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The Timber Industries of Pennsylvania, 1988

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Experiment Station**

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Abstract

More than 238 million cubic feet (ft³) of industrial roundwood were produced from timberlands in Pennsylvania during 1988. Of this total, slightly more than 166 million ft³ (one billion board feet) were in sawlogs. Pennsylvania was the first northeastern state to exceed the one-billion mark in recent times, reporting an increase in sawlog production of more than 430 million board feet since 1976. Most of the increase was in hardwoods, primarily red and black oak, as softwood sawlog production declined. Production of veneer and pulpwood also increased, while production of other products like hardwood mine timbers declined. Pennsylvania's sawmills generated a total of 25 million ft³ of bark and woody manufacturing residue, nearly all of which was used for fiber, residential fuel, and agricultural uses. Only 6 percent of all residue was unused.

Introduction

The Forest and Rangeland Renewable Resources Planning Act of 1974 and more recent legislation authorize the USDA Forest Service to conduct periodic forest resource inventories of all states. These inventories provide a wealth of information about timber and other forest-related resources of the Nation. Each of the 14 states included within the Northeastern Region as delineated by the Forest Service has been inventoried at least three times by the forest inventory and analysis research unit of the Northeastern Forest Experiment Station.

The fourth inventory of Pennsylvania timberlands was completed in 1989 (Alerich 1993); the previous inventory was conducted from 1977 to 1978 (Considine and Powell 1980; Powell and Considine

1982). The Forest Service also conducts studies on the impact of forest-product use on timberlands.

The extent and degree to which timberlands produce forest products are determined from a canvass of all primary wood manufacturers. These are manufacturing facilities that convert roundwood (logs, bolts and other round, split, or chipped timber products) into products such as lumber, pulp, veneer, cooperage, dimension products, and so on. The product may be used as manufactured, or sent to a secondary wood-using mill for further manufacturing.

A canvass of these primary wood-using mills was completed in Pennsylvania for calendar year 1988. The Pennsylvania Bureau of Forestry assisted in compiling a list of manufacturers and conducting the canvass. Data from pulp mills were gathered from an annual survey of all northeastern pulpwood producers (Widmann 1990). All mills were identified from a list of known primary wood-using mills located in the state, and from mills in other states that might have used wood from Pennsylvania timberlands.

Primary wood manufacturers in Pennsylvania as well as out-of-state primary manufacturers were first contacted through a questionnaire mailed by the Pennsylvania Bureau of Forestry. Nonresponding mills were sent an additional questionnaire or were contacted by field personnel with the Bureau of Forestry. The mills were asked to estimate the volume of roundwood they received during the year by species, product, and origin; and to estimate the volume of residues generated during manufacturing.

We report forest-product use in Pennsylvania at the time of the most recent canvass, and changes that have occurred since previous industry canvasses. Earlier studies were conducted for calendar years 1964, 1969 (Bones and Sherwood 1972), and 1976 (Bones and Sherwood 1979). The statistics are reported by geographic units. Figure 1 shows the counties that are within the boundaries of each unit.

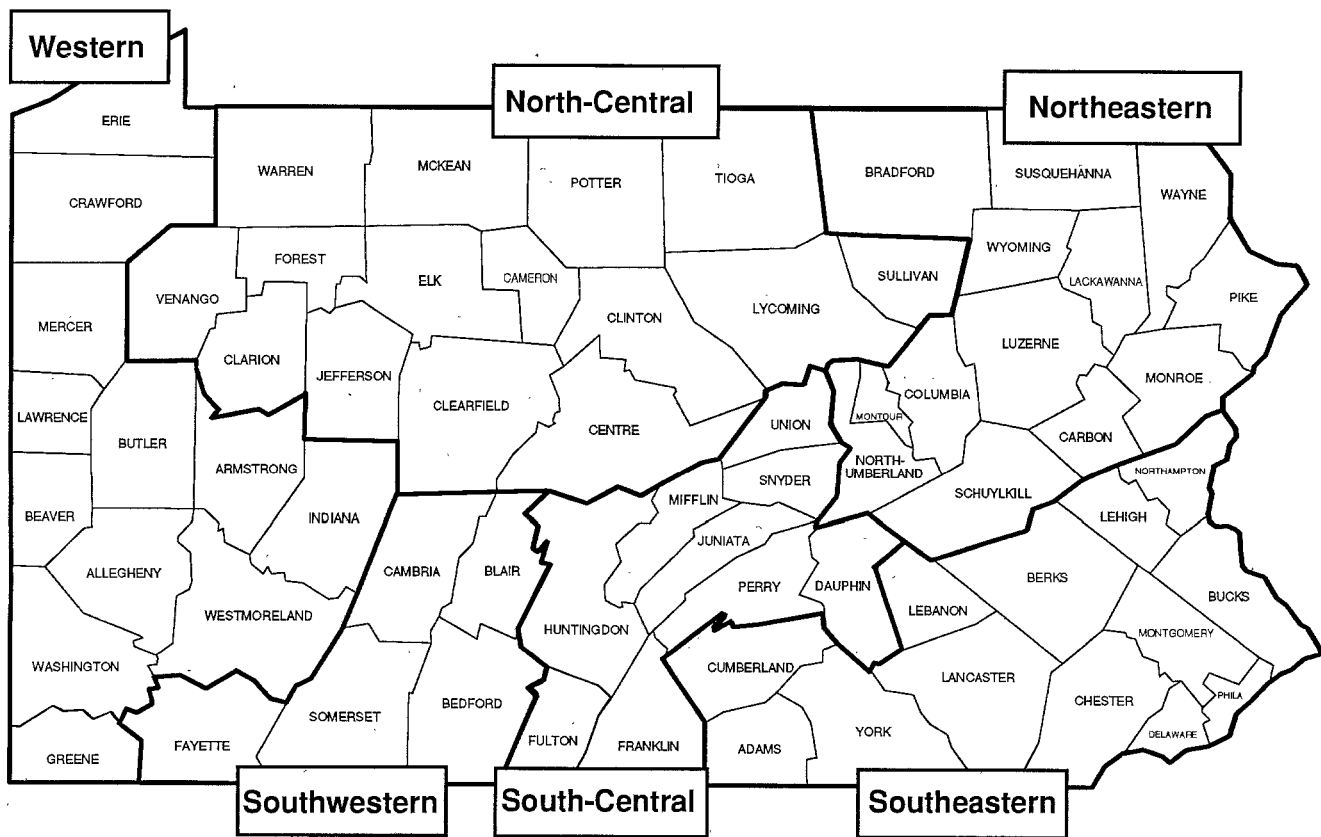


Figure 1.—Pennsylvania counties, by geographic unit

Roundwood Production Exceeds 1 Billion Board Feet

Studies designed to track changes in resource use have been conducted by the Forest Service since the 1940's. Until now, no northeastern state has reached 1 billion board feet of production in a single year. In 1988, more than 238 million ft³ of industrial roundwood were harvested from Pennsylvania's timberlands. Of this total, more than 166 million ft³ (about 1 billion board feet) were in sawlogs. This represents a significant increase from the canvass conducted in 1976 when sawlog production totaled 644 million board feet.

At one time, high production was common throughout the Northeast. In Pennsylvania, softwood lumber production peaked at nearly 2 billion board feet during the late 1800's (Steer 1948). But hardwood lumber production rarely exceeded a half billion board feet, and softwood lumber production has not reached 1 billion board feet since the early 1900's.

In 1988, though, total production of sawlogs, veneer logs, mine timbers, bat and handle stock, cabin logs, and cooperage reached 1,142,020 board feet. This total does not include a significant amount of

pulpwood and small amounts of "other" products that are measured in cords or cubic feet. Pulpwood and other products accounted for about 30 percent of all roundwood, so total production could be as high as an equivalent 1½ billion board feet.

There are a number of reasons for these record volumes. Pennsylvania's contribution in supplying wood for furniture stock always has led in the Northeast. Much of the fine oak, cherry, and other prime hardwoods from the state's timberlands find their way into secondary processing mills in Pennsylvania and along the eastern seaboard, particularly in the Southeast. And even during economic downturns, the furniture industry has remained relatively stable. Possibly, homeowners try to find less expensive ways to improve their lifestyle by purchasing new furniture, refurbishing interiors, or installing hardwood flooring rather than purchasing a new home. Also, demand continues to be strong for pallet stock, which accounts for about 20 percent of the sawlog volume harvested. For many forest products, alternative materials are being used, but wood remains the primary material for manufacturing pallets.

Roundwood production, by product and species group

Product	Species group			All species
	Softwoods	Hardwoods	Total	
----- Thousand Board Feet ^a -----				Thousand ft ³
Sawlogs ^b	42,161	1,039,381	1,081,542	166,459
Veneer logs	84	31,017	31,101	4,800
Mine timbers	42	11,663	11,705	2,531
Bats and handles	--	11,151	11,151	1,713
Cabin logs	4,825	1,279	6,104	1,327
Cooperage	--	417	417	64
----- Standard Cords -----				
Pulpwood	42,673	672,639	715,312	60,802
----- Thousand ft ³ -----				
Other products ^c	6	668	674	674

^aInternational ¼-inch rule.

^bIncludes rough and dressed lumber, landscape ties, furniture dimension, turnstock, dowels, pallet material, and other specialty products.

^cIncludes large poles, fence stock, charcoal wood, and metallurgical wood.

Exports Mostly to Ohio and Canada Mills

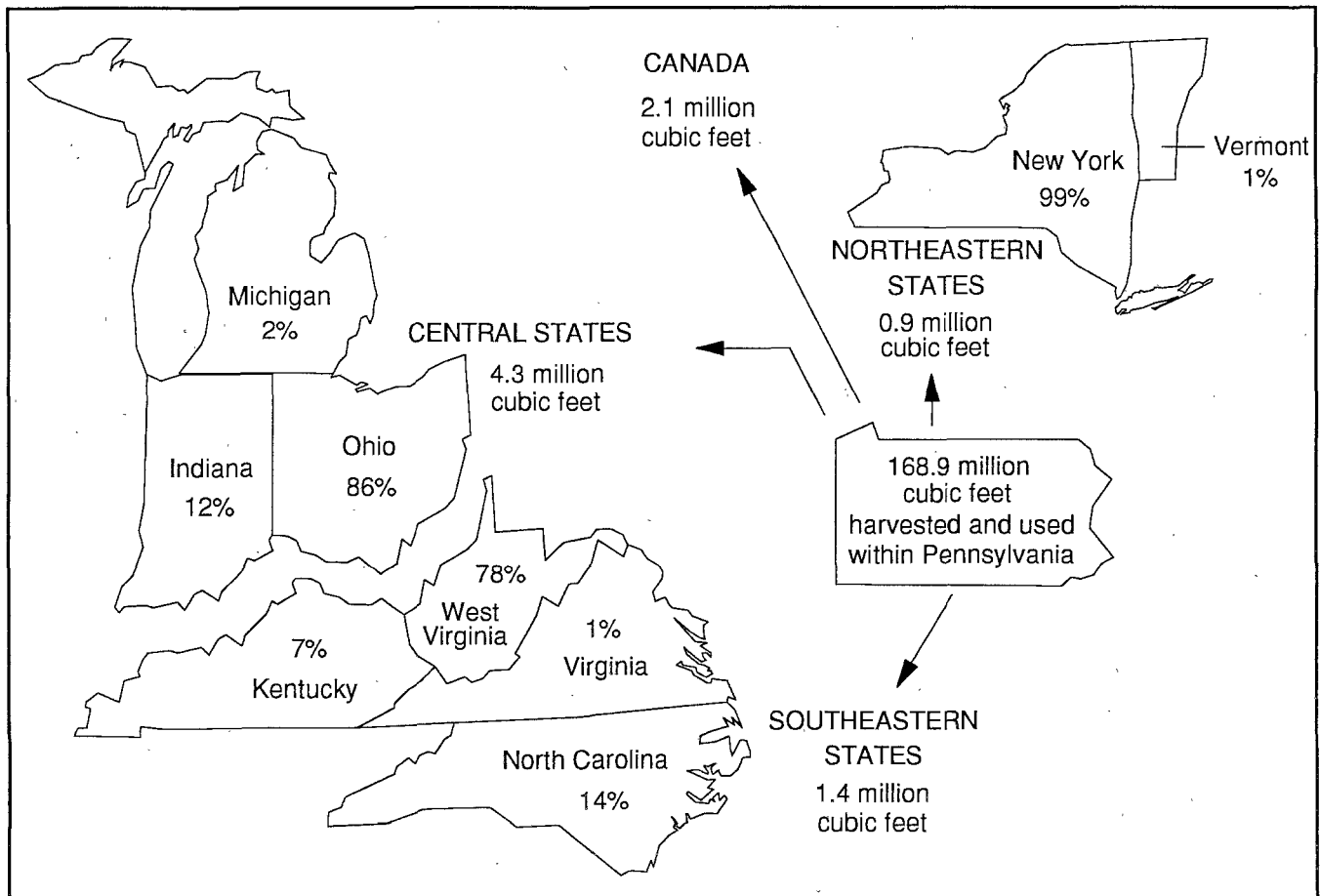
In 1988, nearly 178 million ft³ of roundwood for all sawn products (excludes pulpwood) were produced from timberlands in Pennsylvania. Of this total, all but about 9 million ft³ was used by primary wood-using mills in Pennsylvania. The remainder was exported, mostly to mills in Ohio and Canada. These shipments do not include the volume of roundwood eventually sent overseas, but only exports directly to and used directly by facilities in other states and Canada.

