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Lloyd C. Irland
The Irland Group, lcirland@gmail.com

Paul E. Sendak

Richard H. Widmann

USDA United States Department of Agriculture

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Abstract

Hardwood pulpwood consumption has increased in five leading Northeastern states from 1.2 million cords in 1963 to 4.6 million cords in 1997. A shift from the reliance on softwoods has occurred and by the mid-1970s hardwood use exceeded softwood. This increases the importance of the markets for hardwood pulpwood. These five states—Maine, New Hampshire, New York, Pennsylvania, and Vermont—maintain price reports on stumpage, some dating from the early 1960s. We report analyses of trends, nominal and real prices of hardwood stumpage, and comparisons among states. For the most recent decade, real price increases for hardwood pulpwood were detected only in Maine and Vermont. Due to a tightening demand-supply situation, spruce-fir pulpwood stumpage price increased faster than hardwood price after the early 1980s in Maine, New Hampshire, and New York. Aspen pulpwood stumpage price increased in Maine during the last 10 years, while decreasing in New York. As expected, prices across the region were correlated with harvesting pressure.

The Authors

LLOYD C. IRLAND, forestry consultant, received a B.S. degree in forestry from Michigan State University in 1967, a M.S. degree at the University of Arizona in 1968, and a Ph.D. at Yale University in 1973. He served at the Southern Forest Experiment Station from 1972 to 1973, and since has taught at Yale University, served in Maine state government, and worked as a consultant.

PAUL E. SENDAK, forest economist, received a B.S. degree in forestry from Rutgers University in 1965, and an M.S. degree in 1968 and Ph.D. degree in 1972 from the University of Massachusetts. He joined the Northeastern Research Station in 1969 and since 1993 has been engaged in research on ecology and management of northern forest ecosystems at the Northeastern Research Station's Forestry Sciences Laboratory, Durham, New Hampshire.

RICHARD H. WIDMANN, forest resource analyst, received a B.S. degree in forest management from the University of Missouri in 1975. In 1978 he joined the Northeastern Research Station's Forest Inventory and Analysis project, now headquartered in Newtown Square, Pennsylvania. Since 1980 he has been engaged in research on primary processors of timber in the Northeastern States.

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Introduction

In 1996 the 12 northeastern States[1] accounted for 7.5 percent of pulpwood receipts (volume received at mills, not necessarily produced in-state) (Ingram et al. 1999). This figure has decreased from 14.7 percent in 1953. Although receipts in all regions continued to grow in absolute terms, all regions lost market share to the southeastern coastal states during this period. The South remains the major U.S. producer of wood pulp, with 74 percent of total pulpwood receipts in 1996. Of the 12 northeastern States, Maine, New Hampshire, New York, Pennsylvania, and Vermont accounted for 83 percent of the pulpwood produced in the region and 88 percent of the pulpwood receipts in 1997 (Widmann and Griffith 1999). Maine accounted for 57 percent of the pulpwood receipts in the region and is a net pulpwood importer. In 1997, pulpwood accounted for 5.3 million cords of an estimated total timber cut of 14 million cords in Maine, New Hampshire, New York, and Vermont (Irland Group 1999). Much of this wood crosses state and national boundaries and trade with Canada is important in some regions.

Pulpwood production in the Northeast was projected to increase from 6 million cords in 1969 to 12 to 15 million in 1985 (Kingsley 1971). The projections were based on a period between 1959 and 1965 of unprecedented growth in production, a 10 percent share of the U.S. market, and optimistic national projections for pulpwood. By 1997, the 9.3-million-cord pulpwood production in the Northeast still had not reached the level projected for 1985. Several factors account for this, such as substitution of hardwoods for softwoods resulting in higher yields of pulp per ton of pulpwood, increased efficiency in woodpulping technology, greater use of fiber from wastepaper, substitution of plastics for paper products, and a loss in market share to the South.

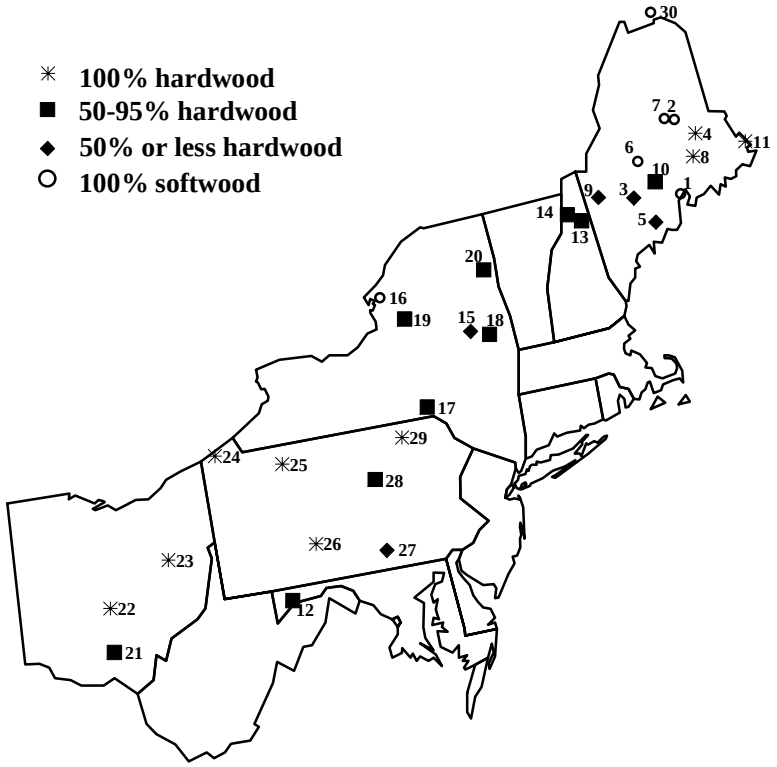
On a relative basis, Northeast pulpwood consumption continues to lose ground to the South, but pulpwood, particularly hardwood pulpwood, is important in the Northeast because of increasing regional mill use and because it constitutes a large proportion of harvested volume. In 1997, 30 mills remained active in the region including a mill in New Brunswick, Canada, just across the border of Maine (Fig. 1). Only six of the mills used softwood exclusively. By the mid-1970s hardwood production exceeded softwood as mills sought the useful traits of hardwood fiber to substitute for more costly softwood (Fig. 2 and Table 1). Hardwood pulpwood markets vary considerably, and major mills are not uniformly spread over the region. Harvesting of hardwood pulpwood is concentrated in a "Pulpwood Belt" (Fig. 3).

In the five states, annual round softwood pulpwood production has remained nearly constant from 1965 to 1997 (Table 2). In that same period, hardwood pulpwood production increased 2.4 times and ranged from a 9-fold increase in Vermont to a 1.5-fold increase in Pennsylvania. Maine's absolute increase of 1.3 million cords of hardwood pulpwood between 1965 and 1997 was the greatest.

Delivered pulpwood is a significant cost of paper production — about 20 percent of the cost of a ton of pulp. Of the cost of delivered pulpwood in the Northeast, stumpage accounts for about 16 percent, transportation accounts for half or more, and logging accounts for the remainder. Temporary factors, e.g. weather, affect pulpwood prices and use on a seasonal basis. This report focuses on long-term trends and does not attempt to analyze seasonal price differences.

Information on stumpage prices is used in forestry in a variety of ways, such as land appraisal and valuation, comparison of management practices, and assessment of investment strategies. Publicly reported stumpage prices also are used to analyze business problems and test research hypotheses (Campbell and White 1989; Dennis 1989; Howard and Chase 1995; Hunter 1982; Lindahl and Plantinga 1997a; Lutz 1998; Plantinga 1998; Sendak 1992; Sendak and McEvoy 1989). Analysts use long-term trends in prices to develop expectations for future prices (Stevens 1987; Wagner et al. 1995; Zinkhan et al. 1992). This report presents analyses of trends in pulpwood stumpage prices with an emphasis on hardwoods for Maine, New Hampshire, New York, Pennsylvania, and Vermont from 1961 to 2000, with analysis dependent on availability of state data (Appendix). The report also explores the relationship between prices and timber supply conditions and discusses the principal limitations in using publicly reported price data for these analyses.

[1]Slightly different definitions of the Northeast are used in the different reports. Ingram et al. (1999) exclude Kentucky and Ohio, Widmann and Griffith (1999) exclude Kentucky, and Kingsley (1971) includes all 14 states.



1. Bucksport, ME; Champion International Corp.
2. E. Millinocket, ME; Great Northern Paper
3. Jay, ME; International Paper Co.
4. Lincoln, ME; Lincoln Pulp and Paper Co.
5. Lisbon Falls, ME; International Paper Co.
6. Madison, ME; Madison Paper Industries
7. Millinocket, ME; Great Northern Paper, Inc.
8. Old Town, ME; Fort James Corp.
9. Rumford, ME; The Mead Corp.
10. Hinckley, ME; S.D. Warren Company, Sappi Ltd.
11. Woodland, ME; Georgia-Pacific Corp.
12. Luke, MD; Westvaco Corp.
13. Berlin, NH; American Tissue Co.
14. Groveton, NH; Groveton Paper Board, Inc.
15. Corinth, NY; International Paper Co.
16. Deferiet, NY; Champion International Corp.
17. Deposit, NY; Norbord Industries
18. Glens Falls, NY; Finch-Pruyn and Company
19. Lyons Falls, NY; Lyons Falls Pulp and Paper Inc.
20. Ticonderoga, NY; International Paper Co.
21. Chillicothe, OH; The Mead Corp.
22. Circleville, OH; Jefferson Smurfit Corp.
23. Coshocton, OH; Stone Container Corp.
24. Erie, PA; International Paper Co.
25. Johnsonburg, PA; Willamette Industries, Inc.
26. Roaring Spring, PA; Appleton Papers, Inc.
27. Spring Grove, PA; The P.H. Glatfelter Co.
28. Sunbury, PA; Celotex Corp.
29. Towanda, PA; Masonite Corp./International Paper
30. Edmundston, New Brunswick, Canada; Fraser, Inc.

Figure 1.—Mills and locations receiving pulpwood in the Northeastern U.S., 1997. There have been a number of mill closings and ownership changes in the Northeast since 1997.

Data Sources And Limitations

Timber stumpage price data are gathered in a variety of ways from many sources. Public records are kept by agencies involved in sales of publicly owned timber, and obtaining the information for sampling is easy. However in the Northeast, most sales occur on private land so no such public records exist. (There are exceptions in states that collect timber sale information for yield tax or current-use tax purposes). In the case of private sales, a sampling frame, such as a list of timber sales, must be established before a sample can be selected. Establishing such a list is not always easy and could entail two-phase or double sampling, where a final selection is made from a larger preselection. For example, loggers are sampled to obtain a list of timber sales for a specified period. From this list of loggers and sales, a second, smaller sample of loggers is selected to obtain information on stumpage prices paid.

