Is Eastern Hardwood Sawtimber Becoming Scarcer?

William G. Luppold *and* Gilbert P. Dempsey, *USDA Forest Service, Northeastern Forest Experiment Station, Route 2, Box 562-B, Princeton, WV 24740.*

ABSTRACT. *In recent years the hardwood lumber industry has become increasingly concerned about the availability and quality of hardwood sawtimber. However, these concerns seem to contradict USDA Forest Service estimates of increased volume and quality of hardwood sawtimber. This paper examines changes in eastern hardwood sawtimber inventories and the apparent contradiction between the industry's perception of decreasing sawtimber availability and the Forest Service's contention of increasing timber inventories. This study did not find a single explanation for the apparent contradiction. Many of the perceived differences appear to result from the fact that industry draws its conclusions from specific situations confined to finite procurement areas while Forest Survey statistics are based on aggregated data. North. J. Appl For. 13(1): 46-49.*

The U.S. hardwood lumber industry is dependent on a continuous flow of sawtimber from the eastern hardwood forests. As a result of this dependency, the hardwood lumber industry has long been concerned about a variety of hardwood timber supply issues (McLintock 1987). These concerns seem to have increased during the 1980s as anecdotal accounts by industry indicated a perception of decreasing supplies of sawtimber. However, these perceptions conflict with the increased sawtimber inventories reported by the USDA Forest Service (Powell et al. 1993).

The objective of this paper is to examine changes in eastern hardwood sawtimber inventories relative to changes in hardwood lumber production and timber ownership. This information is then used to examine the apparent contradiction between the hardwood industry's perception of decreasing timber availability and the Forest Service's contention of increasing physical supplies. However, due to concerns about the quality of hardwood inventory and hardwood lumber production data, we turn first to a discussion of the data used in this paper.

Data Development

Although Forest Service inventory data are developed using well-established sampling techniques, the authors are concerned about the accuracy of multi state or regional inventory estimates for specific years. Because of limited financial and human resources, state inventories are completed on a staggered schedule, with most states being surveyed every 5 to 10 yr. This means that any estimate of sawtimber volume for a single year must be projected by assuming historic timber growth and timber removal trends.

The specific method used to project timber inventories varies depending on the availability of models, techniques, and supporting data (Waddell et al. 1989). The existence or lack of supporting data is a potential source of error in inventory projections. For instance, many northeastern states have not been inventoried since the early 1980s, and many north central states have been surveyed only once in the last decade. As a result of differences in assumptions, supporting data, and estimation procedures, we believe that inventory projections can be inconsistent between regions. This makes any conclusion based on small regional differences precarious.

In addition to potential problems with hardwood sawtimber inventory statistics, there is strong evidence that the U.S. Department of Commerce (1970-1991) underestimates hardwood lumber production (Cardellichio and Binkley 1984, Luppold and Dempsey 1994). In 1990, estimates developed by Luppold and Dempsey (1994) were 75% higher than U.S. Department of Commerce estimates. Therefore, we used alternative estimates of lumber production in the current analysis. These alternative estimates are based on information from a combination of sources including state severance tax records of saw log production, sawlog receipts from Forest Service timber product output studies, and state surveys of hardwood lumber production or saw log receipts. The specific methods used to develop estimates of hardwood lumber production are reported in Luppold and Dempsey (1989,1994).

Changes in Regional Sawtimber Inventories

Estimates of hardwood sawtimber inventories in the eastern United States for 1970,1977,1987, and 1992 (Table 1) indicate sawtimber volumes have increased dramatically in every eastern region over the last 22 yr. Since 1970 average tree diameter and proportion of timber volume in the more highly valued select species also have increased in all regions. The apparent conclusion

 Reprinted from the *Northern Journal of Applied Forestry,* Vol. 13, No.1, March 1996 pp 46-49

Table 1. Comparison of hardwood sawtimber inventories by volume, proportion of select species, and average sawtimber diameter in eastern regions for 1970, 1977, 1987, and 1992 (billion board feet 1/4 in. Int.)