Ohio mills were by far the largest importer of Pennsylvania wood, receiving nearly 24 million board feet (3.7 million ft³). Almost all were sawlogs—22.4 million board feet, or 93 percent of the total exported to the state. Nearly all the sawlogs that Ohio mills imported were red oak and white oak. Most of the red oak was select red oak

(primarily northern red oak in Pennsylvania)—7,400 board feet. Most of the white oak was select white oak (white oak, swamp white oak, and rarely, bur oak and chinkapin oak)—3,300 board feet. Ohio mills import Pennsylvania oak to partially augment supplies of oak within the state, which, while still abundant, are not increasing at as great a rate as other species, and because Ohio mills have access to Pennsylvania oak and are willing to pay a competitive price for roundwood (Nolley 1993).

Timber harvesters and mill operators sent most of their veneer logs out of state. More than 31 million board feet of veneer logs were harvested, yet only 8 million board feet remained in Pennsylvania. Nearly 23 million board feet were exported, 59 percent of which went to Canadian veneer mills.

Total production, by destination of shipments



Imports Mostly from New York and Maryland

Pennsylvania is a net importer of roundwood—more comes into the state than leaves it, but only by a small amount. While 9 million ft³ were exported in 1988, slightly more than 11 million ft³ were imported from other states. Most of this volume came from New York and Maryland.

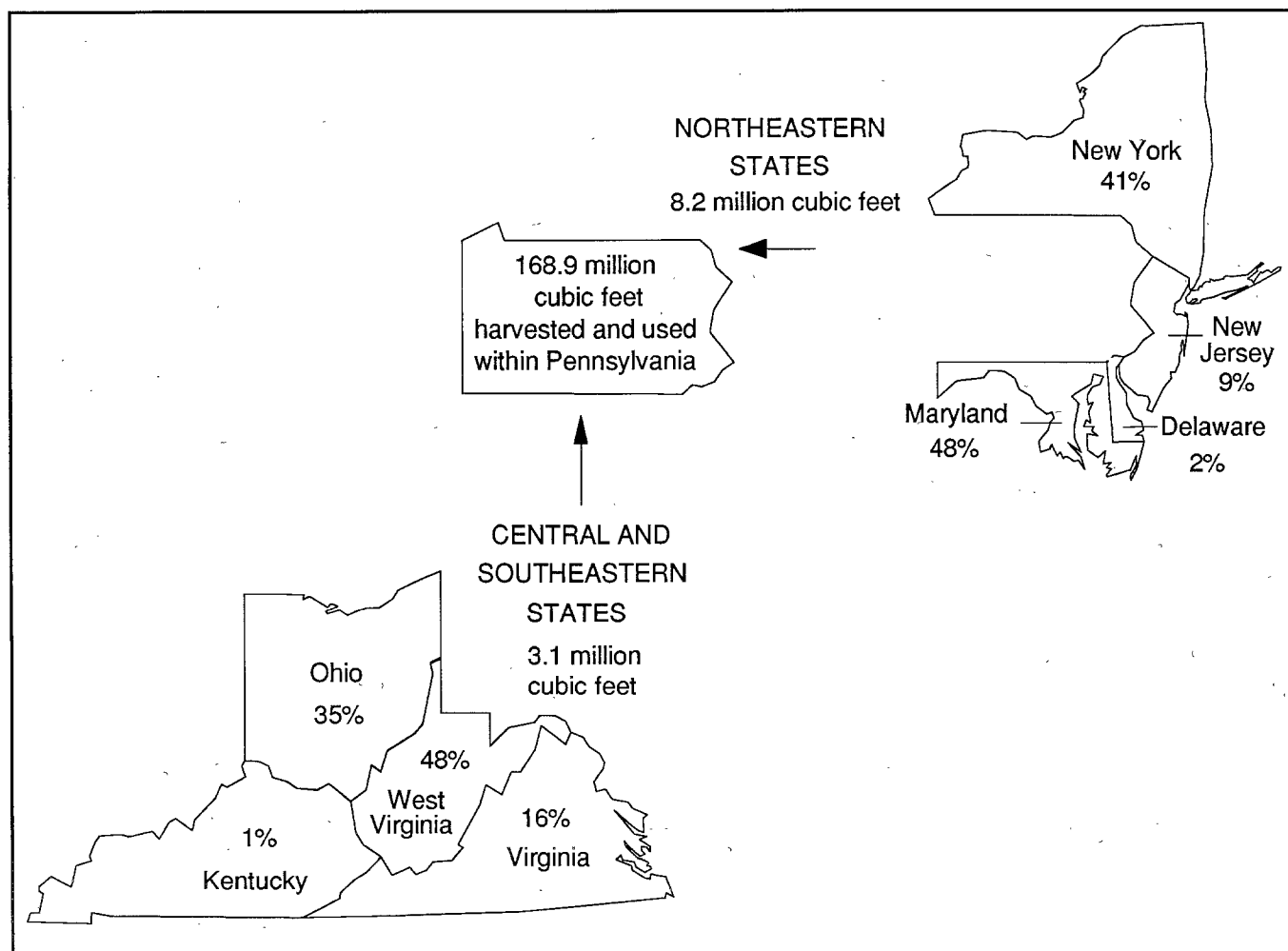
Almost all the roundwood imported was in sawlogs. Most of the imported wood was red oak, accounting for 27 percent of all sawlogs imported. Other important species include white oak (12 percent), black oak (9 percent), and ash (8 percent).

Ash is imported in significant amounts to meet the demand for bats and handles. Ash is only a minor species on Pennsylvania timberlands, so it must be

imported to meet the demand. In 1969, 4 million board feet of ash were shipped in from other states, compared with only 2 million board feet in 1976. However, by 1988, more than 7 million board feet of ash roundwood were imported. Most of the ash was imported from New York.

Oak is shipped in to meet the demand of mills manufacturing furniture and dimension stock. Most of the oak sawlogs were imported from Maryland, but Ohio timberlands also supplied a significant amount of white oak—primarily to manufacture cooperage in Pennsylvania. In fact, Ohio timberlands supplied more timber for cooperage mills in Pennsylvania than Pennsylvania timberlands (41 percent versus 23 percent).

Total consumption, by origin of shipments



Sawlogs Account for 70 Percent of the Harvest

Many diverse roundwood products were harvested from Pennsylvania timberlands in 1988. Only two roundwood products—sawlogs and pulpwood—accounted for the bulk of the harvest. About 95 percent of the wood harvested was for sawlogs and pulpwood, with sawlogs alone accounting for 70 percent of the total volume harvested.

Products other than sawlogs and pulpwood are important to the timber industries of Pennsylvania because they are high value-added products that contribute much to the economic well-being of the state. However, they contribute little to total roundwood production. Greatest production came from veneer logs, bat and handle stock, cabin logs, and mine timbers, which combined accounted for only 5 percent of total roundwood production.

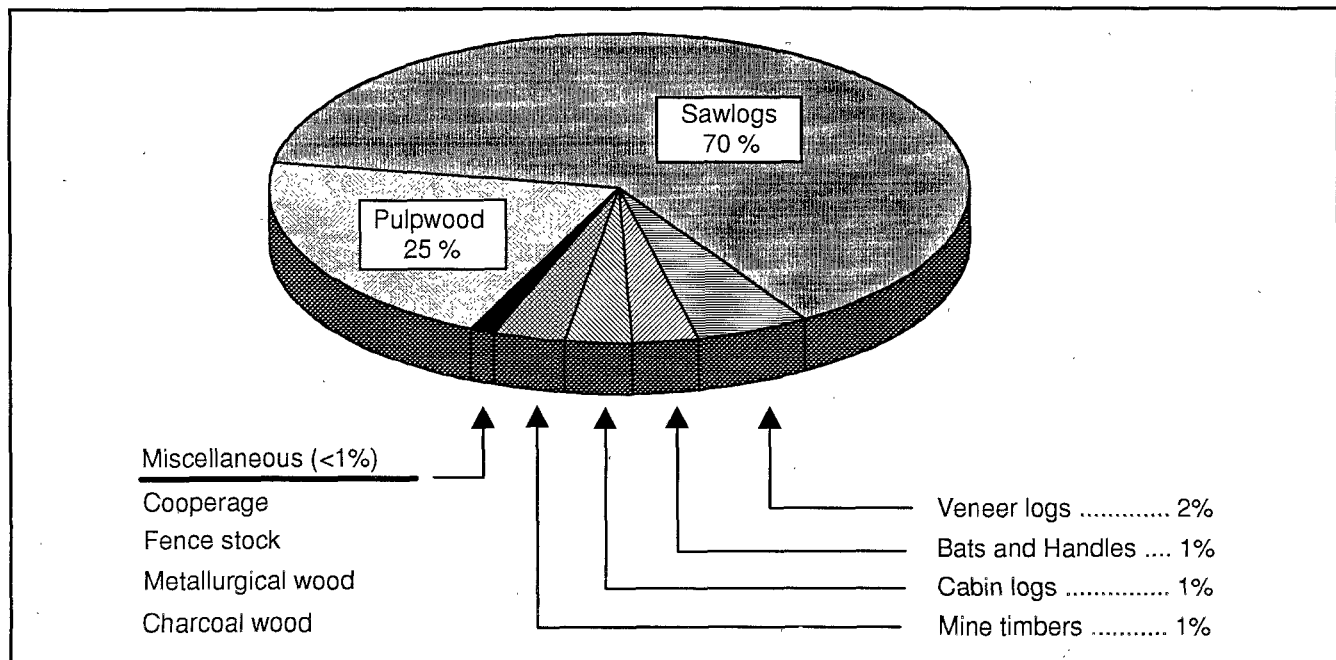
Sawlogs yield a diverse mixture of products in Pennsylvania. Some of the products into which sawlogs were manufactured include rough and dressed lumber, furniture dimension, dowels, landscape ties, pallets, caskets, and specialty items. Roundwood used for lumber was by far the

primary product manufactured, but substantial volumes also were harvested for pallet material and furniture dimension stock.

Pallet manufacturing has been increasing in the Northeast for many years as timber harvesters search for ways to use more of the lower quality material that is available as low grade logs, or the hearts and upper log portions of high-quality trees. About 2.3 million board feet of softwoods and 214 million board feet of hardwoods were harvested for pallet stock in Pennsylvania during 1988. The total (33 million ft³) represents nearly 20 percent of the 70 percent harvested for sawlogs.

Increased production of furniture dimension has resulted from efforts to find high-value uses for low-quality hardwoods. During the industry canvass conducted in 1976, furniture dimension was not considered a major forest product, contributing little to total roundwood production. By 1988, the volume of roundwood harvested for furniture dimension reached 40.6 million board feet, almost all of which was harvested from hardwood species.

Distribution of primary forest products



Most Important Changes in Sawlog Production

Although sawlog production in Pennsylvania has been climbing steadily for years, it has shown substantial gains only recently. Between 1964 and 1969, sawlog production remained stable, reaching 87.5 million ft³ in 1969 (Bones and Sherwood 1972). Between 1969 and 1976, sawlog production increased by 19 percent, to 103.7 million ft³. Between 1976 and 1988 sawlog production again increased, but this time to 166.5 million ft³, a 61-percent increase.