Loggers, foresters, and/or timber buyers are contacted by mail for stumpage prices of sales on private lands in which they were involved. The sample depends on voluntary responses and may be classified as a self-selected sample. Expert choice or judgment sampling also is used. In this case, a small group of "experts" develops what they consider to be representative prices based on their knowledge of the market and recent sales.

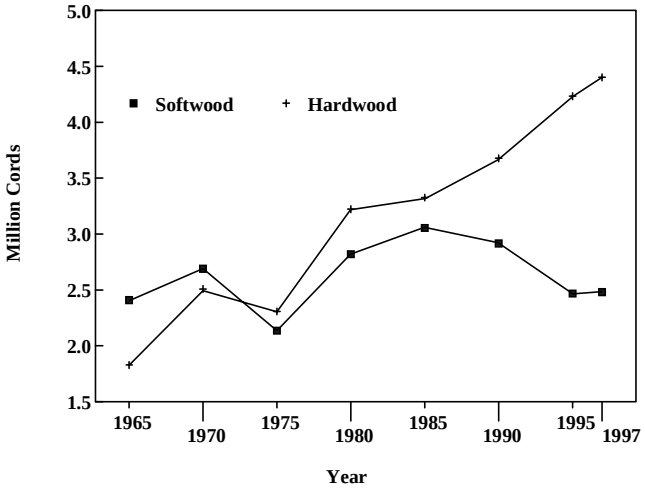


Figure 2.—Northeastern States round pulpwood production by species group, selected years, 1965 to 1997.

Samples based on voluntary responses or expert-choice are not probability samples. Statistical theory cannot be used to draw inferences about the total population of prices if the probability of selecting a sample element is unknown. And although one can report the mean and standard deviation of the sample, one cannot infer that they estimate population values.

The potential for nonsampling errors also must be considered. Nonsampling errors are errors in data collection not related to the sampling design and sample size. For example, the mechanics of selecting a sample unit in the field may be unclear or the data requested from respondents may rely on memory rather than a written record. Uncertainties can arise due to reports using different units of measurements, e.g., cords versus tons, or different log rules. Nonsampling errors also include data handling errors, which occur when data are recorded and transcribed, or in the methods to check and correct errors. Sampling and nonsampling errors, taken together, determine the accuracy of the sample.

There are many points to consider when designing a system for collecting stumpage-price data. The price paid for stumpage is based on an estimate of quantity of final product. Standing timber is not a commodity. Conditions of sale, accessibility, degree of logging difficulty, characteristics of the timber, and market structure combine to influence stumpage price. Therefore, it is desirable to collect and report stumpage prices by species and intrastate regions, recognizing that other characteristics will create a range of observed prices. Some states report prices for quality classes. However, numerous classifications and frequent reporting tend to result in cells with few or no observations.

Since price reporting is used to inform private timberland owners, emphasis should be on private sales with public sales reported separately. Sales should be open and be the result of a bid process or a negotiation between buyer and seller rather than internal sales in which a company mills its own timber.

Sales can either be lump sum by species, where a single price is offered for each species in the sale across the board, or mill tally sales, where the owner is paid stumpage based on volume of logs scaled at the mill by species and grade. Although the latter alternative appears more desirable from a reporting context, it could bias estimates of average prices if simple means, unweighted by volume, are calculated. High-priced quality logs typically account for only a small proportion of the total volume in a sale. Therefore, an unweighted average overestimates their contribution to sale value.

Price data are reported in a variety of ways. Typically, an estimate of the center of the observed price distribution and dispersion around the center are reported. Some reports provide an average range, others provide a mean and standard deviation, or mean and range, or median and range. The prices are reported for a specific period by species/products and geographic area, and occasionally by quality class. Although it may not be stated explicitly, the data in most reports are screened for extreme values.

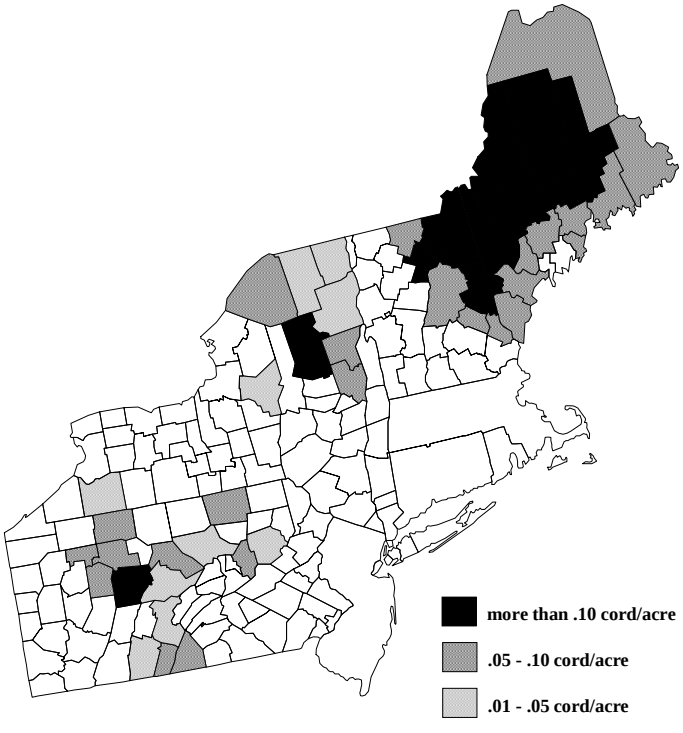


Figure 3.—Hardwood pulpwood belt for selected states in the northeast, counties producing 10 thousand or more cords of hardwood pulpwood.

For example, Maine's current annual stumpage report covers as many as 17 species/species groups and eight products. Average species/products prices, minimum and maximum prices, and number of reports received are provided for all 16 counties and for the entire state. The Maine report is the only one based on a mandatory form filed by all landowners cutting timber, and nominally reports on all private timber sales. Its primary goals are to track annual timber harvest and to develop values for Tree Growth Tax valuations (a form of use-value taxation). Prior to 1992, Maine stumpage prices were estimated by expert choice and reported semi-annually by the Maine Forest Service.

Vermont collects stumpage price data by mailing voluntary questionnaires to private and public foresters, loggers, and timber buyers. Vermont's quarterly report includes median price and lowest and highest prices. The report also indicates when few prices were received for 13 species/products in the three regions in the state. Typically, 30 to 40 respondents report quarterly about 400 individual prices.

Irland has made the following observations from conducting proprietary stumpage prices surveys since 1980:

- Prices were readily obtained and plentiful for commonly sold products, such as white pine sawlogs or spruce-fir pulpwood. But prices were scarce for uncommon or high-value products, such as veneer-quality timber. Publicly reported prices also follow this pattern. Maine's 1998 statewide report included:

Product	Responses
Ash sawlogs	817
Ash veneer	49
Spruce-fir pulpwood	2,512
White pine sawlogs	2,766
White oak sawlogs	113
White oak veneer	39

- Quotations from different sources are highly variable because stumpage is an in situ value and not a commodity. The quoted prices reflect a variety of factors affecting a nonstandard product. Examples of this variation are shown for Maine pulpwood prices in Table 3.

- When markets were tight, buyers were unwilling to say how much they were paying for wood.

- It was more difficult to obtain stumpage prices for large landholdings where contract for logging services (CLS) was common. In CLS operations, landowners market wood to mills and contract for logging and hauling instead of selling stumpage to loggers.

- Pulpwood was commonly sold in multiproduct sales and the circumstances and product mixes affected the price paid for the pulpwood. When pulpwood was removed as part of a sale the primary goal of which was silvicultural, factors affecting stumpage price must include the owner's eagerness to complete the treatment.

- Analysts often use state averages, but these can conceal differences among regions within larger states.

In the Northeast, data from timber sales on public lands are of limited use. If public timber sales are infrequent, data are insufficient to estimate price trends. National Forests' timber sales programs in the five States have dwindled to the point that price trends are increasingly difficult to interpret. Also, the differences of sales practices and procedures between public and private lands affect the data comparability. In Pennsylvania, an extensive State Forest System and the timber sale program on the Allegheny National Forest (at least until recently) may provide frequent enough data to be an exception.

Comparing prices over time or between locations unintentionally can include variables caused by differences in product mix, species, grade, and harvesting and pulpmaking technology. Adjusting for these is difficult in a practical price-reporting system. At one time, the usefulness of stumpage price reporting was debated with some arguing that considerations such as these rendered public stumpage price reporting unreliable and, hence, unwarranted (Zivnuska and Shideler 1958). Nonetheless, many state officials have disregarded this kind of advice believing that some form of public price reporting, whatever its imperfections, remains useful (Duerr 1960; Michie and Kametz 1987; Rosen 1984). We agree with the agencies on this point but when the information is used for business planning or for research and analysis, the limitations of the data should be considered carefully.

Trend Analysis

Annual rates of price change were estimated using the model:

$$\ln V_t = \ln V_0 + rt \qquad [1]$$

where

V_t = future value,
V_o = initial value,
t = time period for compounding,
r = the continuous rate of change, and
ln is the natural logarithm (base e).

The model was fit by ordinary least-squares regression (generalized least squares if autoregression was

detected). Rates of change, *r* in equation [1], were adjusted to estimate the annual percentage rate (Sendak 1991). The coefficient *r*, as estimated in the logarithmic form of the equation, was tested for significance at $\alpha = 0.05$.

Pulpmills are not located uniformly across states except in Maine and Pennsylvania. In New Hampshire, mills are concentrated in the north, and in New York they are located in the north and east. In Vermont, which has no mills, pulpwood is marketed to northern New Hampshire, nearby Maine, and northeastern New York. Pulpwood is shipped long distances in some cases, and as a result, prices can be influenced by Canadian mills' purchases. Instead of analyzing statewide averages, we analyzed regional averages for the northern price-reporting region consisting of the three northern counties in New Hampshire (Table 7), the northern and eastern counties of New York (Table 8), and five northern counties of Vermont (Table 10). The intent in restricting the region to areas of high pulpwood demand was to remove areas producing little pulpwood from the estimate of average price to reduce price volatility. Unless specified otherwise, the price series analyzed in this report are statewide averages for Maine (Table 6) and Pennsylvania (Table 9) and regional averages for New Hampshire, New York, and Vermont.

Results

Annual price-change rates were estimated for the restricted areas for the life of the series, and for the last 10 years to facilitate comparisons between states (Table 4). Average change in real prices was estimated for all pulpwood species and species groups reported in each state by frequency reported. These estimates then were standardized to annual percentage rates.

For the life of the series, 8 of the 20 rates were not significantly different from zero ($p \leq 0.05$). Of those that were significant, about half were positive and ranged from 0.60 percent in Maine for hardwood pulpwood to 1.89 percent in Maine for red pine pulpwood. Most of the significant negative rates occurred in New York and ranged from –1.53 percent for aspen pulpwood to –1.04 percent for paper birch pulpwood.