	Northeast[a]	North central[b]	Southeast[c]	South central[d]
Hardwood sawtimber inventory (mmbf)				
1970	104.5	136.7	125.5	118.2
1977	116.6	158.2	141.9	133.3
1987	170.6	197.6	183.5	161.9
1992	215.6	234.9	205.7	204.3
Percentage change 1970-1994	106.2	71.9	63.9	72.7
Average diameter[e] of sawtimber (in.)				
1970	16.0	16.0	17.1	16.7
1977	15.9	15.9	17.1	16.7
1987	16.2	16.4	17.5	16.9
1992	16.2	16.6	17.6	17.3
Select species[f] % of volume				
1970	40.8	37.2	18.5	19.7
1977	43.1	37.7	18.5	20.2
1987	42.7	38.1	18.7	21.2
1992	41.4	39.1	19.4	22.2

a Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia. b Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, Iowa, Nebraska, Kentucky, Missouri, Kansas.
C Virginia, North Carolina, South Carolina, Georgia, Florida.
d Tennessee, Arkansas, Oklahoma, Alabama, Mississippi, Louisiana, Texas.
e The average diameter of hardwood sawtimber in the south central region includes Kentucky.
f Select white oaks, select red oaks, hard maple, ash, black walnut, and black cherry (Araman 1987, Waddell et al. 1989).
SOURCE: USDA For. Ser. 1973, 1982; Powell et al. 1993, Waddell et al. 1989 (adjusted for initial error).

to be drawn from this information is that the volume and quality of the eastern hardwood resource are increasing.

A closer look at the data contained in Table 1, however, does show some small but possibly troubling changes. Since 1977, the proportion of select species in the northeast region has continually decreased. Average tree diameter in the northeast region also has remained constant since 1987. The aggregate nature of Table 1 also masks some species-specific trends. For instance, overall sawtimber inventory in the north central region increased by nearly 90% between 1970 and 1992, but the volume of red oak and hard maple sawtimber only increased by 21 and 30%, respectively (Powell et al. 1993). Although the volume of white oak sawtimber has increased by 181 % in the north central region since 1970, the average diameter of white oak timber has decreased slightly since 1987 (Waddell et al. 1989, Powell et al. 1993).

Changes in Regional Sawtimber Inventories Versus Changes in Lumber Production

Estimates of average hardwood lumber production for the 5 yr prior to and including 1979, 1977, 1987, and 1992 are presented in Table 2. Five-year averages were used in an effort to eliminate yearly spikes and dips in hardwood lumber production that resulted from the cyclical nature of the hardwood lumber industry (Luppold 1993). As indicated in Table 2, hardwood lumber production increased in all regions between 1970 and 1992. However, production in the two northern regions increased by more than 85%, while production in the southern regions increased by a considerably smaller percentage.

Table 2 also reports average hardwood lumber production as a percentage of hardwood sawtimber inventory (PI-ratios) for 1970, 1977, 1987, and 1992. An increasing PI-ratio means that lumber production increased faster than sawtimber growth, while a decreasing ratio indicates that the rate of timber growth exceeded growth in hardwood lumber production. Given the inelastic nature of the short-run timber supply, an increase in the harvest-to-growth ratio could lead to perceived timber shortages and higher prices.

The north central region is the only region where the PI-ratio has been increasing in the last decade. This result seems to support industry's perceptions of reduced timber supply. Furthermore, red oak and maple inventories have increased at a much slower rate than hardwood lumber production. Industry's perceptions also are

Table 2. Comparisons of average hardwood lumber production and the ratios of lumber production to sawtimber inventory in the eastern United States, by region, for 1970, 1977, 1987, and 1992 (billion board feet).

Item	Northeast	North central	Southeast	South central
Average hardwood lumber production (mmbf)				
1966-1970	1.72	2.27	1.90	2.55
1973-1977	1.79	2.28	1.67	2.23
1983-1987	2.37	3.09	1.99	2.55
1988-1992	2.91	3.99	2.03	2.86
Percentage change 1970-1992	86.9	88.3	10.0	29.9
Lumber production as percent of sawtimber inventory (PI ratio)				
1966-1970	1.64	1.66	1.51	2.15
1973-1977	1.53	1.44	1.18	1.66
1983-1987	1.39	1.56	1.08	1.57
1988-1992	1.35	1.85	.99	1.42

SOURCE: USDA For. Servo 1973, 1982; Powell et al. 1993, Waddell et a11989.

supported by a recent study of Minnesota's forest resource. This study found that although statewide annual harvest and growth of red oak sawtimber have been relatively even, the harvest of red oak has greatly exceeded annual growth in southern Minnesota since 1981 (Minn. Dep. of Natur. Resour. 1993). A recent study of the forest resource in Ohio also revealed that growth and removal rate are nearly equal for both red and white oak (Ervin et al. 1994).