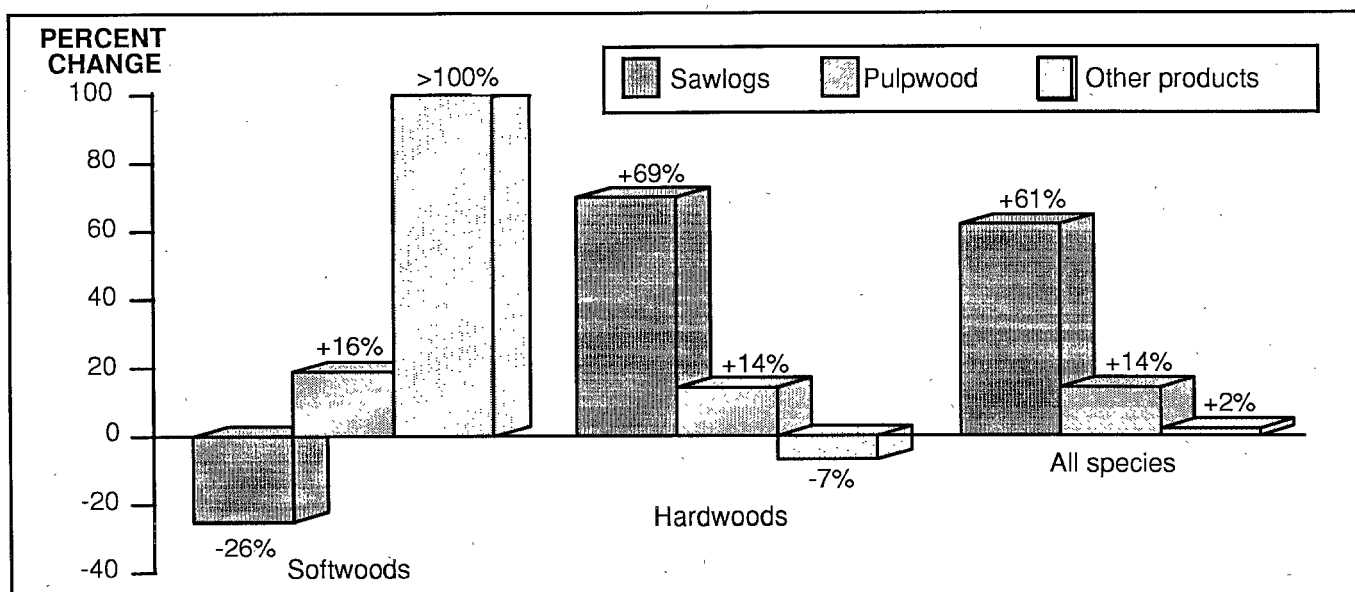
Demand for wood products has reached highs not experienced in the postwar era for softwoods, and never for hardwoods (Steer 1948). Hardwood sawlog production has nearly doubled, a situation associated with the unique characteristics of Pennsylvania sawmills. At the time of the industry canvass in 1976, production increases resulted from the replacement of low-production, portable, parttime sawmills with high-production, stationary, fulltime units (Bones and Sherwood 1979). Then, there were only 740 operating sawmills, but only as far back as 1964 there were about 1,000 operating sawmills, and in 1947 there were nearly 3,000 mills. In 1988, the number of operating sawmills rose above levels in the 1960's to more than 1,500 facilities. Many of these produced fewer than 50,000 board feet a year in 1988.

Some of these facilities probably were portable units returning to production. It would seem that increased markets for low-value products like pallets and dimension stock have spurred low-output mills into production. However, they will be the first to cease production should economic conditions worsen.

Softwood sawlog production declined by 26 percent between 1976 and 1988. This is only the latest drop in a long-term trend of declining softwood lumber markets. Conversely, pulpwood production increased during the period, as it has for years.

Other products essentially remained unchanged in terms of total volume, but there were vast differences among the different products in this group. All declined between 1976 and 1988 except for bat and handle stock, which increased marginally, and veneer and cabin logs, which increased substantially. Cabin logs are manufactured primarily from softwoods; this is why softwood production of other products showed a high percentage increase even though small volumes were involved. Increases in the production of veneer logs were insufficient to offset declines in other hardwood products, which fell 7 percent.

Percent change^a of major forest products, 1976 to 1988



^a Based on production measured in ft³.

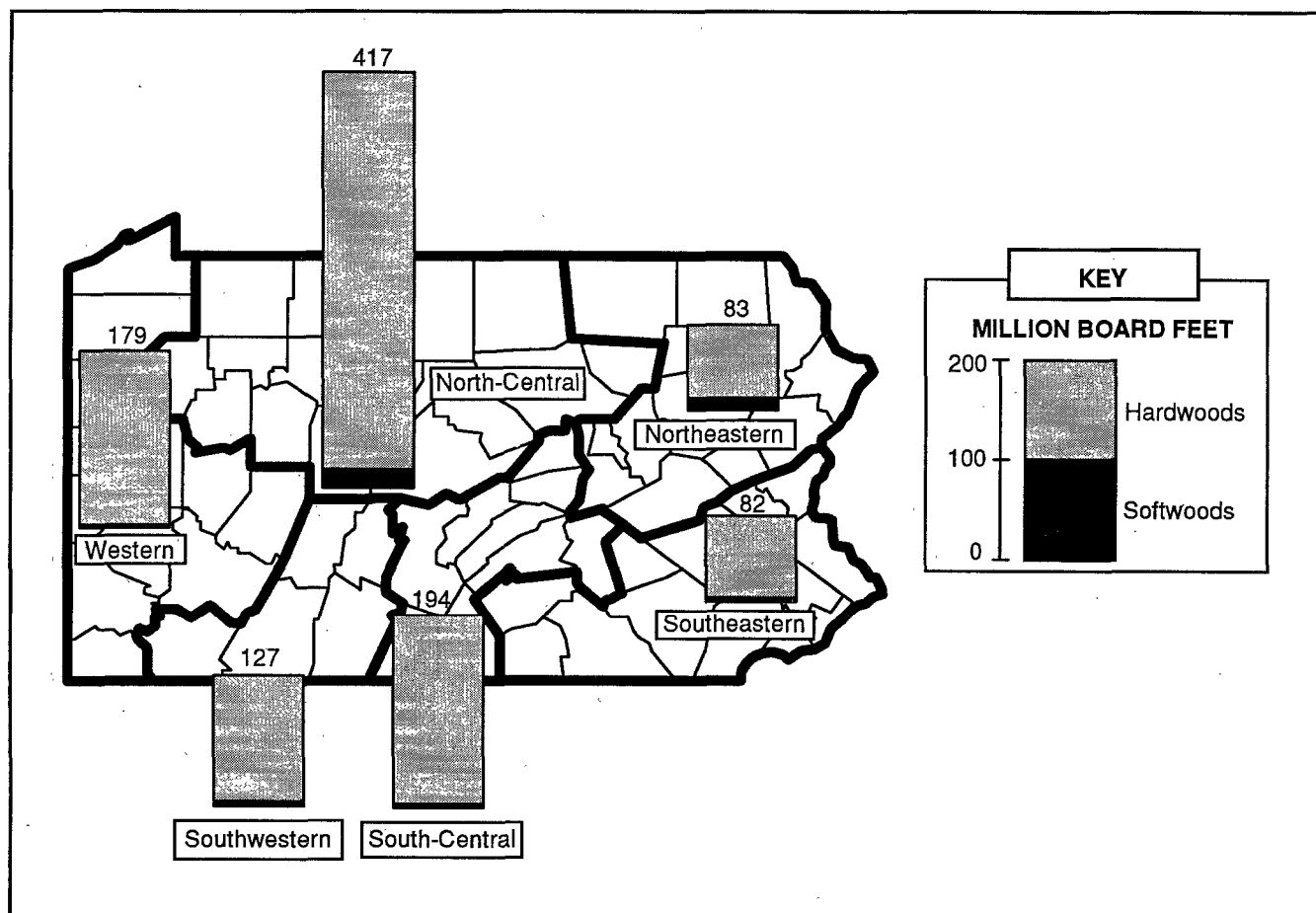
Central Pennsylvania Produces the Most Sawlogs

Much of the sawlog harvest occurs throughout the very heart of Pennsylvania, in the North-Central and South-Central Regions. The North-Central Region produces the most, slightly more than 400 million board feet of sawlogs, but it also is the largest region in total timberland area. Comparing the sawlog harvest on a total, timberland-area basis puts the South-Central Region on more equal footing with North-Central Pennsylvania. The latter region produced only 72 board feet of sawlogs for each acre of total timberland, while the South-Central Region produced nearly 116 board feet of sawlogs per acre of total timberland. The Western and Southwestern Regions also contributed heavily to Pennsylvania's sawlog production, though less

so than North-Central and South-Central Pennsylvania.

Generally, sawlogs stay close to home, even in the North-Central region. Long thought to contain a substantial resource base but little high-value manufacturing, this region is changing. In 1988, 88 percent of the sawlog production remained within the North-Central Region. Most of the export activity occurred in the Western Region, which retained only 58 percent of the sawlogs harvested there. The remainder was exported to other mills in the state (29 percent) or shipped to mills in other states (13 percent).

Sawlog production, by geographic region



South-Central Production Increased the Most

The two regions that produced the most in 1988 (North-Central and South-Central) historically have shown the greatest production increases. Declining between 1964 and 1969, sawlog production in the North-Central Region increased between 1969 and 1976 (Bones and Sherwood 1979). Since that time, sawlog production in the region again increased (69 percent between 1976 and 1988). Increases in the Western and Southeastern Regions were similar to the North-Central Region between 1976 and 1988, increasing by 87 and 69 percent, respectively.

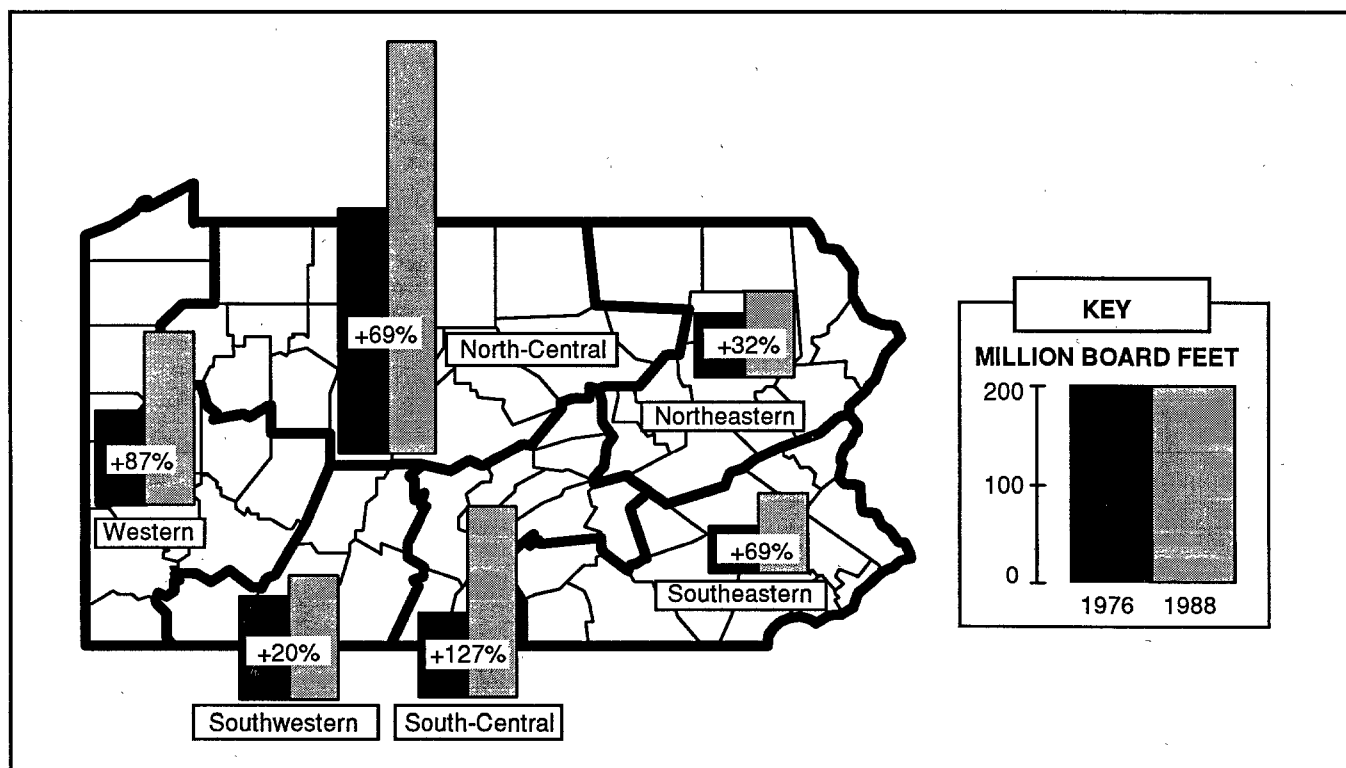
Trends are similar for South-Central Pennsylvania. Since 1964, sawlog production increased here more than anywhere else and nearly as much as in the North-Central Region between 1969 and 1976. This represents a long-term trend of industry growth, since production in the South-Central Region again increased between 1976 and 1988—

this time by almost one and a half times as much as any other region.

Such increases have occurred because mills began to process more of the increasingly larger volume of small and low-quality sawlogs. Increases may be greater through central Pennsylvania because this area has been hardest hit by gypsy moth defoliation over the last decade or so. Subsequent timber salvage operations that recover dead and dying trees depend on markets for lower-quality and smaller material.

To capitalize on the abundant, low-quality resource, new scragg mills have begun operations and other mill operators have expanded production facilities to use the available resource. In doing so, they have developed new or expanded markets, largely for dimension stock and pallet parts.