From 1991 to 2000 (1990 to 1999 for Maine), 8 of the 20 rates were insignificant. Of the 12 significant rates, eight were positive. Perhaps the most noteworthy result was the large positive-price change rates in Maine, where they ranged from 3.01 percent for hardwood pulpwood to 5.23 percent for hemlock. White pine was the only species in Maine that did not change. New York was the only state to have significant negative rates of change—aspen pulpwood prices decreased by 3.58 percent annually and pine pulpwood prices decreased by 5.65 percent annually. However, New York spruce-fir prices increased by more than 5.86 percent per year. Average price trends remained constant in New Hampshire, Pennsylvania, and Vermont for the period.

Graphic Analysis of Price Trends

Regional pulpwood prices generally are influenced by conditions in paper markets for which market pulp prices provide a proxy. Pulpwood prices and operating rates, in turn, are determined by demand/supply cycles in world paper markets. Market pulp prices generally were stable until the early 1970s. At that time, pulpwood was readily available in the Northeast and forest inventories (growing stock) were increasing. The rise in market pulp prices in the mid-1980s (Fig. 4) was mirrored in real price increases for several pulpwood species in several states. Also heavy cutting in Maine during the 1980s in response to the spruce budworm outbreak depressed prices for spruce-fir pulpwood. More recently, as pulpwood markets tightened in Maine, pulpwood prices have become more market responsive. The continued abundant supplies elsewhere in the region minimized this effect outside Maine.

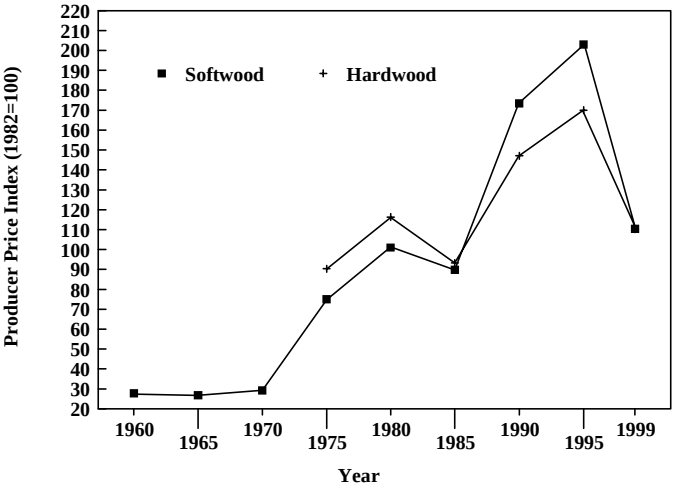


Figure 4.—U.S. Producer Price Indexes, bleached and semibleached sulfate pulp by species, 1960 to 1999.

Maine

In the early 1960s, Maine's hardwood pulpwood production was barely a third of softwood pulpwood production. Today, hardwood pulpwood production exceeds softwood by nearly 40 percent. Over time, hardwood stumpage prices have seen a small but steady increase (Fig. 5 and Table 4). More recently, hardwood prices have experienced a sharper increase, an average annual increase of about 3 percent, which mostly is due to the large increase in 1998. Similar trends were noted in aspen pulpwood stumpage price (not graphed).

Treated by the market as one species group, spruce-fir actually is two or more species (eastern spruces, mostly red; and balsam fir). Spruce-fir was the most important pulpwood species-group in Maine, but now is a distant second in production compared to hardwoods. Spruce-fir stumpage prices declined through the mid-1980s, caused by salvage harvesting from the spruce-budworm outbreak in the late 1970s and early 1980s (Fig. 6). Since the late 1980s, spruce-fir stumpage prices have increased dramatically, since 1990, greater than 5 percent per year, partially as a result of the end to the salvaging of dead trees from the spruce-budworm outbreak and a diminished supply of spruce-fir (Fig. 6 and Table 4). More of the Maine softwood harvest is being converted into sawn products as technology and strong markets for sawn wood are using smaller logs that previously had been considered pulpwood. Ironically, as managers have increased hardwood percentages in their pulpmill's furnish, the softwood fiber needed for paper strength has become even more important. Similar trends were noted for hemlock (not graphed).

New Hampshire

Unlike Maine, New Hampshire's hardwood pulpwood production has exceeded softwood production since the early 1960s. In 1963, 1.1 cords of hardwood were produced for every cord of softwood. By 1997 that ratio had increased to 1.6 cords to 1. Hardwood pulpwood stumpage prices in New Hampshire have increased at an average annual rate of more than 1.58 percent (Fig. 7 and Table 4). Much of this increase was the result of very low prices between 1961 and 1965. Unfortunately, unreported prices in 1962 and 1966 coincide with major turning points in price change. Since the late 1970s, hardwood pulpwood stumpage prices have been volatile but had an average net change of zero.

New Hampshire spruce-fir pulpwood production is fourth after hardwood, white pine, and hemlock. However, spruce-fir pulpwood is second to hardwood in total value. Spruce-fir pulpwood stumpage prices in northern New Hampshire show a shift from a negative trend from 1961 to the early 1980s to a positive trend from the early 1980s to 1998. A price drop occurred in 1999 and 2000 (Fig. 8 and Table 4). Salvage efforts following the last spruce budworm outbreak could be affecting New Hampshire prices as well as those in Maine.

New York

As in New Hampshire, more hardwood pulpwood was produced than softwood since the early 1960s in New York. In 1963, there were 1.7 cords of

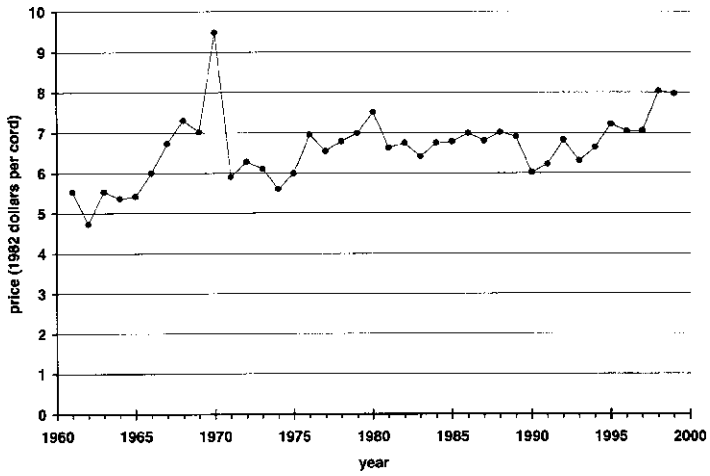


Figure 5.—Maine hardwood pulpwood stumpage prices (1982 dollars), 1961 to 1999.

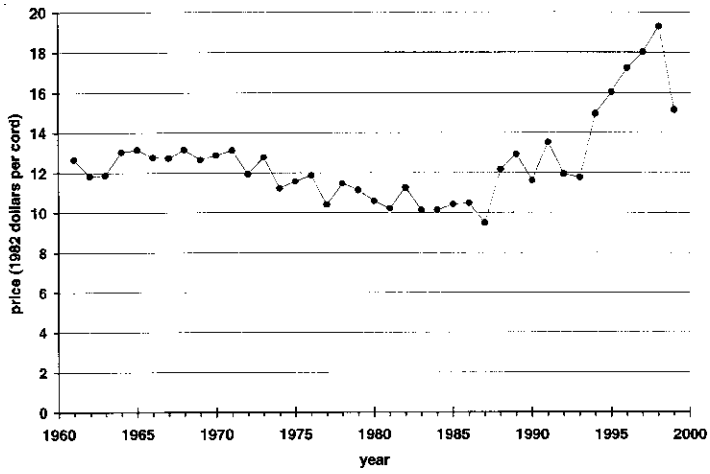


Figure 6.—Maine spruce-fir pulpwood stumpage prices (1982 dollars), 1961 to 1999.

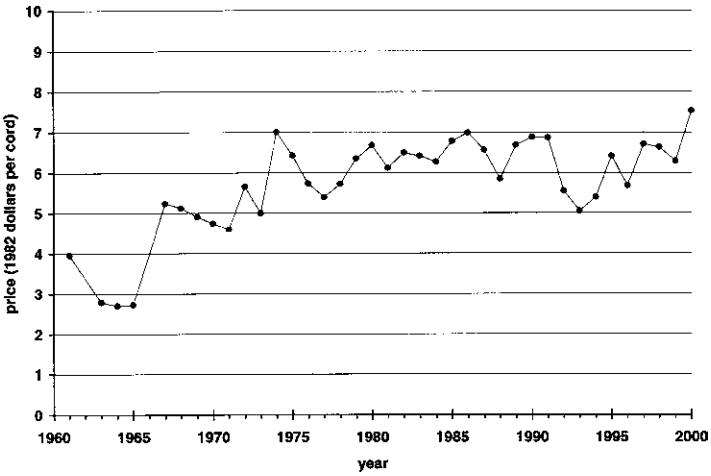


Figure 7.—Northern New Hampshire hardwood pulpwood stumpage prices (1982 dollars), 1961 to 2000.

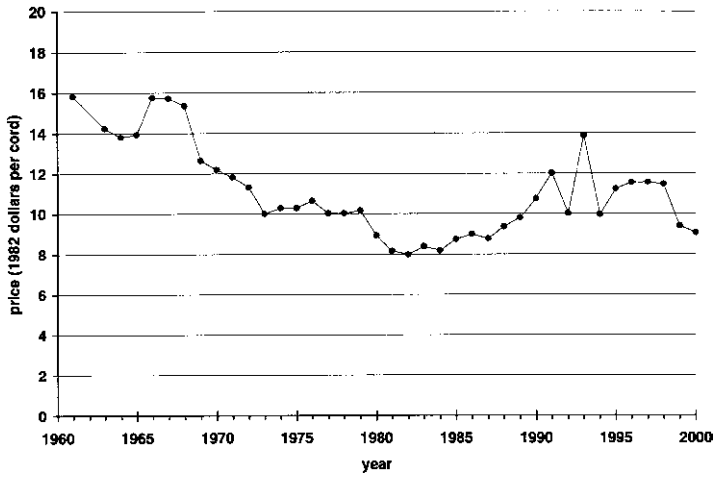


Figure 8.—Northern New Hampshire spruce-fir pulpwood stumpage prices (1982 dollars), 1961 to 2000.

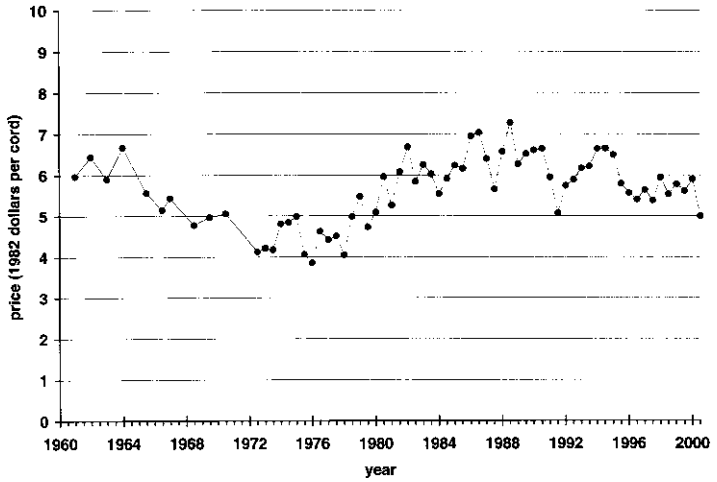


Figure 9.—Northeastern New York hardwood pulpwood stumpage prices (1982 dollars), semi-annual, 1961 to 2000.