The two southern regions have shown a continual drop in the rate of hardwood lumber production relative to the rate of sawtimber growth. However, this trend may not be uniform across all areas of these regions. For instance, Forest Service timber product output studies indicate that lumber production in North Carolina and Virginia has increased since 1970 while production in Georgia, South Carolina, and Florida has remained stable or decreased.

A slightly different pattern of lumber production versus timber growth occurred in the northeast. During the 1970s and early 1980s, reported sawtimber inventories seem to have increased at a faster rate than hardwood lumber production, but since the late 1980s, sawtimber growth and lumber production appear to have increased at similar rates. We believe that part of the drop of the PI-ratio in the northeast may be due to overestimating of hardwood sawtimber inventories. Between 1977 and 1992, sawtimber volume in the northeast increased at a much faster rate than in the other regions. Changes in the amount of timberland do not account for these differences since the 1 % increase in timberland in the northeast since 1977 is considerably less than the 5% increase in the north central region.

In an effort to isolate errors in the assumptions and procedures used to project northeast sawtimber volumes, we found a potential problem with the conversion factors used to translate sawmill log receipts to timber requirements. The average conversion factor of 6.65 bf of lumber per cubic feet of timber seemed too high. The imputed conversion factor for northeastern hardwood sawtimber with a diameter at breast height above 15 in. is 4.6 (Powell et al. 1993). The conversion factor used in the Northeast is considerably higher than the 5.5 bf of lumber per cubic feet of timber used in the Southeast (a region with wider diameter timber). If the conversion factor used to project timber drain is too high, then the cubic footage of timber required to supply the hardwood sawmilling industry would be underestimated. The cumulative effect of this underestimation would be an overestimate of sawtimber volume.

Changes in Sawtimber Ownership

Timber availability is affected by the objectives of the timber owners and thus by changes in timber ownership. Over 75% of eastern hardwood sawtimber volume is on privately owned nonindustrial land (Powell et al. 1993). Recent studies of private nonindustrial land ownership trends in the Northeast indicate a reduction in midsized holdings and an increase in large and small holdings (Birch 1992). This polarization of timber holdings could have implications on timber availability.

Small timber tracts tend to be more expensive to log. The owners of small tracts are less likely to manage and sell timber than owners of larger timber holdings. Also, individuals or companies with large timber holdings usually have greater market power than owners of smaller sized woodlots. This increase in market power could allow larger landowners to obtain higher prices for their timber.

Less than 10% of eastern hardwood sawtimber is on land controlled by forest industry (Powell et al. 1993) and sawtimber volumes on timber industry lands have increased at a much slower rate than sawtimber volumes on public and private nonindustrial lands. In the north central region, sawtimber volume on forest industry land only increased by 21 % between 1970 and 1992.

Although only 15% of the eastern hardwood sawtimber resource is publicly owned, public ownership has increased faster than private ownership (Powell et al. 1993). Since significant portions of publicly owned land are being set aside for nontimber uses, increased public ownership could reduce both current and future timber supplies.

Discussion and Conclusions

The apparent contradiction between the hardwood industry's perception of decreasing timber availability and the Forest Service's contention of increasing timber inventories does not have a single explanation. In general, industry draws its conclusion from situations where specific species are being demanded in a finite procurement area. Forest Survey statistics are based on aggregated data. The broad scale of inventory data makes species specific and quality specific timber shortages difficult to identify.