Sawlog production, by geographic region, 1976 and 1988



Most Sawlogs are Red and Black Oak

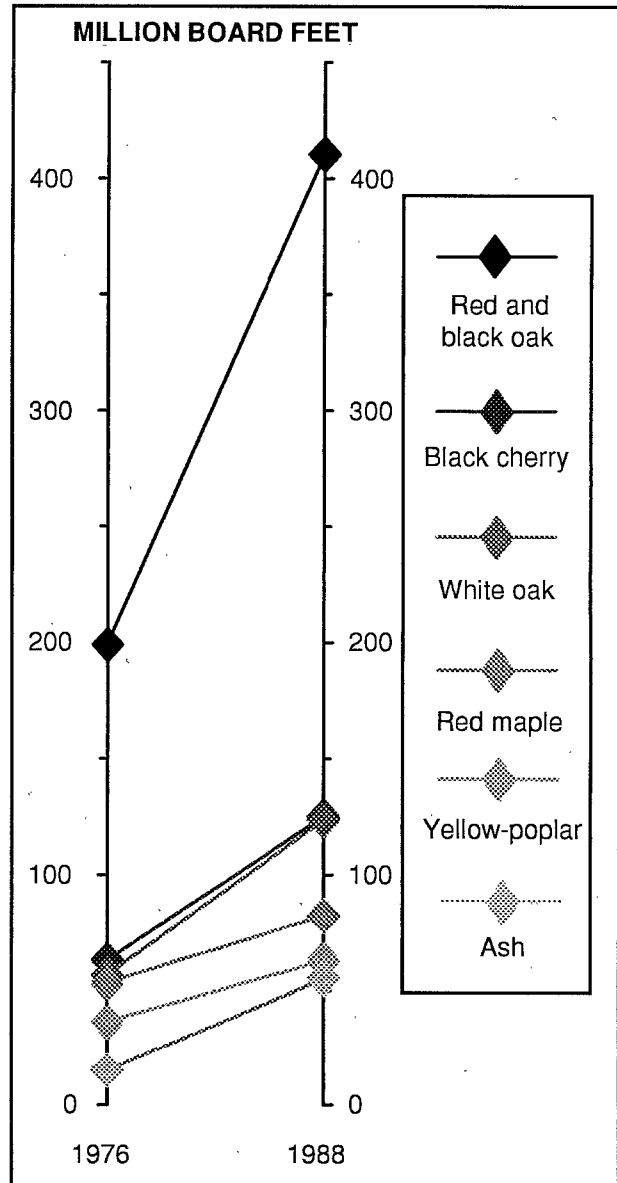
In terms of total volume, no other state produces more hardwood sawlogs than Pennsylvania. Harvesting of hardwoods so dominates timber production in the state that softwoods account for barely more than 2 percent of the total harvest.

In general, species are harvested in relation to their abundance in the resource base. The species in Pennsylvania forests have attracted hardwood sawlog manufactures for many years. Black cherry and oak, especially select oaks like northern red oak and white oak, predominate. As a result, these species are harvested more than other species.

In 1988, more select red oak and black oak were used by the primary wood-using industry in Pennsylvania than had been used during the previous canvass. Black oak is not a select red oak but was included with red oak in the previous canvass for 1976. So to track trends it was necessary to combine them again. These two species (84 percent of which was red oak in 1988) more than doubled, from approximately 200 million board feet in 1976 to more than 410 million board feet in 1988. Black cherry and white oak also have shown sharper increases than other species, though not as much as red and black oak.

According to the most recent resource statistics (Alerich 1993), northern red oak is a leading species, especially through central Pennsylvania where the harvest predominates. Northern red oak accounts for nearly 13 percent of the total sawtimber volume. Northern red oak ranks below the maples and black cherry at the northern extent of this region, but it is the leading species in the southern portion. Presumably, much of the oak in this region has become available due to extensive gypsy moth defoliation.

Sawlog production, by primary species, 1976 and 1988



Veneer-log Production Up Once Again

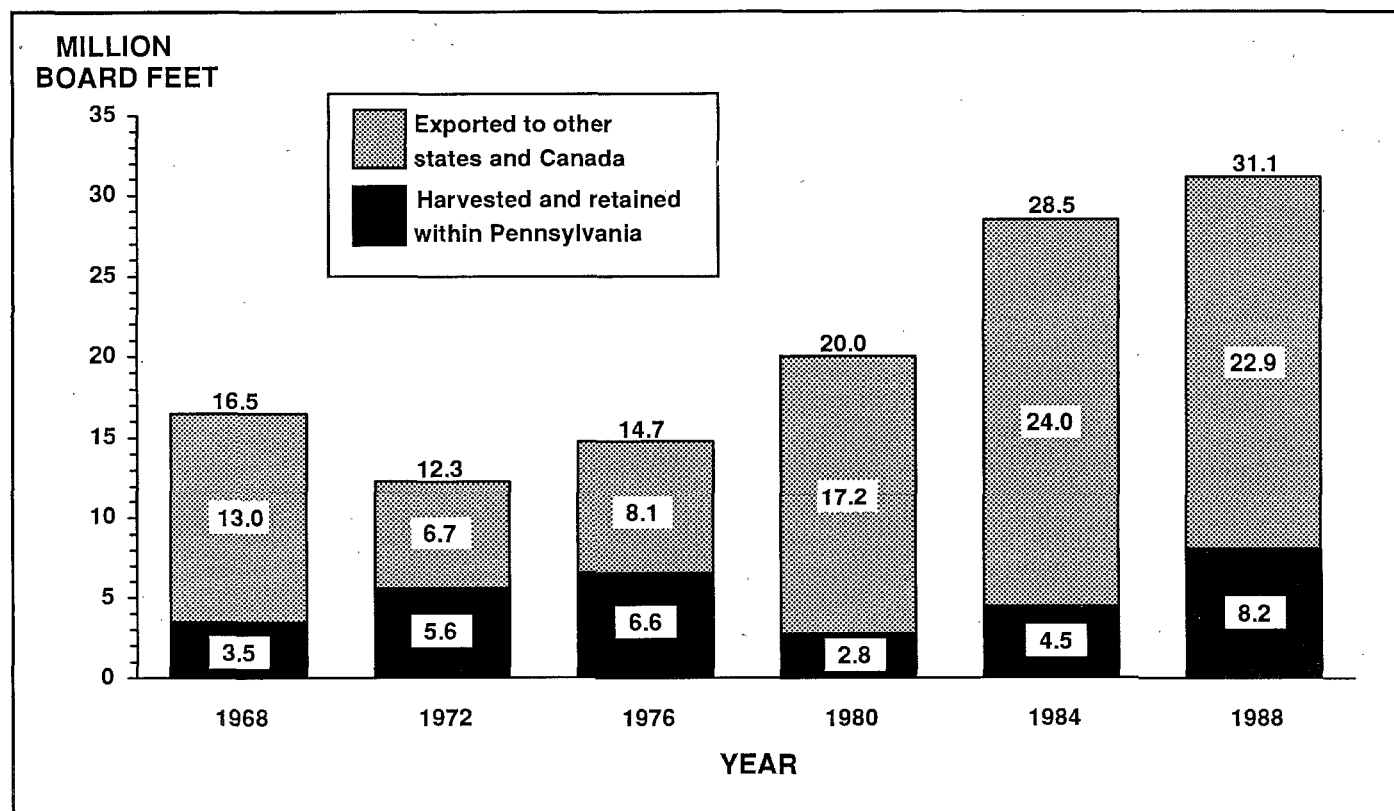
The production of veneer logs increased significantly since 1976, surpassing levels attained in the late 1960's. Production of veneer logs reached 16.5 million board feet by 1968 and then declined. Foreign dominance of the hardwood plywood market in the early 1970's hurt the hardwood veneer industry throughout much of the Northeast (Nevel and Wharton 1987). Many domestic hardwood veneer mills closed, and some relocated their manufacturing facilities overseas.

One of the mills that manufactured face veneer in Pennsylvania was forced to close between 1976 and 1980. This probably resulted in the sharp decline of veneer-log production that was harvested and used within the state, although that production has recently rebounded. In 1988, the volume of logs harvested and used by veneer mills in the

state reached and slightly surpassed 1976 levels, about 8.2 million board feet of veneer logs were produced from Pennsylvania timberlands and used within the state. By contrast, 6.6 million board feet were harvested and used in 1976.

However, total veneer-log production increased even more, reaching more than 31 million board feet of production by 1988. This is double the volume from the 1976 industry canvass and 88 percent more than the previous high reached in 1968. Currently, about 74 percent of the veneer logs harvested from Pennsylvania timberlands leave the state, most of them bound for Canada. This represents only the latest increase in a long-term trend of veneer-log exports that has been building since the early 1980's.

Veneer-log production, by destination of shipments, 1968 to 1988



Pulpwood Production Continues to Rise

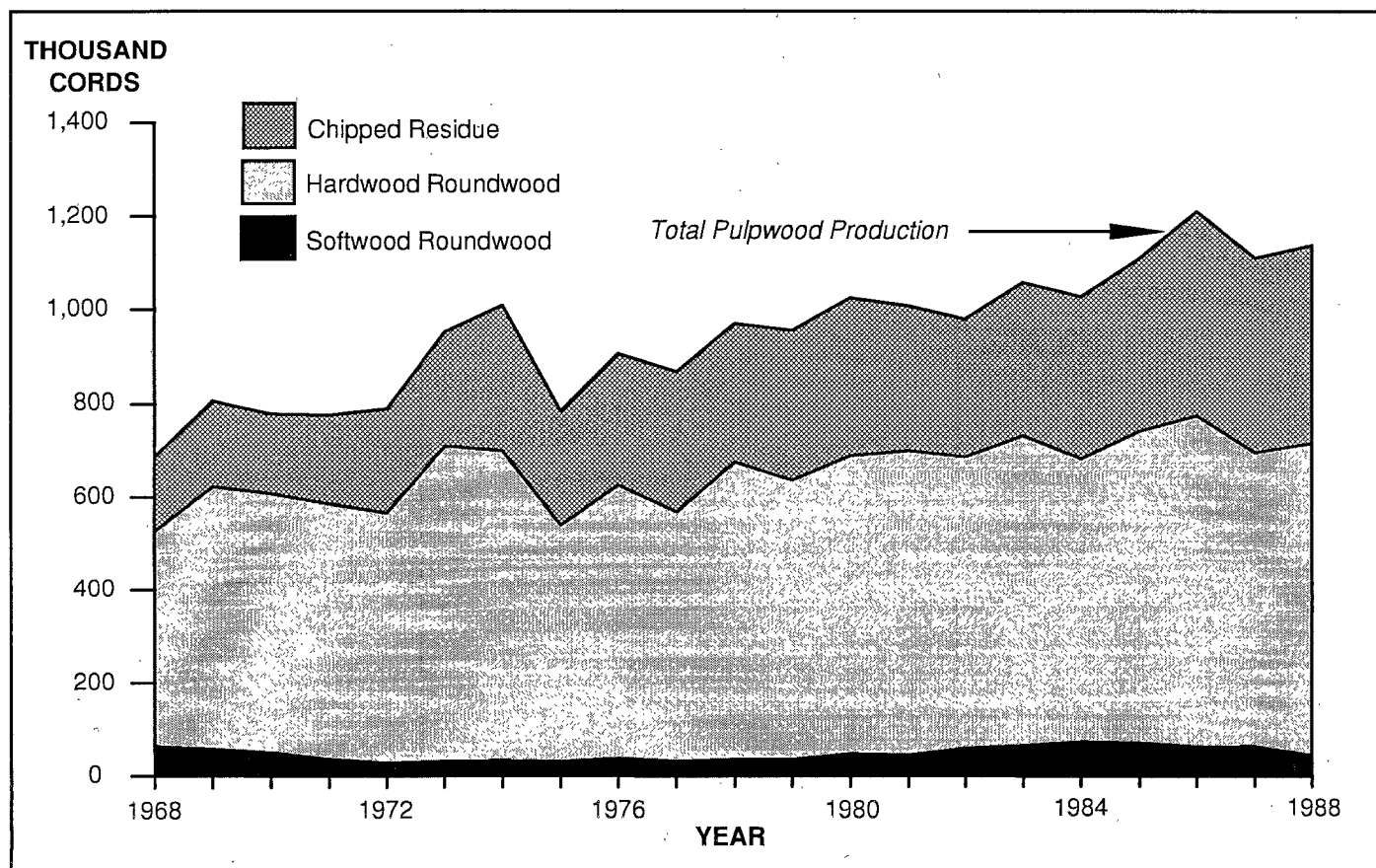
Pulpwood is roundwood that is reduced to individual wood fibers by chemical or mechanical means. The fibers are used to make a broad group of products such as paper, fiberboard, insulating board, and paper board. Pulpwood usually comes from lower quality wood and the upper stem portion of trees harvested for other products. Pulpwood also comes from plant byproducts: recycled materials that result when roundwood is processed for lumber, veneer, and other products.

In 1976, about 625,000 cords of roundwood were harvested for pulpwood. By 1988, that production had increased to slightly more than 715,000 cords, a 10-percent increase. While this was more than in 1976, it was less than record production levels reached in 1986 (Widmann 1988). Twenty years

ago, most of the pulpwood came from roundwood. In 1968, almost 527,000 cords were from roundwood and 159,000 cords were from chip production (manufacturing residue). Over the years, though, the volume of chipped residue used for pulp has increased. By 1988, about 715,000 cords were from roundwood and 421,000 cords were from chips—the chipped-residue proportion of total pulpwood production had increased from 23 to 37 percent.