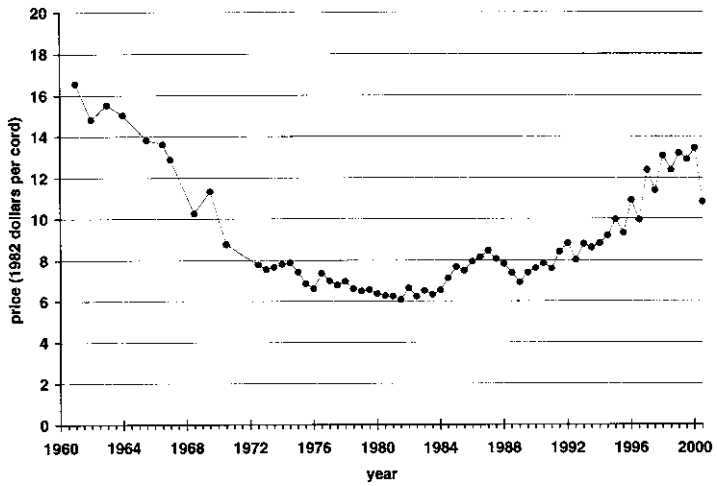


Figure 10.—Northeastern New York spruce-fir pulpwood stumpage prices (1982 dollars), semi-annual, 1961 to 2000.

hardwood pulpwood produced for every cord of softwood and by 1997 the ratio increased to 2.0 cords to 1. Hardwood pulpwood stumpage prices did not change significantly between 1961 and 1998. However, prices declined between 1961 and 1972, increased from 1973 to 1985, and decreased thereafter (Fig. 9). Aspen and paper birch show similar trends (not graphed).

Spruce-fir pulpwood stumpage prices in New York show a more dramatic decline from 1961 to 1980 and a recovery to the early 1960s level by 1997 (Fig. 10). From 1991 to 2000, prices increased at an annual rate of 5.86 percent (Table 4). This price increase was due in part to Canadian sawmills using what was formerly considered pulpwood-size spruce-fir logs to produce dimension lumber beginning in 1989. A proportion of "pulpwood" thus became "sawtimber," increasing the pressure on supply resulting in higher pulpwood prices. This shift in use also was a factor in spruce-fir pulpwood price increases in Maine.

Pennsylvania

The Pennsylvania price data are the most limited of the five states examined. The hardwood pulpwood series aggregates all hardwood species, mostly northern hardwoods, oak, hickory, aspen, and yellow-poplar. Price data were reported quarterly since 1987 but because of a reporting anomaly, only data reported since 1992.2 (second quarter 1992) were analyzed. Hardwood pulpwood production in Pennsylvania exceeds softwood pulpwood production by a ratio of 8 to 1. The quarterly stumpage price data for hardwood pulpwood were relatively volatile over the 9-year span of the series and no significant trend was noted (Fig. 11 and Table 4).

Softwood pulpwood species are aggregated into one class that includes mostly pine and some hemlock. Although the price series is 5 years longer than the hardwood series, no significant trend for softwood pulpwood stumpage prices was detected (Fig. 12 and Table 4). No prices for softwood pulpwood were reported for the last three quarters of 2000 (Table 9).

Vermont

Vermont is unique among the five states because it has not had an operating pulpmill since the 1990s. Vermont pulpwood is exported to markets in northern New Hampshire, nearby Maine, and northeastern New York. In 1963, slightly more than a third of a cord of hardwood pulpwood was cut for every cord of softwood in the five northern counties of Vermont. By 1998, that increased to 1.2 cords of hardwoods for each cord of softwood. This five-

county area accounted for 86 percent of the spruce-fir pulpwood and two-thirds of all the pulpwood produced in the state in 1998.

Vermont pulpwood stumpage price series aggregate all hardwood and softwood species. Hardwood stumpage prices in northern Vermont decreased at an average annual rate of 1.39 percent. The short-term trend, 1991.1 to 2000.4, was positive but not significant (Table 4). From the plotted data, stumpage prices trended downward to about 1992 and were relatively volatile after 1992, with no clear trend (Fig. 13).

In the five northern counties, spruce-fir predominates followed by white pine and hemlock. In the remaining central and southern counties, white pine predominates followed by hemlock and spruce-fir. The long-term trend in northern Vermont for softwood pulpwood stumpage prices was positive and significant (Fig. 14 and Table 4). Short term, the trend was positive but not significant (Table 4).

Hardwood versus Softwood Prices

From 1961 to 1981, the relative price of hardwood stumpage increased dramatically compared to spruce-fir in Maine, New Hampshire, and New York. Since 1981, the price has declined (Fig. 15). This was attributed more to the change in spruce-fir prices than hardwood prices. Hardwood pulpwood stumpage prices in all three states were constant or decreased slightly, while spruce-fir pulpwood stumpage prices decreased until the mid-1970s to early 1980s and then increased through the end of the series. This indicates a more stable and favorable situation for hardwood pulpwood supply than for softwood despite the strong growth in regional hardwood consumption over the entire period.

Cross-section Analysis

On a regional scale, 1997 hardwood pulpwood stumpage price was plotted against 1997 hardwood pulpwood cut per thousand acres of timberland for each of 34 price-reporting regions across the five states (Fig. 16). Regions that reported no pulpwood cut or were not near a pulpmill were omitted. Prices generally increased with the amount cut. This result was expected because mills located in areas where harvesting was intense for hardwood pulpwood tended to pay a premium for their wood (Spelter 1999). A regression equation was fitted to the data with price as the dependent variable and the logarithm (base 10) of production per thousand acres as the independent variable. The resulting relationship was significant ($p = 0.01$) with an R^2 of 0.29, with

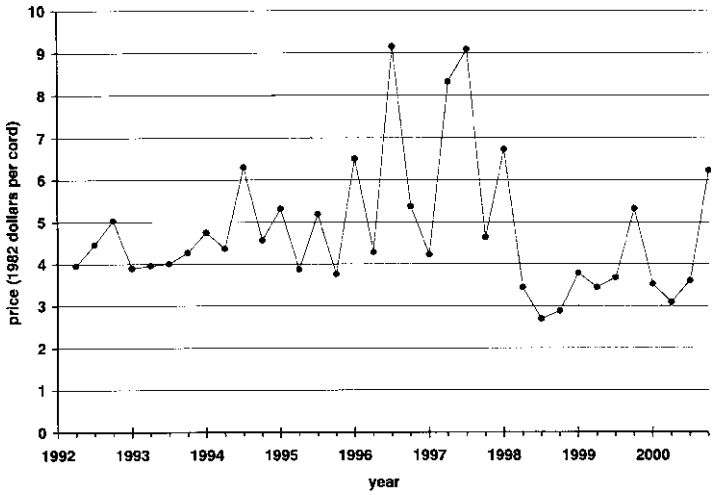


Figure 11.—Pennsylvania hardwood pulpwood stumpage prices (1982 dollars), quarterly, 1992 to 2000.

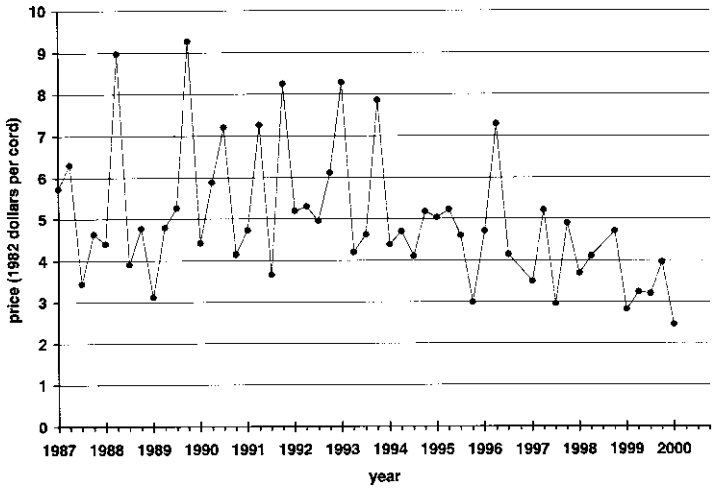


Figure 12.—Pennsylvania softwood pulpwood stumpage prices (1982 dollars), quarterly, 1987 to 2000.

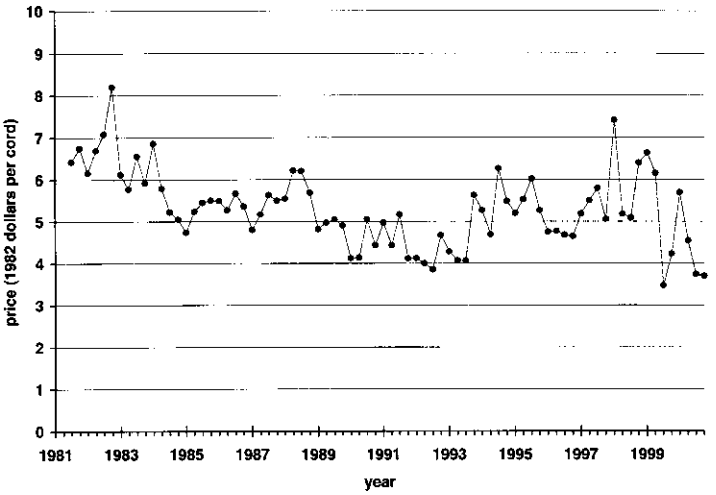


Figure 13.—Northern Vermont hardwood pulpwood stumpage prices (1982 dollars), quarterly, 1981 to 2000.

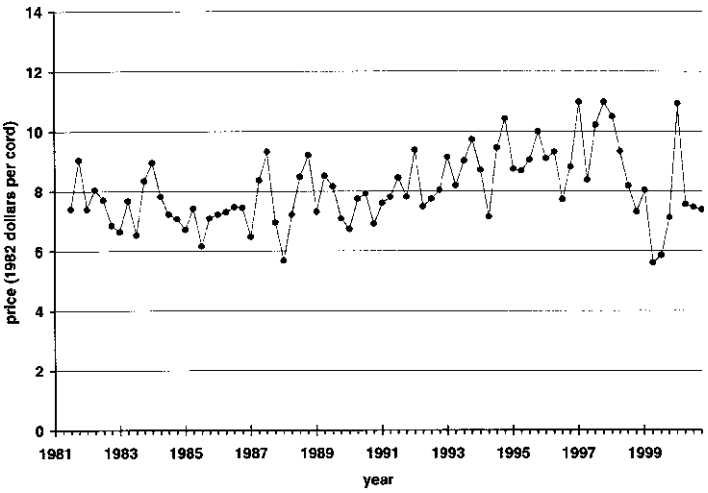


Figure 14.—Northern Vermont softwood pulpwood stumpage prices (1982 dollars), quarterly, 1981 to 2000.

