South, price growth will average nearly 2.0 percent annually from 2005 to 2050. Inventory on private ownerships declines steadily after 2010 and supply conditions become increasingly restrictive. In the North, price growth is lower (0.4 percent) because of continued expansion in northern hardwood inventories, but still positive because of the limited supply response of NIPF owners.

Softwood pulpwood. Prices in the South rose and fell in a sharp cycle during the 1990s in the face of rising demand and constrained supply, then recessionary contraction. The projection does not foresee a return to the high prices of the recent past. Prices experience a strong cycle during the 2000–50 period but show no clear trend. Prices will fall between 2010 and 2030 as softwood inventory (particularly in the pulpwood size classes) and harvests expand rapidly. By 2040, prices will rebound with tightening timber supply and finish the projection near 2000–01 levels, well off the peaks of the 1990s.

Softwood prices have also grown in

the North in the recent past, due in part to shifting supply conditions on NIPF lands, where management objectives place less emphasis on timber harvest. Future prices in the North are projected to follow a cycle similar to that in the South, driven by cross-regional arbitrage and shifts in product output, then rise steadily to levels somewhat above the South by the end of the projection.

Hardwood pulpwood. Prices also have risen sharply in the recent past, as greater proportions of hardwood were used in pulp and paper production. Continued growth in hardwood pulpwood prices is foreseen in the South. As in the case of sawtimber prices, this reflects the projected decline in hardwood inventories on both industrial and nonindustrial owners and shrinking supplies. In the North, in contrast, future hardwood pulpwood demand growth will be less rapid. Even with a sluggish private response to rising inventories, supply will rise enough to roughly stabilize hardwood pulpwood prices over the projection.

Summary of Findings

The timber assessment projections indicate that America's appetite for timber will continue to grow. Domestic harvests of both softwoods and hardwoods will rise in the long term, but roundwood consumption will exceed domestic harvest by at least 20 percent in each of the next five decades (compared to 9 to 10 percent in the 1980s and 1990s). In the current decade, no US region has the potential for significant expansion in softwood timber supply based exclusively on harvest from private lands. Increased softwood consumption during this interval will come largely from imports, particularly for softwood lumber. After 2010, imports will continue to rise but less rapidly. Maturing inventories in the South will lead to major increases in softwood growth and expanding harvests. Harvests in the West will stabilize by 2010 and increase modestly thereafter. Private softwood inventories will rise in all regions and for all private owner groups over the period to 2025. Growth-drain relationships will be mixed after 2025, with some inventories continuing to rise while others stabilize. By 2050, however, private softwood inventories will be higher than 1997 levels in all regions. The combination of rising imports and timber growth in the longer term will reduce, but not eliminate, trend increases in softwood stumpage prices. At the same time, there is no indication that prices will fall back to the levels of the 1980s and early 1990s.

Hardwoods comprise the largest part of the forest inventory in the eastern United States, but their growth is not rapid and their harvest in recent decades has increased significantly. Assessment projections show substantial differences in the outlook for hardwoods between the North and South. Harvest will exceed growth on private lands in the South after 2010, and inventory will decline. Coupled with declining interest in timber harvest on the part of some nonindustrial owners, harvestable volumes will shrink still faster, reducing supply and forcing up prices of both sawtimber and pulpwood. In the North, in contrast, harvests will rise less rapidly than growth and nonindustrial inventories will expand by more than 50 percent over the next 50 years. As a result, northern hardwood sawtimber prices will experience less rapid growth than in the South, while hardwood pulpwood prices will remain stable.

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