Total pulpwood production itself has increased by nearly 40 percent over the last 20 years (1968-88). Pulp processors have begun to rely more heavily on chipped residues to handle increases in production, aided by increases in sawlog production that have made manufacturing residue more available.

Annual pulpwood production, by source of material



Other Products

Mine timbers and certain miscellaneous products like cooperage logs, poles, and fence stock declined between 1976 and 1988. Production of bats and handles increased slightly, but only cabin logs (manufactured mostly from softwoods) have increased substantially since 1976.

Round and split wood used in underground mining has been declining for many years. This trend has continued as production of mine timbers decreased from 4.6 million ft^3 in 1976 to 2.5 million ft^3 in 1988. This is less a result of encroachment from alternative materials as it is from a decline in coal mining itself. But as long as underground mines remain in production, wood probably will continue to be used for props, shoring, and wedges.

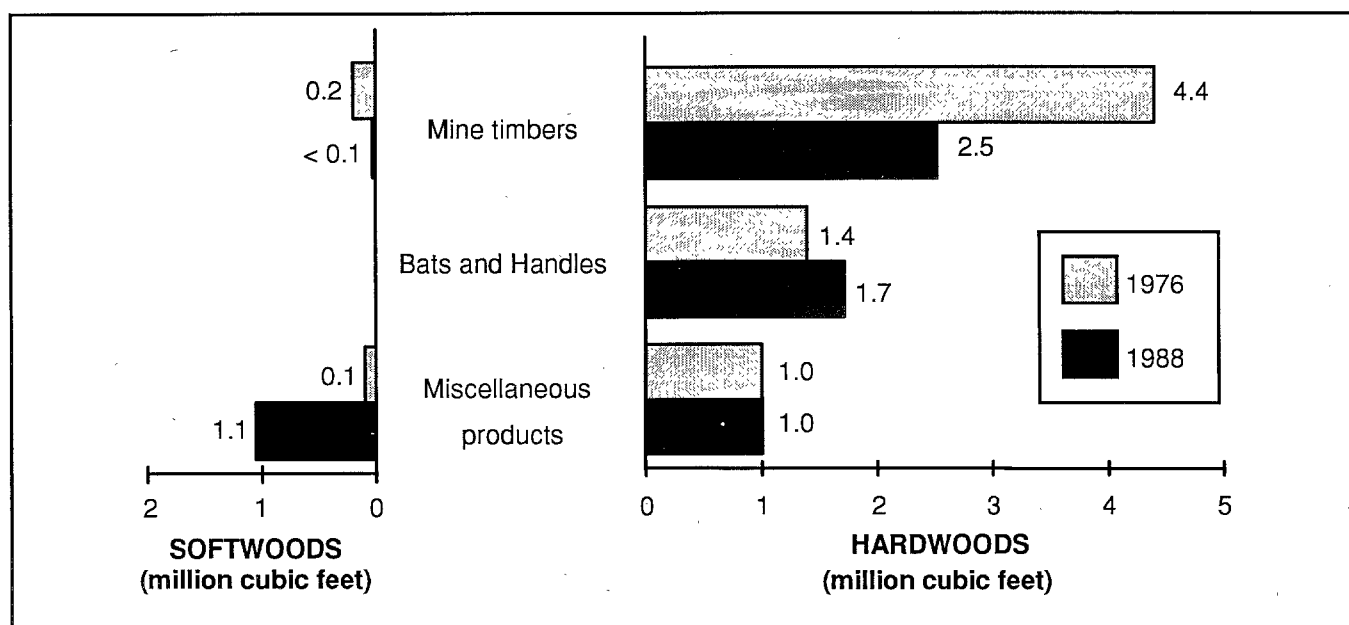
Production of bats and handles, manufactured entirely from hardwoods, has increased by a small amount. Production was 12.8 million board feet in 1964, 13.7 million board feet in 1969, 8.7 million board feet in 1976, and 11.3 million board feet in 1988. While production declined when alternative products like plastic handles and metal baseball bats first entered the market years ago, wooden

bats and handles should remain a viable commodity, at least at current levels of production.

Cooperage, currently the principle hardwood component of miscellaneous products, once had been a fairly stable part of Pennsylvania's timber harvest. However, production of cooperage logs, which peaked at 9.7 million board feet around 1969, declined to 4.2 million board feet (500,000 ft^3) in 1976 and finally to 417,000 board feet (64,000 ft^3) in 1988. Over the years, many manufacturers of tight cooperage have closed their facilities due to eroding markets for wooden barrels throughout the Northeast.

Although a small portion of the softwood harvest was used for products like hemlock and cedar fencing, most was used for cabin logs. Previously, relatively few cabin logs were produced in Pennsylvania. By 1988, however, nearly 5 million board feet were produced for cabin logs. This industry has demonstrated positive growth over the last decade as more people look for more rustic and less expensive alternatives in new-home purchases.

Production of other products, by species group, 1976 and 1988



Coarse Residue Used for Fiber, Bark and Fine Residue Used for Agriculture

During 1988, Pennsylvania mills generated nearly 120 million ft³ of residue by processing wood products from roundwood. Of this amount, more than 20 million ft³ (17 percent) was in bark. Also generated was an additional 63 million ft³ of coarse residue suitable for chipping and 36 million ft³ of fine residue too small to be chipped. Together, these two kinds of woody residue accounted for 83 percent of all manufacturing residue in the state.

Most use is made of the coarse residue; only 6 percent was left unused. In terms of volume, just as much fine residue was left unused (about 4 million ft³), but the volume of fine residue left unused represented a larger proportion—approximately 10 percent. Approximately 8 percent of bark residue was left unused.

With the increase in volume of roundwood manufactured, more residue is generated, and since it can no longer be burned or trucked to landfills, some use must be found. In Pennsylvania

during 1988, agricultural uses accounted for nearly 42 thousand ft³ of the residue generated. Agriculture drew mostly from bark and fine residue. Generally, bark is used for horticultural mulch and fine residue is used for livestock bedding and mulch.

Since it can be chipped and handled more easily, coarse residue is used primarily for fiber products like pulp, residential fuel, and industrial or commercial fuel. Residential fuel is used in fireplaces and wood stoves to provide heat. Industrial and commercial fuel is used to generate energy at facilities: at wood-using mills for industrial fuel and at non-manufacturing facilities such as schools, correctional institutions, and electrical generating plants for commercial fuel. Of the residue used for fuel, almost 18,000 ft³ was used for residential fuel. Nearly 10,000 ft³ finds its way into wood-fire boilers as mills strive for energy self-sufficiency.

End use of manufacturing residue, by type of residue

(Thousand cubic feet)

End use	Type of residue ^a			All types
	Bark	Coarse	Fine	
Fiber ^b	837	25,981	536	27,354
Industrial fuel	718	3,614	5,437	9,769
Residential Fuel	2,382	13,673	1,557	17,612
Agricultural uses ^c	12,040	9,542	20,104	41,686
Other uses ^d	2,774	6,449	5,104	14,327
All uses	18,751	59,259	32,738	110,748
Not used	1,580	3,785	3,595	8,960

^aWoody mill residue types are based on their suitability as wood chips. Coarse residue can be chipped—it includes slabs, edgings, trimmings, miscuts, and veneer core and clippings. Fine residue cannot be chipped—it includes sawdust, shavings, and pulp screening.

^bIncludes wood pulp and composite products.

^cIncludes livestock bedding, chicken litter, and farm or horticultural mulch.

^dIncludes miscellaneous uses such as charcoal, chemical and metallurgical wood (used as a reducing agent in the smelting of metal-bearing ores), small dimension stock, and specialty items.

Less Unused Mill Residue

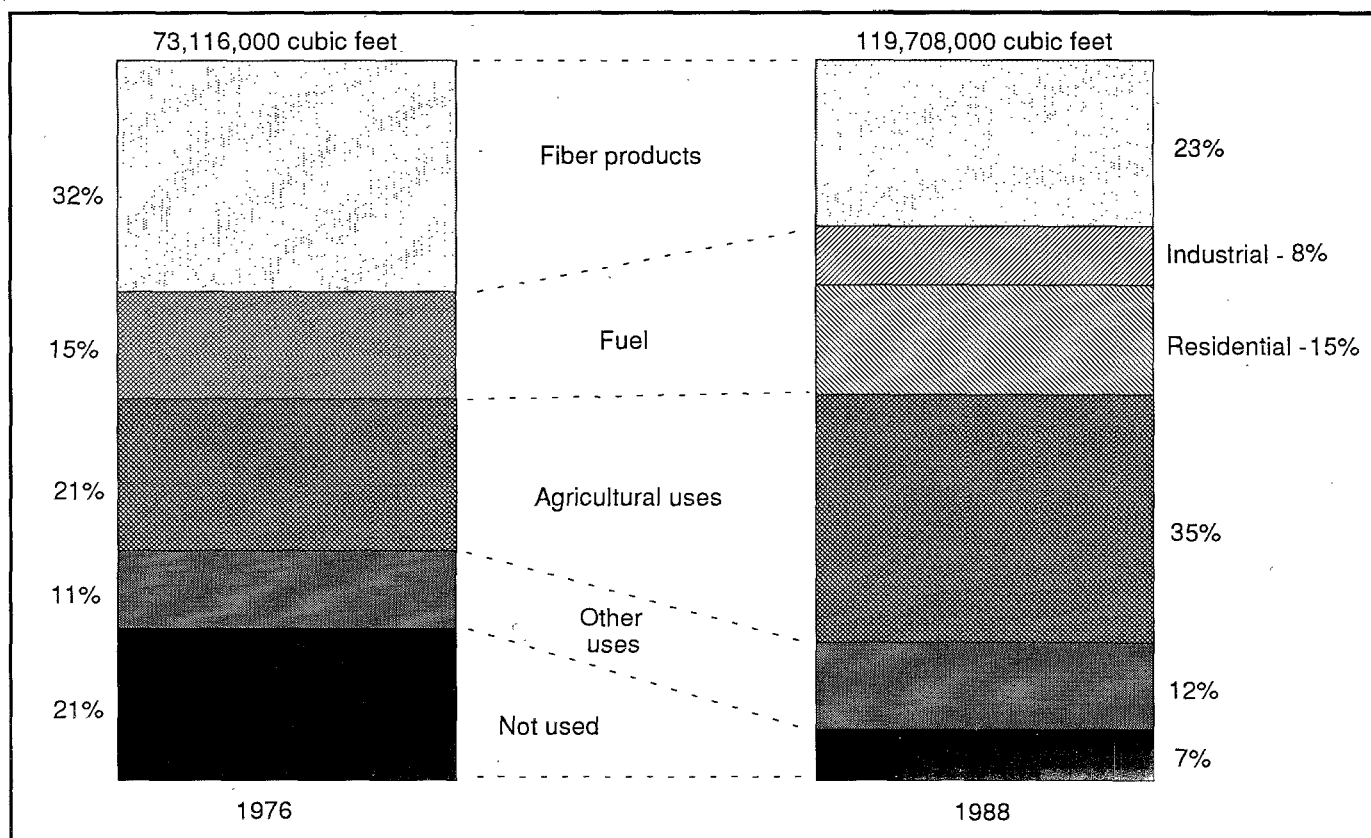
Pulp mills historically have been the largest user of manufacturing residue, primarily because they are in a good economic position to compete for the residue and generally have developed a long-term demand structure that is relatively stable. While pulp mills may have used less (27,354 ft³) than was used for agricultural purposes (41,686 ft³), this volume used for fiber products actually represents an increase from previous years. In 1976, about 23,000 ft³ were used for fiber products.

However, even though the volume of residues used for fiber products has increased, the proportion of total residue used for fiber products dropped from 32 to 23 percent. Pulp mills are unable to provide a market for all the additional volume of residue that resulted from increased roundwood production in the other segments of Pennsylvania's wood-using industry. Agricultural uses have shouldered that burden, increasing from 21 to 35 percent, and are now the leading outlet for manufacturing residue.

Another important change in the use of manufacturing residue is how much is unused. Mills in Pennsylvania have significantly reduced the amount of residue left following manufacturing. At the time of the 1976 canvass, nearly 21 percent was unused. During 1988, the amount unused accounted for only 7 percent of the total residue generated when mills processed primary forest products.

At one time, manufacturing residues were dumped, burned on-site, or given away. While burning is still permitted in most of rural Pennsylvania, regulations today prohibit disposing of residues by dumping, and economic conditions dictate that mills gain financially when disposing of manufacturing residue. The increased use of previously unused manufacturing residue is a response by many mills to find economically feasible and environmentally safe ways to dispose of waste.

End use of manufacturing residue, 1976 and 1988



Definitions

Board foot—A unit of measure applied to roundwood. It relates to lumber that is 1 foot long, 1 foot wide, and 1 inch thick (or its equivalent).