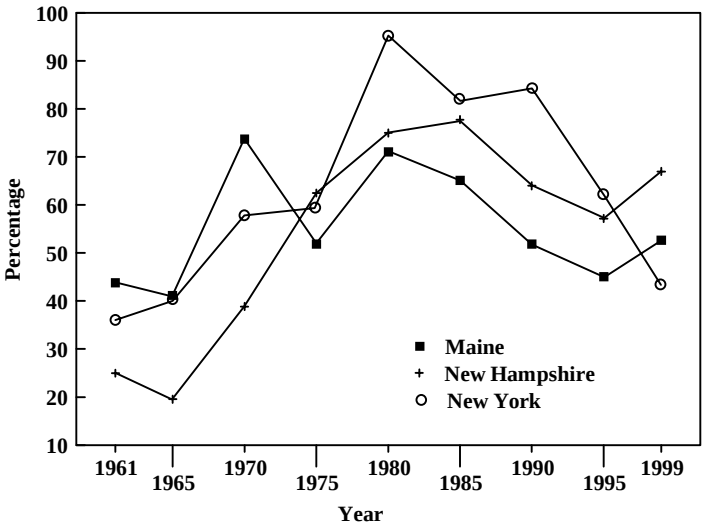


Figure 15.—Hardwood pulpwood stumpage price as a percentage of spruce-fir stumpage price by state, 1961 to 1999.

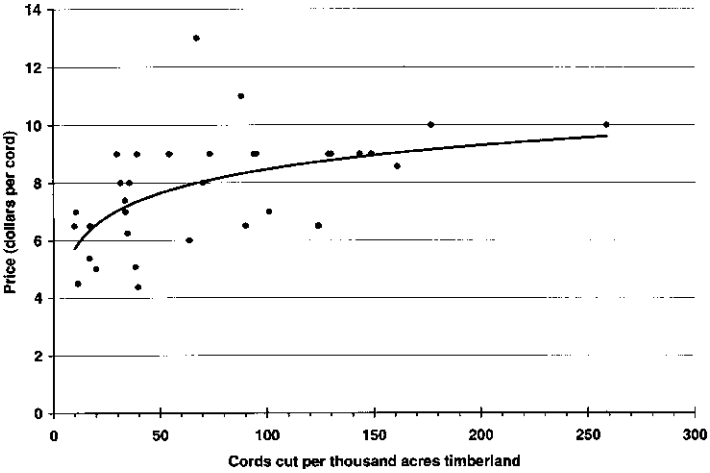


Figure 16.—Hardwood pulpwood stumpage prices versus harvesting pressure in the northeast for 1997 by price reporting regions. The estimated regression line: y = 2.94 + 2.76 [log(production/1000 ac)].

71 percent of the variation explained by other factors. The other factors might include hardwood species used, mill type and number, pulp and paper markets, sawlog markets, and geographic location within the region. These conditions, known as "market imperfections" to economists, can affect price behavior in local areas.

Average real stumpage prices from 1989 to 1998 were compared by species and state using analysis of variance. For species reported by at least two states, Maine had the highest prices for aspen, white pine, and spruce-fir pulpwood (Table 5). For hardwood and hemlock pulpwood, Maine was grouped with the states that had the highest prices. Clearly, there were differences in pulpwood prices between states. Some price differences can be explained by species. For example, softwood pulpwood in northern Vermont is predominantly higher valued spruce-fir while in Pennsylvania it is predominantly pine with some hemlock. Market differences and pressure on the resource also contribute to price differences between states.

Conclusions And Implications For The Future

Forest owners, potential investors, and managers are interested in the price trends and outlook for hardwood pulpwood. Because of improving markets, hardwood pulpwood is financially more important than ever before to Northeastern landowners, papermills, and other buyers. To date, there has been little research on the hardwood pulpwood market in the Northeast.

Analysts use time trends, price correlations, and regional comparisons of stumpage prices for a variety of business and resource assessment purposes. Users should be mindful of the inherent limitations in price reporting for a nonstandard product like stumpage. Limitations could be especially significant for hardwood pulpwood that often is sold in imperfect markets for a variety of reasons. Hardwood pulpwood can be considered a byproduct of hardwood sawlog production. The harvest of high-value hardwood sawlogs drives the production of hardwood pulp at logging jobs where tops, branches, and small-diameter trees, and cull trees go into pulp, and by the hardwood residues produced by sawmills. This is especially true in Pennsylvania, where more than a billion board feet of hardwood sawlogs are harvested each year. The pulpwood value plays a small part in any landowner's decision to harvest.

We estimated long-term price trends by state using regression analysis. Over the entire period, the rate of increase for hardwood pulpwood stumpage price

was significant in Maine (1961 to 1999) and New Hampshire (1961 to 2000). In New York (1961 to 2000) and Pennsylvania (1992 to 2000), the change was not significant. In Vermont, hardwood pulpwood prices decreased, on average, from 1981 to 2000.

Different patterns emerged in the most recent 10-year period. In Maine the rate of change was significant and positive. In New Hampshire, New York, Pennsylvania, and Vermont the change was not significant. Results depend on the time periods considered in the analyses. It is natural to feel that the best results for prediction will come from analyzing data collected over the longest period of time. Perhaps for long-term planning purposes the best price expectations are based on long-term trends. However, it is possible that market conditions in the 1960s or 1970s were so different from those of today that it is unwise to include them in short-term analyses. In other words, for short-term price expectations, recent price trends might be more useful than long-term.

As expected, cross-section analyses indicated that higher rates of cutting were associated with higher prices. The relationship was statistically significant but other factors obviously affect price because the R^2 was only 0.29. A hardwood pulpwood surplus exists throughout the region and that tends to curb price changes.

Large macroeconomic models that forecast future timber-stumpage prices are difficult to build and maintain, and require a quantity and quality of data that does not exist in the Northeast. A simpler model that describes the behavior of a variable such as stumpage price in terms of past values has been studied in the Northeast (Lindahl and Plantinga 1997a, b; Lutz 1998). This research has revealed that timber stumpage price series in Maine and New York are stationary stochastic processes, i.e., they revert to a mean value or more appropriately to a mean trend. Lindahl and Plantinga (1997a) estimated several time-series forecasting models for Maine stumpage price series of the type shown in Table 6. For a specific forecast, actual value could differ substantially, but in the long term, prices would be expected to revert to the mean trend.

Pulpwood is one of the lower valued forest products, ranking between industrial boiler fuel and the lowest quality sawlogs—pallet logs and studwood. But pulpwood also competes in the global market with market pulp from foreign producers. Pulpwood prices throughout the Northeast are affected by competition from foreign market pulp. Wood fiber was substituted for dwindling rag supplies in the late 1800s and hardwood was substituted for dwindling softwood supplies in recent years. In the future, vegetable fiber from other sources could be substituted for wood.

We do not envision large departures from long-term trends in pulpwood stumpage prices in the Northeast. Circumstances may lead to short-term price increases or decreases as has been noted for recent significant increases in spruce-fir pulpwood stumpage prices in Maine and New York. But market forces should mitigate these departures from long-term trends. Stronger markets for hardwood pulpwood and higher stumpage prices offer important opportunities for improving forest practices and returns to forest-land owners. Growing hardwood use has been one reason for a narrowing of growth-to-cut balances in the Northeast. Past trends in hardwood pulpwood prices undoubtedly will continue to influence expectations of future prices. And price expectations will influence decisions about forest management practices, landowner investments and policies, and capacity and fiber mix planning for mills.

Acknowledgments

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Table 1.—Hardwood roundwood pulpwood production, receipts, and percent of total roundwood for selected Northeastern States, 1997

State	Hardwood as percent of total roundwood production	Hardwood pulpwood	
		Production	Receipts
		Thousands of cords	
Maine	54	1,898.4	2,341.4
New Hampshire	62	344.5	(D)
New York	67	493.0	318.3
Pennsylvania	89	717.4	821.6
Vermont	60	230.4	0.0
Total		3,453.3	NA

D = Data withheld to avoid disclosure for individual mills.
Source: Widmann and Griffith, 1999.

Table 2.—Round pulpwood produced in state by species group, selected years, 1965-1997

State/Species	1965	1970	1975	1980	1985	1990	1995	1997
	Thousands of cords and percent							
Maine								
Softwood	1,831.7	2,320.2	1,738.5	2,304.6	2,171.0	1,899.5	1,524.9	1,589.4
Hardwood	585.7	900.7	753.4	1,143.4	1,299.4	1,436.1	1,940.5	1,898.4
HW % of SW	32.0%	38.8%	43.3%	49.6%	59.9%	75.6%	127.3%	119.4%
New Hampshire								
Softwood	125.3	47.2	56.6	92.5	130.3	222.0	228.0	211.1
Hardwood	75.1	151.9	168.9	161.6	186.3	246.6	366.9	344.5
HW % of SW	59.9%	321.8%	298.4%	174.7%	143.0%	111.1%	160.9%	163.2%
New York								
Softwood	131.6	97.9	179.3	156.1	367.6	366.4	309.7	244.1
Hardwood	239.3	290.1	272.6	461.0	354.5	396.4	366.6	493.4
HW % of SW	181.8%	296.3%	152.0%	295.3%	96.4%	108.2%	118.4%	202.1%
Pennsylvania								
Softwood	231.6	147.9	88.5	137.1	204.3	186.9	218.1	284.1
Hardwood	900.6	1,115.6	1,019.0	1,286.6	1,342.4	1,418.0	1,333.8	1,434.8
HW % of SW	388.9%	754.3%	1151.4%	938.6%	657.1%	758.7%	611.6%	505.0%
Vermont								
Softwood	87.1	75.7	71.6	127.7	181.9	241.5	186.0	152.5
Hardwood	26.0	49.1	93.4	169.3	145.1	180.1	224.5	230.4
HW % of SW	29.9%	64.9%	130.4%	132.6%	79.8%	74.6%	120.7%	151.1%
Region Total								
Softwood	2,407.2	2,688.9	2,134.5	2,818.0	3,055.1	2,916.3	2,466.7	2,481.2
Hardwood	1,826.7	2,507.4	2,307.3	3,221.9	3,327.7	3,677.2	4,232.3	4,401.5
HW % of SW	75.9%	93.3%	108.1%	114.3%	108.9%	126.1%	171.6%	177.4%

Source: Tabulation by R. Widmann.

Table 3.—Maine pulpwood stumpage prices and number of reports, by major species group, 1998

Species	Average	Minimum	Maximum	No. reports
		dollars per cord		
Aspen/Poplar	10	0.14	48	1,612
Hemlock	13	1.15	60	1,566
Other Hardwood	10	0.58	55	2,709
Spruce-Fir	24	0.92	116	2,512
White Pine	7	0.86	55	2,017

Source: Maine Forest Service 1998.