The strongest case for localized decreases in hardwood sawtimber availability can be made in the north central region. Hardwood inventories are increasing in the north central region, but lumber production is increasing at a faster rate. Also, increases in hardwood lumber production have exceeded increases in sawtimber inventories on forest industry land by a ratio of 4 to 1. This region also had the greatest relative increase of sawtimber ownership on public lands. Furthermore, the growth of red oak and hard maple has been considerably lower than growth in hardwood lumber production. The strongest evidence of overcutting exists in southern Minnesota (red oak) and Ohio (red and white oak). However, more research is required to determine if timber is being cut faster than it is being grown for other species and locations in the north central region.

The information examined in this paper also indicates some potential timber supply problems in the northeast region. Since 1977 the proportion of select species has been decreasing in this region. Average tree diameter has remained constant since 1987. Furthermore, the fragmentation of nonindustrial private lands combined with increased public ownership may be causing some localized reductions in timber supply. Although inventory statistics indicate a 106% increase in sawtimber volume in this region between

1970 and 1992, the authors also question the 85% increase in sawtimber volume between 1977 and 1992.

Timber supplies appear to be adequate in the southeastern and south central regions. Although there have been substantial increases in sawtimber inventories on public lands in these regions, sawtimber growth on private nonindustrial and forest industry lands exceeds the growth of hardwood lumber production. One emerging trend that could be affecting south central and southeastern sawtimber supplies is the increased hardwood consumption by the pulp industry. The actual impact of hardwood pulpwood demand is currently difficult to predict and merits additional research.

Even though there is some evidence of localized sawtimber shortages, forest survey data do not indicate any overall eastwide timber shortage. A major problem with timber inventory data is the infrequency of timber surveys and timber product output studies. The lack of current inventory and usage information is especially acute in the northeast region. Given the variety of sawtimber sizes being consumed by the various types of primary hardwood processors, the conversion factors used to project sawtimber inventories should be examined. Finally, greater frequency of forest surveys in the northern regions would be extremely useful to both resource planners and primary hardwood processors.

Literature Cited

ARAMAN, P.A. 1987. Eastern United States hardwood sawtimber resources and export potential. P. 127-134 in Proc. South. For. Econ. Workers and Mid-West For. Econ. Symp.

BIRCH, T.W. 1992. Land ownership and harvesting trends in eastern forests. P. 143-157 in Proc. 21st Hardwood Res. Counc. Symp.

ERVIN, M.D., R.L. TODD, R.L. ROMIG, AND I.E. DORKA. 1994. Forests of Ohio 1994. Ohio State Univ. Ext. 24 p.

CARDELLICHIO, P.A., AND C.S. BINKLEY. 1984. Hardwood lumber demand in the United States: 1950 to 1980. For. Prod. J. 34(2): 15-22.

LUPPOLD, W.G. 1993. A decade of change in the hardwood industry. P. 11-24 in Proc. 21st Hardwood Res. Counc. Symp.

LUPPOLD, W.G., AND G.P. DEMPSEY. 1989. New estimates of central and eastern U.S. hardwood lumber production. North. J. Appl. For. 6(3): 120-123.

LUPPOLD, W.G., AND G.P. DEMPSEY. 1994. Factors affecting regional changes in hardwood lumber production. For. Prod. J. 44(6).

McLINTOCK, T.F. 1987. Research priorities for eastern hardwoods. Hardwood Res. Counc. 103 p.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES. 1993. Minnesota's forest resources. Minn. Dep. of Natur. Resour., Div. For., St. Paul, Minn. 48 p.

POWELL, D.S., ET AL. 1993. Forest statistics of the United States, 1992. USDA For. Servo Gen. Tech. Rep. RM-234. 132 p.

USDA FOREST SERVICE. 1973. The outlook for timber in the U.S. USDA For. Servo For. Resour. Rep. 20. 367 p.

USDA FOREST SERVICE. 1982. An analysis of the timber situation in the United States, 1952-2030. USDA For. Servo For. Resour. Rep. 23. 499 p.

U.S. DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS. 1970-91. Current industrial reports: Lumber production and mill stocks. U.S. Dep. Comm. Bur. Census. MA24T (70-91).

WADDELL, K.D., D.D. OSWALD, AND D.S. POWELL. 1989. Forest statistics of the United States, 1987. USDA For. Servo Resour. Bull. PNW RB-168. 106 p.