Bolt—A primary forest product that is harvested in short, mostly 4- or 6-foot lengths. No clear distinction can be drawn among bolt, billet, and block.

Coarse residue—Manufacturing residue that can be chipped, for example, slabs, edgings, trimmings, miscuts, and veneer cores and clippings.

Commercial fuelwood—A roundwood product, with or without bark, that is used to generate energy at non-manufacturing facilities such as schools, correctional institutions, and electrical generating plants.

Composite product—A roundwood product that is reduced by mechanical means to wood chips, curls, flakes, shavings, sawdust, etc., and then combined with a synthetic resin or other suitable binders to make a broad generic group of panels such as flakeboard, oriented-strand board, particleboard, and waferboard.

Consumption—The total volume of roundwood that was received at primary wood-using mills within the boundaries of a specified area, regardless of where it was harvested. Consumption is the sum of timber harvested and used by the mill within the area, plus all roundwood imported.

Cooperage—A roundwood product from which containers are made, consisting of two round heads and a body composed of staves held together by hoops, such as barrels and kegs. Cooperage is manufactured into two kinds of containers. Containers from slack cooperage are used for dry, semi-dry, or solid products; their staves are not fitted closely. Containers from tight cooperage are used for liquids, semi-solids, and heavy solids; their staves are held tightly together.

Cord equivalent—A unit of measure applied to forms of wood other than roundwood. It relates to chips, slabs, edgings, and other manufacturing residues equal to 85 cubic feet of solid wood or 1 standard cord.

Dimension stock—A roundwood product sawn into material of varying sizes to make optimum use of the raw material.

Exports—The total volume of roundwood consumed outside the boundaries of a specified area that originated from within those boundaries.

Fine residue—Manufacturing residue that cannot be chipped, for example, sawdust, shavings, and pulp screening.

Hardwoods—Dicotyledonous trees, usually broad-leaved and deciduous.

Imports—The total volume of roundwood consumed within the boundaries of a specified area that originated from outside those boundaries.

Industrial forest product—Roundwood that is supplied to primary wood-using mills. Does not include roundwood that has been harvested for industrial or commercial fuelwood, or for personal use such as residential fuelwood.

Industrial fuelwood—A roundwood product, with or without bark, that is used to generate energy at a manufacturing facility such as a wood-using mill.

International 1/4-inch rule—A log rule or formula for estimating the board-foot volume of logs, allowing one-half inch of taper for each 4-foot length. The rule appears in a number of forms that allow for kerf. In this form, one-quarter inch of kerf is assumed. The mathematical formula is:

$$(0.22D^2 - 0.71D)(0.904762)$$

for 4-foot sections, where D = diameter inside bark at the small end of the log section. This rule is used as the USDA Forest Service standard log rule in the Eastern United States.

Log—A primary forest product that is harvested in long, mostly 8-foot lengths.

Log rule—Tables or formulas that estimate or calculate the amount of lumber in board feet that can be sawn from logs of given length and top diameter inside the bark. Also called log scale.

Manufacturing residue—Bark and woody material generated when roundwood is processed. The woody material is coarse or fine depending on its suitability for wood chips. If these residues are used, they are referred to as a plant byproduct.

Metallurgical wood—Roundwood, whole-tree chips, or manufacturing plant residues used as a reducing agent in the smelting of metal-bearing ores.

Mine timber—A roundwood product, rough hewn or sawn, that is used as structural support in underground mining activities.

Nonindustrial forest product—Roundwood harvested for industrial or commercial fuel production, or for personal use such as firewood.

Piling—A roundwood product, relatively slender, that is used as structural support, driven or otherwise buried in the ground to provide vertical or lateral support in building foundations, bridges, docks, and other such structures that are built on soft, wet, or submerged sites.

Plant byproduct—A wood product, such as pulp chips, that is recycled from manufacturing residue.

Pole—A roundwood product that is used as structural support, driven or otherwise buried in the ground to provide vertical or lateral support for electric power and telephone transmission lines.

Post—A roundwood product, relatively short and usually straight, that is used to support fence structures.

Primary forest product—Roundwood that is harvested for industrial forest products or for personal use.

Primary wood-using mill—A manufacturing facility that converts roundwood into wood products such as lumber, pulp, veneer, cooperage, and dimension products. The final product may be used as manufactured or sent to a secondary wood-using mill for further manufacture.

Production—The total volume of roundwood that was harvested from land within the boundaries of a specified area, regardless of where it was consumed. Production is the sum of timber harvested and used within the area, plus all roundwood exported.

Pulpwood—A roundwood product that has been reduced to individual wood fibers by chemical or mechanical means. The fibers are used to make a broad generic group of pulp products such as paper, fiberboard, insulating board, and paperboard.

Residential fuelwood—A roundwood product, usually with bark, that is used in fireplaces and home wood-fired boilers for heat.

Roundwood—Logs, bolts, and other round, split, or chipped timber products generated by harvesting trees for industrial or consumer use.

Sawlog—A roundwood product from which products such as lumber are sawn. It is cut to standard sizes and meets minimum standards of diameter and length (including a minimum 8-foot length), and meets maximum standards for combinations of size and defect specified in regional standards. Products from sawlogs are manufactured by sawing, resawing, passing lengthwise through a standard planing machine, crosscutting to length, or matching to produce different kinds of lumber.

Softwoods—Coniferous trees, usually evergreen and having needles or scale-like leaves.

Standard cord—A unit of measure applied to roundwood, usually bolts or split wood. It relates to a stack of wood 4 feet high, 4 feet wide, and 8 feet long—encompassing 128 cubic feet of wood, bark, and air space. In the Northeast, this usually translates to 80 cubic feet of solid wood for fuelwood and 85 cubic feet of solid wood for pulpwood, since pulpwood is more uniform. A standard cord often is referred to as a cord, but should not be confused with a face cord that is commonly used in firewood marketing.

Veneer—A roundwood product from which a thin layer or sheet of wood of uniform thickness is produced by peeling (rotary cut), slicing, or sawing. It is manufactured into glued wood panels made up of crossbanded layers, or plies that generally are at right angles to each other. Veneer is a broad generic group that includes a variety of single- and multi-ply products such as composite panels, containers, interior/exterior plywood, face veneer, and specialty products.

Whole-tree chips—Unbarked wood chips generated by harvesting and chipping some portion of aboveground tree components.

Sources for definitions include Ford-Robertson (1971), Simmons (1979), Forest Products Laboratory (1987), and the USDA Forest Service's Forest Survey Handbook.

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Table 1.--Production of sawlogs, by species and destination of shipments,
WESTERN Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	1,423	465	1,888	0	1,888
White pine	223	52	275	0	275
Other softwoods	325	50	375	0	375
Total softwoods	1,971	567	2,538	0	2,538
Ash	5,070	1,314	6,384	1,141	7,525
Basswood	346	115	461	80	541
Beech	1,125	799	1,924	1,218	3,142
Sweet birch	106	126	232	3	235
Yellow birch	72	18	90	0	90
Black cherry	13,541	7,244	20,785	1,588	22,373
Cucumbertree	203	83	286	2	288
Elm	255	23	278	308	586
Black gum	126	3	129	3	132
Hickory	1,101	445	1,546	519	2,065
Red maple	11,583	5,579	17,162	1,887	19,049
Sugar maple	3,844	2,011	5,855	1,784	7,639
White oak	7,001	4,244	11,245	3,324	14,569
Chestnut oak	1,722	446	2,168	41	2,209
Red oak	34,321	21,459	55,780	7,444	63,224
Black oak	7,468	1,502	8,970	0	8,970
Other red oaks	1,507	1,080	2,587	1,101	3,688
Black walnut	888	17	905	151	1,056
Yellow-poplar	9,387	5,342	14,729	2,132	16,861
Other hardwoods	1,249	389	1,638	279	1,917
Total hardwoods	100,915	52,239	153,154	23,005	176,159
All species	102,886	52,806	155,692	23,005	178,697

^aInternational 1/4-inch rule

Table 2.--Consumption of sawlogs, by species and origin of shipments,
WESTERN Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	1,423	356	1,779	146	1,925
White pine	223	76	299	13	312
Other softwoods	325	29	354	0	354
Total softwoods	1,971	461	2,432	159	2,591
Ash	5,070	1,530	6,600	666	7,266
Basswood	346	210	556	0	556
Beech	1,125	167	1,292	33	1,325
Sweet birch	106	26	132	0	132
Yellow birch	72	19	91	1	92
Black cherry	13,541	4,768	18,309	536	18,845
Cucumbertree	203	157	360	2	362
Elm	255	58	313	2	315
Black gum	126	60	186	0	186
Hickory	1,101	334	1,435	31	1,466
Red maple	11,583	2,802	14,385	606	14,991
Sugar maple	3,844	3,342	7,186	1,771	8,957
White oak	7,001	3,032	10,033	639	10,672
Chestnut oak	1,722	390	2,112	19	2,131
Red oak	34,321	13,158	47,479	1,803	49,282
Black oak	7,468	1,642	9,110	1,206	10,316
Other red oaks	1,507	494	2,001	22	2,023
Black walnut	888	457	1,345	0	1,345
Yellow-poplar	9,387	1,787	11,174	76	11,250
Other hardwoods	1,249	290	1,539	5	1,544
Total hardwoods	100,915	34,723	135,638	7,418	143,056
All species	102,886	35,184	138,070	7,577	145,647

^aInternational 1/4-inch rule

Table 3.--Production of sawlogs, by species and destination of shipments,
NORTH-CENTRAL Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	9,413	4,250	13,663	3	13,666
White pine	4,667	448	5,115	0	5,115
Other softwoods	1,755	162	1,917	0	1,917
Total softwoods	15,835	4,860	20,695	3	20,698
Ash	16,682	1,616	18,298	198	18,496
Basswood	2,007	248	2,255	61	2,316
Beech	14,001	277	14,278	0	14,278
Sweet birch	1,134	63	1,197	0	1,197
Yellow birch	784	40	824	3	827
Black cherry	72,977	4,621	77,598	1,052	78,650
Cucumbertree	725	100	825	0	825
Elm	18	32	50	0	50
Black gum	0	59	59	0	59
Hickory	852	476	1,328	0	1,328
Red maple	40,073	2,733	42,806	178	42,984
Sugar maple	19,479	4,015	23,494	428	23,922
White oak	31,924	6,045	37,969	245	38,214
Chestnut oak	6,115	2,009	8,124	0	8,124
Red oak	119,585	14,126	133,711	1,001	134,712
Black oak	10,030	2,707	12,737	0	12,737
Other red oaks	5,380	1,103	6,483	0	6,483
Black walnut	22	50	72	0	72
Yellow-poplar	5,713	1,242	6,955	0	6,955
Other hardwoods	3,849	258	4,107	0	4,107
Total hardwoods	351,350	41,820	393,170	3,166	396,336
All species	367,185	46,680	413,865	3,169	417,034

^aInternational 1/4-inch rule

Table 4.--Consumption of sawlogs, by species and origin of shipments,
NORTH-CENTRAL Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	9,413	956	10,369	180	10,549
White pine	4,667	140	4,807	174	4,981
Other softwoods	1,755	510	2,265	29	2,294
Total softwoods	15,835	1,606	17,441	383	17,824
Ash	16,682	1,996	18,678	1,670	20,348
Basswood	2,007	127	2,134	53	2,187
Beech	14,001	1,069	15,070	621	15,691
Sweet birch	1,134	128	1,262	0	1,262
Yellow birch	784	53	837	8	845
Black cherry	72,977	7,667	80,644	2,236	82,880
Cucumbertree	725	119	844	14	858
Elm	18	0	18	0	18
Black gum	0	0	0	0	0
Hickory	852	414	1,266	5	1,271
Red maple	40,073	5,171	45,244	1,152	46,396
Sugar maple	19,479	1,506	20,985	1,535	22,520
White oak	31,924	4,179	36,103	611	36,714
Chestnut oak	6,115	469	6,584	38	6,622
Red oak	119,585	19,141	138,726	3,045	141,771
Black oak	10,030	1,511	11,541	5	11,546
Other red oaks	5,380	1,026	6,406	3	6,409
Black walnut	22	14	36	0	36
Yellow-poplar	5,713	1,976	7,689	58	7,747
Other hardwoods	3,849	4,281	4,281	31	4,312
Total hardwoods	351,350	46,998	398,348	11,085	409,433
All species	367,185	48,604	415,789	11,468	427,257