Table 4.—Pulpwood real stumpage price trends for selected states and times

State and species	Annual percentage rate of price change, life of series	Annual percentage rate of price change, last 10 years
Maine: 1961 to 1999		
Eastern white pine	1.46	-0.10[a]
Red pine	1.89	5.13
Hemlock	0.30[a]	5.23
Spruce-fir	0.46[a]	5.06
Aspen	1.04	3.97
Hardwood	0.60	3.01
New Hampshire: 1961 to 2000		
Eastern white pine	-0.39[a]	-1.13[a]
Hemlock	-0.36[a]	3.40[a]
Spruce-fir	-1.15	-2.10[a]
Hardwood	1.58	2.21[a]
New York: 1961.1 to 2000.2		
Pine	-1.26	-5.65
Hemlock	1.23	1.48[a]
Spruce-fir	-2.14[a]	5.86
Aspen	-1.53	-3.58
Paper birch	-1.04	-0.97[a]
Hardwood	0.18[a]	-1.07[a]
Pennsylvania: 1987.1 to 2000.4		
Hardwood (1992.2 to 2000.4)	-1.39[a]	NA
Softwood	-3.30[a]	-6.99[a]
Vermont: 1981.3 to 2000.4		
Hardwood	-1.39	0.60[a]
Softwood	0.86	0.58[a]

[a]Not significantly different from zero ($p \leq 0.05$).

Table 5.—Mean real pulpwood stumpage prices (standard deviation in parentheses) from 1989 to 1998 by state and species. Means within species followed by the same letter are not significantly different ($p \leq 0.05$) by Tukey's method

State	Aspen	Paper birch	Hardwood	Hemlock	Red pine	White pine	Spruce-fir	Softwood
	1982 dollars per cord							
Maine	6.18 A (0.92)	—	6.83 A (0.58)	7.85 A (1.49)	6.99 (1.29)	5.49 A (0.26)	14.73 A (2.80)	—
New Hampshire	—	—	6.19 A (0.69)	5.69 B (2.06)	—	4.01 B (0.80)	11.22 B (1.21)	—
New York	4.27 B (0.70)	5.52 (1.16)	6.00 A (0.49)	8.65 A (0.94)	—	4.21 B (0.83)	9.37 B (1.80)	—
Pennsylvania	—	—	5.00[a] B (1.69)	—	—	—	—	5.16 A (1.53)
Vermont	—	—	4.98 B (0.74)	—	—	—	—	8.60 B (1.12)

[a] Period 1992.2 (1992, second quarter) to 1998.4.

Table 6.—Maine annual pulpwood stumpage prices, by species, in dollars and real dollars (1982 dollars per cord)

		Aspen		Eastern hemlock		White pine		Red pine		Hardwood		Spruce Fir	
Year	PPI [a]	Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price
1961	31.6	1.25	3.96	2.50	7.91	1.00	3.16	1.25	3.96	1.75	5.54	4.00	12.66
1962	31.7	1.25	3.94	2.25	7.10	1.00	3.15	1.25	3.94	1.50	4.73	3.75	11.83
1963	31.6	1.25	3.96	2.25	7.12	1.00	3.16	1.25	3.96	1.75	5.54	3.75	11.87
1964	32.6	1.50	4.60	2.00	6.13	1.00	3.07	1.00	3.07	1.75	5.37	4.25	13.04
1965	32.3	1.50	4.64	2.50	7.74	1.50	4.64	1.50	4.64	1.75	5.42	4.25	13.16
1966	33.3	1.75	5.26	2.25	6.76	1.25	3.75	1.50	4.50	2.00	6.01	4.25	12.76
1967	33.4	2.00	5.99	2.50	7.49	1.50	4.49	1.50	4.49	2.25	6.74	4.25	12.72
1968	34.2	1.75	5.12	2.50	7.31	1.50	4.39	1.50	4.39	2.50	7.31	4.50	13.16
1969	35.6	1.75	4.92	2.50	7.02	1.50	4.21	1.50	4.21	2.50	7.02	4.50	12.64
1970	36.9	2.00	5.42	2.50	6.78	1.75	4.74	1.75	4.74	3.50	9.49	4.75	12.87
1971	38.1	2.00	5.25	2.75	7.22	1.50	3.94	1.75	4.59	2.25	5.91	5.00	13.12
1972	39.8	2.00	5.03	2.75	6.91	1.75	4.40	1.75	4.40	2.50	6.28	4.75	11.93
1973	45.0	2.25	5.00	3.25	7.22	2.25	5.00	2.25	5.00	2.75	6.11	5.75	12.78
1974	53.5	3.00	5.61	4.00	7.48	3.00	5.61	2.50	4.67	3.00	5.61	6.00	11.21
1975	58.4	3.25	5.57	4.00	6.85	2.50	4.28	2.00	3.42	3.50	5.99	6.75	11.56
1976	61.1	3.75	6.14	4.50	7.36	3.25	5.32	3.50	5.73	4.25	6.96	7.25	11.87
1977	64.9	4.25	6.55	4.25	6.55	3.50	5.39	3.50	5.39	4.25	6.55	6.75	10.40
1978	69.9	4.50	6.44	5.00	7.15	4.00	5.72	3.75	5.36	4.75	6.80	8.00	11.44
1979	78.7	5.00	6.35	5.50	6.99	4.50	5.72	4.25	5.40	5.50	6.99	8.75	11.12
1980	89.8	5.75	6.40	6.25	6.96	4.75	5.29	4.75	5.29	6.75	7.52	9.50	10.58
1981	98.0	5.50	5.61	6.25	6.38	5.00	5.10	4.00	4.08	6.50	6.63	10.00	10.20
1982	100.0	6.00	6.00	6.75	6.75	5.50	5.50	5.50	5.50	6.75	6.75	11.25	11.25
1983	101.3	5.75	5.68	6.25	6.17	5.25	5.18	5.75	5.68	6.50	6.42	10.25	10.12
1984	103.7	6.75	6.51	6.75	6.51	5.50	5.30	6.50	6.27	7.00	6.75	10.50	10.13
1985	103.2	6.50	6.30	6.00	5.81	5.75	5.57	5.75	5.57	7.00	6.78	10.75	10.42
1986	100.2	5.75	5.74	6.50	6.49	5.50	5.49	5.50	5.49	7.00	6.99	10.50	10.48
1987	102.8	6.00	5.84	6.75	6.57	5.25	5.11	5.75	5.59	7.00	6.81	9.75	9.48
1988	106.9	6.00	5.61	6.50	6.08	5.50	5.14	6.25	5.85	7.50	7.02	13.00	12.16
1989	112.2	6.75	6.02	6.75	6.02	6.25	5.57	6.50	5.79	7.75	6.91	14.50	12.92
1990	116.3	6.00	5.16	7.00	6.02	6.50	5.59	6.75	5.80	7.00	6.02	13.50	11.61
1991	116.5	6.50	5.58	8.25	7.08	6.25	5.36	6.50	5.58	7.25	6.22	15.75	13.52
1992	117.2	6.00	5.12	8.00	6.83	7.00	5.97	7.00	5.97	8.00	6.83	14.00	11.95
1993	118.9	6.50	5.47	8.25	6.94	6.25	5.26	8.00	6.73	7.50	6.31	14.00	11.77
1994	120.4	8.00	6.64	10.00	8.31	6.00	4.98	9.00	7.48	8.00	6.64	18.00	14.95
1995	124.7	8.00	6.42	11.00	8.82	7.00	5.61	10.00	8.02	9.00	7.22	20.00	16.04
1996	127.7	8.00	6.26	11.00	8.61	7.00	5.48	9.00	7.05	9.00	7.05	22.00	17.23
1997	127.6	9.00	7.05	12.00	9.40	7.00	5.49	10.00	7.84	9.00	7.05	23.00	18.03
1998	124.4	10.00	8.04	13.00	10.45	7.00	5.63	12.00	9.65	10.00	8.04	24.00	19.29
1999	125.5	8.00	6.37	11.00	8.76	9.00	7.17	10.00	7.97	10.00	7.97	19.00	15.14

[a]PPI = Producer price index, all commodities, 1982 = 100.

Source: Maine Forest Service 1961-1992 and Maine Forest Service 1993-2000.

Table 7.—Northern New Hampshire[a] annual pulpwood stumpage prices, by species, in dollars and real dollars (1982 dollars per cord)

		Eastern hemlock		White pine		Hardwood		Spruce-fir	
Year	PPI [b]	Price	Real price	Price	Real price	Price	Real price	Price	Real price
1961	31.6	1.25	3.96	1.25	3.96	1.25	3.96	5.00	15.82
1963	31.6	1.75	5.54	1.25	3.96	0.88	2.78	4.50	14.24
1964	32.6	2.00	6.13	1.25	3.83	0.88	2.70	4.50	13.80
1965	32.3	2.00	6.19	1.25	3.87	0.88	2.72	4.50	13.93
1966	33.3	3.00	9.01	1.75	5.26	—	—	5.25	15.77
1967	33.4	1.75	5.24	2.00	5.99	1.75	5.24	5.25	15.72
1968	34.2	1.75	5.12	2.00	5.85	1.75	5.12	5.25	15.35
1969	35.6	2.00	5.62	1.50	4.21	1.75	4.92	4.50	12.64
1970	36.9	2.00	5.42	1.50	4.07	1.75	4.74	4.50	12.20
1971	38.1	2.00	5.25	1.50	3.94	1.75	4.59	4.50	11.81
1972	39.8	2.50	6.28	1.50	3.77	2.25	5.65	4.50	11.31
1973	45.0	2.50	5.56	1.50	3.33	2.25	5.00	4.50	10.00
1974	53.5	3.00	5.61	2.25	4.21	3.75	7.01	5.50	10.28
1975	58.4	3.00	5.14	2.25	3.85	3.75	6.42	6.00	10.27
1976	61.1	3.00	4.91	2.25	3.68	3.50	5.73	6.50	10.64
1977	64.9	3.00	4.62	2.25	3.47	3.50	5.39	6.50	10.02
1978	69.9	3.00	4.29	2.75	3.93	4.00	5.72	7.00	10.01
1979	78.7	3.75	4.76	3.75	4.76	5.00	6.35	8.00	10.17
1980	89.8	5.00	5.57	5.00	5.57	6.00	6.68	8.00	8.91
1981	98.0	5.00	5.10	5.00	5.10	6.00	6.12	8.00	8.16
1982	100.0	5.00	5.00	5.00	5.00	6.50	6.50	8.00	8.00
1983	101.3	5.00	4.94	5.00	4.94	6.50	6.42	8.50	8.39
1984	103.7	5.00	4.82	5.00	4.82	6.50	6.27	8.50	8.20
1985	103.2	4.00	3.88	4.00	3.88	7.00	6.78	9.00	8.72
1986	100.2	4.00	3.99	3.50	3.49	7.00	6.99	9.00	8.98
1987	102.8	4.00	3.89	3.50	3.40	6.75	6.57	9.00	8.75
1988	106.9	3.50	3.27	3.50	3.27	6.25	5.85	10.00	9.35
1989	112.2	4.00	3.57	4.00	3.57	7.50	6.68	11.00	9.80
1990	116.3	6.00	5.16	6.00	5.16	8.00	6.88	12.50	10.75
1991	116.5	6.00	5.15	6.00	5.15	8.00	6.87	14.00	12.02
1992	117.2	5.75	4.91	4.25	3.63	6.50	5.55	11.75	10.03
1993	118.9	6.00	5.05	4.50	3.78	6.00	5.05	16.50	13.88
1994	120.4	12.50	10.38	4.00	3.32	6.50	5.40	12.00	9.97
1995	124.7	5.00	4.01	3.50	2.81	8.00	6.42	14.00	11.23
1996	127.7	9.25	7.24	6.25	4.89	7.25	5.68	14.75	11.55
1997	127.6	9.25	7.25	5.00	3.92	8.56	6.71	14.75	11.56
1998	124.4	5.17	4.16	4.88	3.92	8.25	6.63	14.25	11.45
1999	125.5	6.75	5.38	5.01	3.99	7.89	6.29	11.78	9.39
2000	132.6	5.00	3.77	4.50	3.39	10.00	7.54	12.00	9.05

[a]Counties included: Carroll, Coos, and Grafton.
[b]PPI = Producer price index, all commodities, 1982 = 100, (2000 preliminary).
Source: University of New Hampshire 1961-1998 and New Hampshire Timberland Owners Association 1999-2000.

Table 8.—New York semi-annual pulpwood stumpage prices in northern and eastern regions[a], by species, in dollars and real dollars (1982 dollars per cord)

		Aspen		Eastern Hemlock		Pine		Hardwood		Paper birch		Spruce-fir	
Year[b]	PPI[c]	Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price
1961.1	31.7	2.00	6.31	2.00	6.31	2.50	7.89	1.89	5.97	2.5	7.89	5.25	16.56
1962.1	31.6	1.96	6.20	1.95	6.17	2.00	6.33	2.04	6.44	2.00	6.33	4.68	14.81
1963.1	31.5	2.10	6.67	1.63	5.16	1.83	5.82	1.86	5.90	2.33	7.41	4.89	15.53
1964.1	31.6	2.10	6.65	2.17	6.86	1.79	5.65	2.11	6.67	4.50	14.24	4.75	15.03
1965.2	32.1	2.00	6.23	2.17	6.75	1.72	5.35	1.79	5.56	2.75	8.57	4.44	13.82
1966.2	33.5	1.83	5.47	1.63	4.85	1.59	4.74	1.72	5.14	2.00	5.97	4.56	13.62
1967.1	33.4	2.00	5.99	2.00	5.99	1.71	5.13	1.81	5.43	2.83	8.48	4.31	12.89
1968.2	34.1	2.50	7.33	—	—	1.50	4.40	1.63	4.77	3.50	10.26	3.50	10.26
1969.2	35.3	2.50	7.08	—	—	1.50	4.25	1.75	4.96	3.50	9.92	4.00	11.33
1970.2	37.1	2.50	6.74	—	—	1.50	4.04	1.88	5.05	5.00	13.48	3.25	8.76
1972.2	40.3	2.00	4.96	—	—	1.86	4.62	1.66	4.13	1.63	4.03	3.14	7.79
1973.1	43.0	1.79	4.16	—	—	1.75	4.07	1.81	4.22	1.90	4.42	3.25	7.56
1973.2	46.6	2.28	4.88	—	—	2.55	5.47	1.95	4.18	2.65	5.69	3.58	7.67
1974.1	50.8	2.14	4.22	—	—	2.21	4.35	2.44	4.80	—	—	3.97	7.82
1974.2	56.3	2.28	4.05	—	—	2.56	4.54	2.72	4.84	—	—	4.44	7.89
1975.1	57.5	2.11	3.67	—	—	2.59	4.51	2.86	4.98	—	—	4.28	7.44
1975.2	59.4	2.47	4.16	—	—	2.44	4.12	2.42	4.07	3.75	6.31	4.08	6.87
1976.1	60.4	2.28	3.77	—	—	2.56	4.23	2.33	3.86	3.00	4.97	4.00	6.62
1976.2	61.9	2.44	3.95	—	—	2.50	4.04	2.86	4.62	3.17	5.12	4.56	7.36
1977.1	64.3	2.56	3.97	—	—	2.67	4.15	2.83	4.41	3.33	5.18	4.50	7.00
1977.2	65.5	2.44	3.73	—	—	2.61	3.99	2.94	4.50	3.00	4.58	4.44	6.79
1978.1	68.5	2.50	3.65	—	—	2.81	4.11	2.78	4.06	2.75	4.01	4.78	6.97
1978.2	71.4	2.78	3.89	—	—	3.44	4.81	3.56	4.98	4.00	5.60	4.72	6.61
1979.1	76.2	2.94	3.86	—	—	3.56	4.68	4.17	5.47	3.83	5.03	4.94	6.49
1979.2	81.3	3.22	3.96	—	—	3.81	4.69	3.83	4.72	4.50	5.54	5.33	6.56
1980.1	87.4	3.50	4.00	—	—	3.28	3.75	4.44	5.09	4.33	4.96	5.56	6.36
1980.2	92.3	4.00	4.33	—	—	3.44	3.73	5.50	5.96	5.00	5.42	5.78	6.26
1981.1	97.2	4.22	4.34	—	—	3.71	3.82	5.11	5.26	6.25	6.43	6.06	6.24
1981.2	98.9	4.25	4.30	—	—	3.69	3.73	6.00	6.07	5.50	5.56	6.00	6.07
1982.1	99.8	4.50	4.51	—	—	4.29	4.29	6.67	6.68	5.50	5.51	6.63	6.64
1982.2	100.3	4.50	4.49	—	—	4.36	4.34	5.86	5.84	6.00	5.98	6.25	6.23
1983.1	100.6	4.44	4.42	—	—	4.06	4.03	6.29	6.25	5.00	4.97	6.56	6.52
1983.2	102.0	4.39	4.30	6.71	6.58	4.36	4.27	6.14	6.02	5.00	4.90	6.44	6.32
1984.1	103.7	5.57	5.37	7.00	6.75	4.86	4.68	5.75	5.54	6.67	6.43	6.78	6.54
1984.2	103.7	5.86	5.65	8.57	8.27	4.93	4.75	6.13	5.91	6.25	6.03	7.39	7.13
1985.1	103.4	5.67	5.48	9.00	8.70	4.86	4.70	6.44	6.23	6.25	6.04	7.94	7.68

Continued

Table 8.—continued

Year[b]	PPI[c]	Aspen		Eastern Hemlock		Pine		Hardwood		Paper birch		Spruce-fir	
		Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price	Price	Real price
1985.2	103.0	6.00	5.83	8.07	7.84	4.71	4.58	6.33	6.15	5.00	4.85	7.72	7.50
1986.1	100.8	5.71	5.67	8.14	8.08	4.79	4.75	7.00	6.94	6.40	6.35	8.00	7.94
1986.2	99.6	5.33	5.35	7.42	7.45	4.71	4.73	7.00	7.03	6.33	6.36	8.13	8.16
1987.1	101.7	5.00	4.92	7.43	7.30	4.38	4.30	6.50	6.39	6.50	6.39	8.61	8.47
1987.2	104.0	5.38	5.17	6.17	5.93	4.64	4.46	5.88	5.65	6.63	6.37	8.39	8.07
1988.1	105.7	5.67	5.36	7.89	7.46	5.25	4.97	6.94	6.57	6.75	6.39	8.28	7.83
1988.2	108.3	6.00	5.54	9.67	8.93	7.20	6.65	7.88	7.27	9.00	8.31	8.00	7.39
1989.1	111.9	6.00	5.36	9.00	8.04	4.83	4.32	7.00	6.26	7.25	6.48	7.75	6.93
1989.2	112.6	5.89	5.23	8.89	7.89	4.71	4.19	7.33	6.51	6.00	5.33	8.33	7.40
1990.1	114.4	6.33	5.54	10.00	8.74	5.57	4.87	7.56	6.60	6.00	5.24	8.72	7.62
1990.2	118.0	5.94	5.03	11.43	9.69	6.38	5.40	7.83	6.64	7.00	5.93	9.28	7.86
1991.1	116.9	5.11	4.37	9.11	7.79	4.31	3.69	6.94	5.94	6.00	5.13	8.89	7.60
1991.2	116.2	5.17	4.45	9.29	7.99	5.07	4.36	5.89	5.07	6.25	5.38	9.78	8.41
1992.1	116.6	5.75	4.93	9.71	8.33	5.71	4.90	6.69	5.74	6.88	5.90	10.28	8.81
1992.2	117.8	4.96	4.21	8.64	7.34	5.36	4.55	6.94	5.89	6.00	5.09	9.44	8.02
1993.1	119.0	5.06	4.25	9.00	7.56	5.14	4.32	7.33	6.16	6.00	5.04	10.44	8.78
1993.2	118.9	4.13	3.47	9.28	7.80	6.07	5.11	7.39	6.21	6.00	5.05	10.22	8.60
1994.1	119.7	5.33	4.46	12.75	10.65	4.71	3.94	7.94	6.64	10.75	8.98	10.53	8.80
1994.2	121.1	5.44	4.50	12.94	10.69	5.46	4.51	8.06	6.65	9.75	8.05	11.11	9.18
1995.1	124.2	5.57	4.49	12.19	9.81	7.75	6.24	8.06	6.49	6.00	4.83	12.39	9.97
1995.2	125.3	4.42	3.52	10.83	8.65	4.60	3.67	7.25	5.79	6.00	4.79	11.67	9.31
1996.1	127.1	3.71	2.92	11.29	8.88	4.33	3.41	7.07	5.56	6.33	4.98	13.86	10.90
1996.2	128.3	4.71	3.67	10.64	8.30	3.92	3.05	6.93	5.40	5.60	4.36	12.75	9.94
1997.1	127.9	4.67	3.65	11.43	8.94	4.33	3.39	7.21	5.64	5.50	4.30	15.83	12.38
1997.2	127.4	5.17	4.06	11.00	8.63	4.75	3.73	6.86	5.38	7.20	5.65	14.50	11.38
1998.1	125.0	4.57	3.66	11.14	8.91	4.25	3.40	7.43	5.94	5.67	4.53	16.33	13.07
1998.2	123.9	4.57	3.69	10.43	8.42	3.83	3.09	6.86	5.53	6.60	5.33	15.33	12.38
1999.1	123.6	5.33	4.32	12.43	10.06	3.58	2.90	7.14	5.78	6.20	5.02	16.33	13.21
1999.2	127.4	4.43	3.48	11.29	8.86	3.50	2.75	7.14	5.61	5.60	4.40	16.43	12.90
2000.1	130.8	4.00	3.06	12.86	9.83	3.43	2.62	7.71	5.90	7.80	5.96	17.57	13.43
2000.2	134.5	3.57	2.66	11.43	8.50	4.00	2.97	6.71	4.99	8.25	6.13	14.57	10.83

[a]Counties included: Broome, Cayuga, Chenango, Clinton, Cortland, Delaware*, Essex, Franklin, Fulton, Hamilton, Herkimer, Jefferson, Lewis, Madison, Montgomery*, Oneida, Onondaga, Oswego, Otsego, Saratoga, Schoharie*, St. Lawrence, Tioga, Tompkins, Warren, Washington. Starred counties excluded after 1995.1.
[b]*Year*.1 and *Year*.2 represent consecutive semi-annual periods that are consistent with current reporting in January and July. Prices prior to 1973 were reported annually and assigned a year value based on publication date.
[c]PPI = Producer price index, all commodities, 1982 = 100, (2000.2 preliminary).
Source: New York Department of Environmental Conservation 1961-2000.