^aInternational 1/4-inch rule

Table 5.--Production of sawlogs, by species and destination of shipments,
SOUTH-WESTERN Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	502	101	603	3	606
White pine	541	21	562	21	583
Other softwoods	284	0	284	0	284
Total softwoods	1,327	122	1,449	24	1,473
Ash	2,037	686	2,723	169	2,892
Basswood	572	129	701	221	922
Beech	488	428	916	19	935
Sweet birch	70	35	105	18	123
Yellow birch	76	15	91	18	109
Black cherry	11,250	4,223	15,473	122	15,595
Cucumbertree	154	73	227	8	235
Elm	71	45	116	8	124
Black gum	0	43	43	38	81
Hickory	825	143	968	80	1,048
Red maple	6,297	1,822	8,119	286	8,405
Sugar maple	5,056	839	5,895	124	6,019
White oak	10,370	1,852	12,222	696	12,918
Chestnut oak	3,490	1,071	4,561	443	5,004
Red oak	38,001	11,082	49,083	1,080	50,163
Black oak	2,565	1,073	3,638	0	3,638
Other red oaks	2,375	743	3,118	573	3,691
Black walnut	89	458	547	1	548
Yellow-poplar ^c	8,712	1,234	9,946	677	10,623
Other hardwoods ^c	2,091	280	2,371	1	2,372
Total hardwoods	94,589	26,274	120,863	4,582	125,445
All species	95,916	26,396	122,312	4,606	126,918

^aInternational 1/4-inch rule

Table 6.--Consumption of sawlogs, by species and origin of shipments,
SOUTH-WESTERN Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	502	179	681	5	686
White pine	541	95	636	27	663
Other softwoods	284	10	294	7	301
Total softwoods	1,327	284	1,611	39	1,650
Ash	2,037	764	2,801	1,278	4,079
Basswood	572	67	639	0	639
Beech	488	155	643	0	643
Sweet birch	70	36	106	2	108
Yellow birch	76	2	78	0	78
Black cherry	11,250	3,588	14,838	1,751	16,589
Cucumbertree	154	54	208	0	208
Elm	71	40	111	0	111
Black gum	0	4	4	6	10
Hickory	825	278	1,103	73	1,176
Red maple	6,297	2,593	8,890	783	9,673
Sugar maple	5,056	1,844	6,900	923	7,823
White oak	10,370	3,394	13,764	2,651	16,415
Chestnut oak	3,490	686	4,176	285	4,461
Red oak	38,001	12,943	50,944	5,895	56,839
Black oak	2,565	861	3,426	263	3,689
Other red oaks	2,375	596	2,971	111	3,082
Black walnut	89	40	129	27	156
Yellow-poplar	8,712	4,189	12,901	1,261	14,162
Other hardwoods	2,091	241	2,332	0	2,332
Total hardwoods	94,589	32,375	126,964	15,309	142,273
All species	95,916	32,659	128,575	15,348	143,923

^aInternational 1/4-inch rule

Table 7.--Production of sawlogs, by species and destination of shipments,
SOUTH-CENTRAL Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	1,252	103	1,355	0	1,355
White pine	1,786	212	1,998	0	1,998
Other softwoods	679	63	742	0	742
Total softwoods	3,717	378	4,095	0	4,095
Ash	3,244	2,774	6,018	0	6,018
Basswood	772	368	1,140	0	1,140
Beech	582	12	594	0	594
Sweet birch	828	256	1,084	0	1,084
Yellow birch	90	2	92	0	92
Black cherry	556	224	780	0	780
Cucumbertree	237	101	338	0	338
Elm	264	25	289	0	289
Black gum	265	3	268	0	268
Hickory	3,242	882	4,124	0	4,124
Red maple	2,816	1,021	3,837	0	3,837
Sugar maple	1,988	1,012	3,000	0	3,000
White oak	31,607	5,968	37,575	75	37,650
Chestnut oak	29,862	1,361	31,223	122	31,345
Red oak	47,698	7,734	55,432	80	55,512
Black oak	20,504	4,716	25,220	70	25,290
Other red oaks	4,070	1,850	5,920	0	5,920
Black walnut	315	93	408	0	408
Yellow-poplar	6,572	3,332	9,904	90	9,994
Other hardwoods	1,693	341	2,034	0	2,034
Total hardwoods	157,205	32,075	189,280	437	189,717
All species	160,922	32,453	193,375	437	193,812

^aInternational 1/4-inch rule

Table 8.--Consumption of sawlogs, by species and origin of shipments,
SOUTH-CENTRAL Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	1,252	654	1,906	2	1,908
White pine	1,786	469	2,255	12	2,267
Other softwoods	679	187	866	2	868
Total softwoods	3,717	1,310	5,027	16	5,043
Ash	3,244	1,291	4,535	161	4,696
Basswood	772	207	979	8	987
Beech	582	510	1,092	95	1,187
Sweet birch	828	347	1,175	66	1,241
Yellow birch	90	107	197	2	199
Black cherry	556	1,220	1,776	9	1,785
Cucumbertree	237	61	298	0	298
Elm	264	63	327	0	327
Black gum	265	117	382	61	443
Hickory	3,242	891	4,133	255	4,388
Red maple	2,816	784	3,600	76	3,676
Sugar maple	1,988	1,006	2,994	27	3,021
White oak	31,607	7,549	39,156	455	39,611
Chestnut oak	29,862	6,184	36,046	558	36,604
Red oak	47,698	12,197	59,895	683	60,578
Black oak	20,504	5,446	25,950	591	26,541
Other red oaks	4,070	2,226	6,296	216	6,512
Black walnut	315	125	440	7	447
Yellow-poplar	6,572	2,609	9,181	541	9,722
Other hardwoods	1,693	611	2,304	85	2,389
Total hardwoods	157,205	43,551	200,756	3,896	204,652
All species	160,922	44,861	205,783	3,912	209,695

^aInternational 1/4-inch rule

Table 9.--Production of sawlogs, by species and destination of shipments,
NORTHEASTERN Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	7,333	707	8,040	0	8,040
White pine	2,602	242	2,844	124	2,968
Other softwoods	504	513	1,017	0	1,017
Total softwoods	10,439	1,462	11,901	124	12,025
Ash	2,742	1,953	4,695	347	5,042
Basswood	678	143	821	12	833
Beech	1,407	278	1,685	5	1,690
Sweet birch	487	296	783	15	798
Yellow birch	546	84	630	3	633
Black cherry	4,561	1,039	5,600	21	5,621
Cucumbertree	8	28	36	0	36
Elm	16	5	21	0	21
Black gum	49	18	67	0	67
Hickory	204	281	485	8	493
Red maple	4,979	1,007	5,986	31	6,017
Sugar maple	4,472	745	5,217	0	5,217
White oak	5,487	4,232	9,719	140	9,859
Chestnut oak	2,054	933	2,987	47	3,034
Red oak	18,215	5,197	23,412	249	23,661
Black oak	2,115	1,450	3,565	31	3,596
Other red oaks	255	383	638	0	638
Black walnut	46	53	99	0	99
Yellow-poplar	1,768	1,058	2,826	10	2,836
Other hardwoods	462	592	1,054	0	1,054
Total hardwoods	50,551	19,775	70,326	919	71,245
All species	60,990	21,237	82,227	1,043	83,270

^aInternational 1/4-inch rule

Table 10.--Consumption of sawlogs, by species and origin of shipments,
NORTHEASTERN Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	7,333	3,920	11,253	519	11,772
White pine	2,602	518	3,120	1,463	4,583
Other softwoods	504	106	610	107	717
Total softwoods	10,439	4,544	14,983	2,089	17,072
Ash	2,742	781	3,523	257	3,780
Basswood	678	350	1,028	5	1,033
Beech	1,407	571	1,978	17	1,995
Sweet birch	487	86	573	21	594
Yellow birch	546	34	580	13	593
Black cherry	4,561	1,970	6,531	103	6,634
Cucumbertree	8	3	11	134	145
Elm	16	0	16	0	16
Black gum	49	4	53	0	53
Hickory	204	54	258	0	258
Red maple	4,979	1,030	6,009	164	6,173
Sugar maple	4,472	788	5,260	171	5,431
White oak	5,487	1,669	7,156	785	7,941
Chestnut oak	2,054	969	3,023	283	3,306
Red oak	18,215	4,198	22,413	2,101	24,514
Black oak	2,115	832	2,947	277	3,224
Other red oaks	255	459	714	28	742
Black walnut	46	2	48	22	70
Yellow-poplar	1,768	758	2,526	1,327	3,853
Other hardwoods	462	17	479	0	479
Total hardwoods	50,551	14,575	65,126	5,708	70,834
All species	60,990	19,119	80,109	7,797	87,906

^aInternational 1/4-inch rule

Table 11.--Production of sawlogs, by species and destination of shipments,
SOUTHEASTERN Pennsylvania, 1988

Species	Retained within the unit	In-state production		Total production	
		Exported to other units	Total	Exported to other states	Total
-----thousand board feet ^a -----					
Hemlock	105	494	599	0	599
White pine	186	409	595	0	595
Other softwoods	84	54	138	0	138
Total softwoods	375	957	1,332	0	1,332
Ash	4,152	1,207	5,359	0	5,359
Basswood	55	300	355	0	355
Beech	245	685	930	0	930
Sweet birch	258	336	594	0	594
Yellow birch	58	56	114	0	114
Black cherry	85	1,891	1,976	0	1,976
Cucumbertree	0	9	9	0	9
Elm	90	38	128	0	128
Black gum	158	60	218	0	218
Hickory	1,072	479	1,551	0	1,551
Red maple	1,009	1,037	2,046	0	2,046
Sugar maple	406	857	1,263	0	1,263
White oak	7,639	2,546	10,185	0	10,185
Chestnut oak	2,895	3,144	6,039	0	6,039
Red oak	11,543	5,676	17,219	0	17,219
Black oak	8,654	2,951	11,605	0	11,605
Other red oaks	1,634	794	2,428	0	2,428
Black walnut	598	66	664	0	664
Yellow-poplar	14,054	2,313	16,367	0	16,367
Other hardwoods	1,280	149	1,429	0	1,429
Total hardwoods	55,885	24,594	80,479	0	80,479
All species	56,260	25,551	81,811	0	81,811

^aInternational 1/4-inch rule

Table 12.--Consumption of sawlogs, by species and origin of shipments,
SOUTHEASTERN Pennsylvania, 1988

Species	Retained within the unit	In-state consumption		Total consumption	
		Imported from other units	Total	Imported from other states	Total
-----thousand board feet ^a -----					
Hemlock	105	55	160	0	160
White pine	186	86	272	19	291
Other softwoods	84	0	84	35	119
Total softwoods	375	141	516	54	570
Ash	4,152	3,188	7,340	837	8,177
Basswood	55	342	397	1	398
Beech	245	7	252	42	294
Sweet birch	258	489	747	30	777
Yellow birch	58	0	58	0	58
Black cherry	85	29	114	0	114
Cucumbertree	0	0	0	0	0
Elm	90	7	97	67	164
Black gum	158	1	159	0	159
Hickory	1,072	735	1,807	252	2,059
Red maple	1,009	819	1,828	349	2,177
Sugar maple	406	993	1,399	70	1,469
White oak	7,639	5,064	12,703	2,487	15,190
Chestnut oak	2,895	266	3,161	1,231	4,392
Red oak	11,543	3,637	15,180	3,156	18,336
Black oak	8,654	4,107	12,761	2,990	15,751
Other red oaks	1,634	1,152	2,786	602	3,388
Black walnut	598	99	697	192	889
Yellow-poplar	14,054	3,202	17,256	3,198	20,454
Other hardwoods	1,280	418	1,698	444	2,142
Total hardwoods	55,885	24,555	80,440	15,948	96,388
All species	56,260	24,696	80,956	16,002	96,958

^aInternational 1/4-inch rule

Table 13.--Production of sawlogs, by species and destination of shipments,
Pennsylvania, 1988

Species	Retained within the state	Exported to other states				Total production
		New York	Ohio	West Virginia	All states	
-----thousand board feet ^a -----						
Hemlock	26,148	3	0	3	6	26,154
White pine	11,389	124	0	21	145	11,534
Other softwoods	4,473	0	0	0	0	4,473
Total softwoods	42,010	127	0	24	151	42,161
Ash	43,477	545	1,129	181	1,855	45,332
Basswood	5,733	73	72	229	374	6,107
Beech	20,327	5	1,200	37	1,242	21,569
Sweet birch	3,995	15	0	21	36	4,031
Yellow birch	1,841	6	0	18	24	1,865
Black cherry	122,212	1,073	1,574	136	2,783	124,995
Cucumbertree	1,721	0	0	10	10	1,731
Elm	882	0	304	12	316	1,198
Black gum	784	0	0	41	41	825
Hickory	10,002	8	493	106	607	10,609
Red maple	79,956	209	1,871	302	2,382	82,338
Sugar maple	44,724	428	1,772	136	2,336	47,060
White oak	118,915	460	3,276	744	4,480	123,395
Chestnut oak	55,102	169	0	484	653	55,755
Red oak	334,637	1,330	7,387	1,137	9,854	344,491
Black oak	65,735	101	0	0	101	65,836
Other red oaks	21,174	0	966	708	1,674	22,848
Black walnut	2,695	0	140	12	152	2,847
Yellow-poplar	60,727	100	1,974	835	2,909	63,636
Other hardwoods	12,633	0	266	14	280	12,913
Total hardwoods	1,007,272	4,522	22,424	5,163	32,109	1,039,381
All species	1,049,282	4,649	22,424	5,187	32,260	1,081,542