Table 9.—Pennsylvania quarterly pulpwood stumpage prices, by species, in dollars and real dollars (1982 dollars per cord)

Year.quarter	PPI[a]	Softwood		Hardwood	
		Price	Real price	Price	Real price
1987.1	100.9	5.78	5.73	—	—
1987.2	102.5	6.47	6.31	—	—
1987.3	103.7	3.58	3.45	—	—
1987.4	104.2	4.83	4.64	—	—
1988.1	104.7	4.61	4.40	—	—
1988.2	106.6	9.56	8.97	—	—
1988.3	108.0	4.22	3.91	—	—
1988.4	108.5	5.17	4.76	—	—
1989.1	110.9	3.47	3.12	—	—
1989.2	112.8	5.41	4.79	—	—
1989.3	112.4	5.91	5.26	—	—
1989.4	112.8	10.45	9.27	—	—
1990.1	114.5	5.06	4.42	—	—
1990.2	114.3	6.73	5.89	—	—
1990.3	116.5	8.39	7.20	—	—
1990.4	119.5	4.96	4.15	—	—
1991.1	117.5	5.56	4.73	—	—
1991.2	116.3	8.45	7.27	—	—
1991.3	116.1	4.25	3.66	—	—
1991.4	116.2	9.59	8.25	—	—
1992.1	115.9	6.01	5.19	—	—
1992.2	117.2	6.21	5.30	4.63	3.95
1992.3	117.8	5.83	4.95	5.26	4.46
1992.4	117.8	7.20	6.11	5.92	5.03
1993.1	118.4	9.80	8.28	4.62	3.90
1993.2	119.5	5.02	4.20	4.73	3.96
1993.3	118.9	5.49	4.62	4.76	4.01
1993.4	118.9	9.34	7.85	5.07	4.27
1994.1	119.3	5.23	4.38	5.67	4.75
1994.2	120.0	5.64	4.70	5.24	4.36
1994.3	120.9	4.96	4.10	7.62	6.30
1994.4	121.2	6.28	5.18	5.53	4.57
1995.1	123.4	6.21	5.03	6.56	5.31
1995.2	124.9	6.53	5.22	4.83	3.87
1995.3	125.2	5.76	4.60	6.49	5.19
1995.4	125.4	3.76	3.00	4.71	3.75
1996.1	126.3	5.94	4.70	8.22	6.51
1996.2	127.8	9.32	7.29	5.47	4.28
1996.3	128.2	5.31	4.14	11.74	9.15
1996.4	128.4	—	—	6.90	5.37
1997.1	128.5	4.50	3.50	5.42	4.22
1997.2	127.2	6.63	5.21	10.59	8.33
1997.3	127.2	3.76	2.95	11.56	9.09
1997.4	127.5	6.24	4.89	5.91	4.63
1998.1	125.0	4.61	3.69	8.41	6.72
1998.2	124.9	5.13	4.11	4.30	3.44

Continued

Table 9.—continued

Year.quarter	PPI[a]	Softwood		Hardwood	
		Price	Real price	Price	Real price
1998.3	124.3	—	—	3.35	2.69
1998.4	123.5	5.81	4.70	3.56	2.88
1999.1	122.6	3.45	2.81	4.63	3.78
1999.2	124.5	4.03	3.24	4.28	3.44
1999.3	126.9	4.06	3.20	4.66	3.67
1999.4	127.9	5.06	3.96	6.80	5.32
2000.1	129.6	3.14	2.45	4.56	3.52
2000.2	132.0	—	—	4.08	3.09
2000.3	133.8	—	—	4.82	3.61
2000.4	135.2	—	—	8.43	6.23

[a] PPI = Producer price index, all commodities, 1982 = 100 (2000.4 preliminary).
Source: Pennsylvania State University 1987-2000.

Table 10.—Northern Vermont[a] quarterly pulpwood stumpage prices, by species, in dollars and real dollars (1982 dollars per cord)

		Softwood		Hardwood	
Year.quarter	PPI[b]	Price	Real price	Price	Real price
1981.3	98.9	7.33	7.41	6.35	6.42
1981.4	98.8	8.94	9.05	6.67	6.75
1982.1	99.7	7.38	7.40	6.14	6.16
1982.2	99.8	8.04	8.06	6.69	6.70
1982.3	100.2	7.73	7.71	7.10	7.09
1982.4	100.3	6.87	6.85	8.23	8.20
1983.1	100.4	6.67	6.64	6.14	6.12
1983.2	100.7	7.73	7.68	5.81	5.77
1983.3	101.7	6.64	6.53	6.67	6.56
1983.4	102.2	8.53	8.35	6.05	5.92
1984.1	103.3	9.25	8.96	7.08	6.86
1984.2	104.0	8.14	7.83	6.03	5.80
1984.3	103.8	7.50	7.23	5.43	5.23
1984.4	103.5	7.32	7.07	5.23	5.06
1985.1	103.3	6.93	6.71	4.90	4.74
1985.2	103.4	7.69	7.43	5.42	5.24
1985.3	102.7	6.32	6.16	5.60	5.45
1985.4	103.3	7.33	7.10	5.69	5.51
1986.1	101.7	7.35	7.22	5.59	5.50
1986.2	99.8	7.29	7.30	5.26	5.27
1986.3	99.4	7.43	7.47	5.64	5.67
1986.4	99.7	7.43	7.45	5.34	5.36
1987.1	100.9	6.53	6.47	4.85	4.80
1987.2	102.5	8.58	8.37	5.30	5.17
1987.3	103.7	9.67	9.32	5.84	5.63
1987.4	104.2	7.24	6.95	5.73	5.50
1988.1	104.7	5.96	5.69	5.80	5.54
1988.2	106.6	7.69	7.22	6.63	6.22
1988.3	108.0	9.16	8.48	6.70	6.20
1988.4	108.5	9.99	9.21	6.18	5.69
1989.1	110.9	8.11	7.32	5.34	4.82
1989.2	112.8	9.60	8.51	5.62	4.98
1989.3	112.4	9.18	8.16	5.68	5.06
1989.4	112.8	8.00	7.09	5.54	4.91
1990.1	114.5	7.71	6.73	4.72	4.12
1990.2	114.3	8.86	7.75	4.73	4.13
1990.3	116.5	9.23	7.92	5.89	5.06
1990.4	119.5	8.25	6.90	5.29	4.43
1991.1	117.5	8.94	7.61	5.85	4.98
1991.2	116.3	9.08	7.81	5.15	4.43
1991.3	116.1	9.82	8.46	6.00	5.17
1991.4	116.2	9.08	7.82	4.79	4.12
1992.1	115.9	10.88	9.38	4.78	4.12
1992.2	117.2	8.78	7.49	4.69	4.00
1992.3	117.8	9.13	7.75	4.54	3.85
1992.4	117.8	9.48	8.05	5.51	4.68

Continued

Table 10.—continued

Year.quarter	PPI[b]	Softwood		Hardwood	
		Price	Real price	Price	Real price
1993.1	118.4	10.83	9.15	5.07	4.28
1993.2	119.5	9.80	8.20	4.87	4.07
1993.3	118.9	10.73	9.02	4.83	4.07
1993.4	118.9	11.58	9.74	6.70	5.63
1994.1	119.3	10.40	8.72	6.29	5.28
1994.2	120.0	8.58	7.15	5.63	4.69
1994.3	120.9	11.44	9.47	7.58	6.27
1994.4	121.2	12.65	10.43	6.66	5.49
1995.1	123.4	10.80	8.75	6.42	5.21
1995.2	124.9	10.85	8.69	6.91	5.53
1995.3	125.2	11.33	9.05	7.55	6.03
1995.4	125.4	12.55	10.01	6.62	5.28
1996.1	126.3	11.50	9.11	6.00	4.75
1996.2	127.8	11.92	9.32	6.10	4.77
1996.3	128.2	9.92	7.74	6.00	4.68
1996.4	128.4	11.33	8.83	5.97	4.65
1997.1	128.5	14.11	10.98	6.67	5.19
1997.2	127.2	10.67	8.39	7.00	5.50
1997.3	127.2	13.00	10.22	7.38	5.80
1997.4	127.5	14.00	10.98	6.46	5.06
1998.1	125.0	13.13	10.51	9.27	7.42
1998.2	124.9	11.67	9.34	6.48	5.18
1998.3	124.3	10.18	8.19	6.33	5.10
1998.4	123.5	9.04	7.32	7.91	6.40
1999.1	122.6	9.88	8.05	8.14	6.64
1999.2	124.5	7.00	5.62	7.67	6.16
1999.3	126.9	7.44	5.86	4.40	3.47
1999.4	127.9	9.12	7.13	5.41	4.23
2000.1	129.6	14.18	10.94	7.39	5.70
2000.2	132.0	10.00[c]	7.58	6.00[c]	4.55
2000.3	133.8	10.00[c]	7.47	5.00[c]	3.74
2000.4	135.2	10.00[c]	7.40	5.00[c]	3.70

[a]Counties include: Caledonia, Essex, Franklin, Lamoille, and Orleans.
[b]PPI = Producer price index, all commodities, 1982 = 100 (2000.4 preliminary).
[c]Median value from published report.
Source: University of Vermont 1981-2000.

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Hardwood pulpwood consumption has increased in five leading Northeastern states from 1.2 million cords in 1963 to 4.6 million cords in 1997. A shift from the reliance on softwoods has occurred and by the mid-1970s hardwood use exceeded softwood. This increases the importance of the markets for hardwood pulpwood. These five states—Maine, New Hampshire, New York, Pennsylvania, and Vermont—maintain price reports on stumpage, some dating from the early 1960s. We report analyses of trends, nominal and real prices of hardwood stumpage, and comparisons among states. For the most recent decade, real price increases for hardwood pulpwood were detected only in Maine and Vermont. Due to a tightening demand-supply situation, spruce-fir pulpwood stumpage price increased faster than hardwood price after the early 1980s in Maine, New Hampshire, and New York. Aspen pulpwood stumpage price increased in Maine during the last 10 years, while decreasing in New York. As expected, prices across the region were correlated with harvesting pressure.

Keywords: harvest, mills, price reporting, spruce-fir, timber output

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