^aInternational 1/4-inch rule

Table 14.--Consumption of sawlogs, by species and origin of shipments,
Pennsylvania, 1988

Species	Retained within the state	Imported from other states				Total consumption
		Maryland	New York	Other states ^a	All states	
-----thousand board feet ^b -----						
Hemlock	26,148	32	794	26	852	27,000
White pine	11,389	96	1,528	84	1,708	13,097
Other softwoods	4,473	9	136	35	180	4,653
Total softwoods	42,010	137	2,458	145	2,740	44,750
Ash	43,477	1,152	1,928	1,789	4,869	48,346
Basswood	5,733	8	55	4	67	5,800
Beech	20,327	129	641	38	808	21,135
Sweet birch	3,995	90	21	8	119	4,114
Yellow birch	1,841	2	19	3	24	1,865
Black cherry	122,212	440	2,774	1,421	4,635	126,847
Cucumbertree	1,721	0	16	134	150	1,871
Elm	882	60	0	9	69	951
Black gum	784	67	0	0	67	851
Hickory	10,002	489	36	91	616	10,618
Red maple	79,956	534	1,683	913	3,130	83,086
Sugar maple	44,724	432	2,624	1,441	4,497	49,221
White oak	118,915	3,004	867	3,757	7,628	126,543
Chestnut oak	55,102	1,854	221	339	2,414	57,516
Red oak	334,637	4,703	4,936	7,044	16,683	351,320
Black oak	65,735	3,240	109	1,983	5,332	71,067
Other red oaks	21,174	778	3	201	982	22,156
Black walnut	2,695	204	21	23	248	2,943
Yellow-poplar	60,727	3,466	67	2,928	6,461	67,188
Other hardwoods	12,633	482	36	47	565	13,198
Total hardwoods	1,007,272	21,134	16,057	22,173	59,364	1,066,636
All species	1,049,282	21,271	18,515	22,318	62,104	1,111,386

^aIncludes Delaware, New Jersey, Virginia, Ohio and West Virginia

^bInternational 1/4-inch rule

Table 15.--Production of sawlogs, by county and destination of shipments,
Pennsylvania, 1988

Counties	Retained within the county	Exported			Total production
		Other counties	Other states	All exports	
-----thousand board feet ^a -----					
Allegheny	420	4,776	0	4,776	5,196
Armstrong	6,532	16,034	0	16,034	22,566
Beaver	875	183	0	183	1,058
Butler	5,430	7,702	0	7,702	13,132
Crawford	14,738	7,396	1,868	9,264	24,002
Erie	2,355	4,612	0	4,612	6,967
Greene	226	9,172	3,041	12,213	12,439
Indiana	12,789	14,335	0	14,335	27,124
Lawrence	1,374	2,599	6,073	8,672	10,046
Mercer	8,786	6,270	8,580	14,850	23,636
Washington	462	4,328	3,443	7,771	8,233
Westmoreland	12,821	11,477	0	11,477	24,298
Western	66,808	88,884	23,005	111,889	178,697
Cameron	2,678	9,153	0	9,153	11,831
Centre	10,224	15,577	0	15,577	25,801
Clarion	19,999	6,393	0	6,393	26,392
Clearfield	18,252	16,491	0	16,491	34,743
Clinton	2,929	6,593	0	6,593	9,522
Elk	14,443	24,032	0	24,032	38,475
Forest	1,211	26,832	0	26,832	28,043
Jefferson	13,533	19,851	0	19,851	33,384
Lycoming	15,236	12,960	1,083	14,043	29,279
McKean	12,267	17,578	2,021	19,599	31,866
Potter	13,323	8,143	0	8,143	21,466
Sullivan	10,223	4,814	0	4,814	15,037
Tioga	9,946	13,619	22	13,641	23,587
Venango	15,370	22,643	0	22,643	38,013
Warren	27,710	21,842	43	21,885	49,595
North-Central	187,344	226,521	3,169	229,690	417,034
Bedford	19,974	5,616	1,689	7,305	27,279
Blair	3,012	3,978	0	3,978	6,990
Cambria	9,361	14,019	0	14,019	23,380
Fayette	24,345	3,477	2,917	6,394	30,739
Somerset	21,488	17,042	0	17,042	38,530
Southwestern	78,180	44,132	4,606	48,738	126,918

(continued)

Table 15.--continued

Counties	Retained within the county	Exported			Total production
		Other counties	Other states	All exports	
-----thousand board feet ^a -----					
Dauphin	2,293	7,069	0	7,069	9,362
Franklin	24,273	4,802	216	5,018	29,291
Fulton	12,202	9,225	221	9,446	21,648
Huntingdon	22,727	19,383	0	19,383	42,110
Juniata	13,064	12,216	0	12,216	25,280
Mifflin	12,030	10,115	0	10,115	22,145
Perry	6,789	15,293	0	15,293	22,082
Snyder	4,164	7,826	0	7,826	11,990
Union	2,695	7,209	0	7,209	9,904
South-Central	100,237	93,138	437	93,575	193,812
Bradford	4,574	5,945	0	5,945	10,519
Carbon	10	757	0	757	767
Columbia	2,684	4,951	0	4,951	7,635
Lackawanna	3,482	1,187	0	1,187	4,669
Luzerne	2,070	7,364	0	7,364	9,434
Monroe	891	879	0	879	1,770
Montour	0	458	0	458	458
Northumberland	129	8,783	0	8,783	8,912
Pike	0	3,609	656	4,265	4,265
Schuylkill	4,468	3,884	0	3,884	8,352
Susquehanna	4,203	3,808	0	3,808	8,011
Wayne	8,059	1,657	387	2,044	10,103
Wyoming	5,302	3,073	0	3,073	8,375
Northeastern	35,872	46,355	1,043	47,398	83,270
Adams	3,054	9,430	0	9,430	12,484
Berks	3,482	5,389	0	5,389	8,871
Bucks	970	313	0	313	1,283
Chester	545	10,057	0	10,057	10,602
Cumberland	298	7,371	0	7,371	7,669
Delaware	0	391	0	391	391
Lancaster	12,540	3,911	0	3,911	16,451
Lebanon	4,553	1,783	0	1,783	6,336
Lehigh	391	1,517	0	1,517	1,908
Montgomery	100	514	0	514	614
Northampton	458	281	0	281	739
Philadelphia	0	200	0	200	200
York	6,627	7,636	0	7,636	14,263
Southeastern	33,018	48,793	0	48,793	81,811
All counties	501,459	547,823	32,260	580,083	1,081,542

^aInternational 1/4-inch rule

Table 16.--Consumption of sawlogs, by county and origin of shipments,
Pennsylvania, 1988

Counties	Retained within the county	Imported			Total consumption
		Other counties	Other states	All imports	
-----thousand board feet ^a -----					
Allegheny	420	2,424	0	2,424	2,844
Armstrong	6,532	9,432	12	9,444	15,976
Beaver	875	448	172	620	1,495
Butler	5,430	2,462	0	2,462	7,892
Crawford	14,738	16,753	4,500	21,253	35,991
Erie	2,355	2,377	1,545	3,922	6,277
Greene	226	3	4	7	233
Indiana	12,789	15,222	0	15,222	28,011
Lawrence	1,374	1,464	1	1,465	2,839
Mercer	8,786	9,757	1,343	11,100	19,886
Washington	462	20	0	20	482
Westmoreland	12,821	10,900	0	10,900	23,721
Western	66,808	71,262	7,577	78,839	145,647
Cameron	2,678	16,746	0	16,746	19,424
Centre	10,224	1,635	0	1,635	11,859
Clarion	19,999	20,967	0	20,967	40,966
Clearfield	18,252	23,302	0	23,302	41,554
Clinton	2,929	4,324	0	4,324	7,253
Elk	14,443	18,011	0	18,011	32,454
Forest	1,211	6,763	151	6,914	8,125
Jefferson	13,533	54,045	0	54,045	67,578
Lycoming	15,236	7,826	0	7,826	23,062
McKean	12,267	24,455	0	24,455	36,722
Potter	13,323	26,369	9,787	36,156	49,479
Sullivan	10,223	4,572	0	4,572	14,795
Tioga	9,946	3,264	170	3,434	13,380
Venango	15,370	10,175	0	10,175	25,545
Warren	27,710	5,991	1,360	7,351	35,061
North-Central	187,344	228,445	11,468	239,913	427,257
Bedford	19,974	12,414	6,526	18,940	38,914
Blair	3,012	1,071	0	1,071	4,083
Cambria	9,361	10,647	3,666	14,313	23,674
Fayette	24,345	21,862	5,151	27,013	51,358
Somerset	21,488	4,401	5	4,406	25,894
Southwestern	78,180	50,395	15,348	65,743	143,923

(continued)

Table 16.--continued

Counties	Retained within the county	Imported			Total consumption
		Other counties	Other states	All imports	
-----thousand board feet ^a -----					
Dauphin	2,293	11,958	1,389	13,347	15,640
Franklin	24,273	12,287	1,801	14,088	38,361
Fulton	12,202	1,392	0	1,392	13,594
Huntingdon	22,727	12,548	0	12,548	35,275
Juniata	13,064	20,625	0	20,625	33,689
Mifflin	12,030	21,097	0	21,097	33,127
Perry	6,789	6,457	722	7,179	13,968
Snyder	4,164	8,880	0	8,880	13,044
Union	2,695	10,302	0	10,302	12,997
South-Central	100,237	105,546	3,912	109,458	209,695
Bradford	4,574	11,905	0	11,905	16,479
Carbon	10	287	0	287	297
Columbia	2,684	3,956	5	3,961	6,645
Lackawanna	3,482	12,649	1,475	14,124	17,606
Luzerne	2,070	83	0	83	2,153
Monroe	891	773	0	773	1,664
Montour	0	0	0	0	0
Northumberland	129	201	0	201	330
Pike	0	0	0	0	0
Schuylkill	4,468	4,281	1,712	5,993	10,461
Susquehanna	4,203	4,792	1,160	5,952	10,155
Wayne	8,059	1,961	3,445	5,406	13,465
Wyoming	5,302	3,349	0	3,349	8,651
Northeastern	35,872	44,237	7,797	52,034	87,906
Adams	3,054	1,483	2,525	4,008	7,062
Berks	3,482	830	0	830	4,312
Bucks	970	2,012	838	2,850	3,820
Chester	545	123	3	126	671
Cumberland	298	738	12	750	1,048
Delaware	0	0	0	0	0
Lancaster	12,540	6,431	6,305	12,736	25,276
Lebanon	4,553	35,575	4,036	39,611	44,164
Lehigh	391	210	0	210	601
Montgomery	100	133	0	133	233
Northampton	458	73	127	200	658
Philadelphia	0	0	0	0	0
York	6,627	330	2,156	2,486	9,113
Southeastern	33,018	47,938	16,002	63,940	96,958
All counties	501,459	547,823	62,104	609,927	1,111,386

^aInternational 1/4-inch rule

Table 17.--Production of veneer logs, by species and destination of shipments, Pennsylvania, 1988

Species	Retained within the state	Exported to other states			Total production
		Northeastern states	Other states ^a	All exports	
-----thousand board feet ^b -----					
Hemlock	0	0	0	0	0
White pine	0	0	14	14	14
Other softwoods	0	0	70	70	70
Total softwoods	0	0	84	84	84
Ash	74	0	487	487	561
Basswood	0	0	0	0	0
Beech	32	0	0	0	32
Sweet birch	0	0	0	0	0
Yellow birch	0	0	37	37	37
Black cherry	511	2,286	6,540	8,826	9,337
Cucumbertree	0	0	21	21	21
Elm	0	0	0	0	0
Black gum	0	0	0	0	0
Hickory	1,448	0	98	98	1,546
Red maple	0	0	0	0	0
Sugar maple	6	1,046	562	1,608	1,614
White oak	74	9	864	873	947
Chestnut oak	0	0	0	0	0
Red oak	5,989	445	9,729	10,174	16,163
Black oak	0	0	0	0	0
Other red oaks	0	0	0	0	0
Black walnut	0	1	126	127	127
Yellow-poplar	89	0	454	454	543
Other hardwoods	0	0	89	89	89
Total hardwoods	8,223	3,787	19,007	22,794	31,017
All species	8,223	3,787	19,091	22,878	31,101

^aIncludes Indiana, Michigan, North Carolina, Virginia, and Canadian provinces of Quebec, Ontario, and New Brunswick.

^bInternational 1/4-inch rule

Table 18.--Consumption of veneer logs, by species and origin of shipments,
Pennsylvania, 1988

Species	Retained within the state	Imported from other states			Total consumption
		Northeastern states	Other states	All imports	
-----thousand board feet ^a -----					
Hemlock	0	0	0	0	0
White pine	0	0	0	0	0
Other softwoods	0	0	0	0	0
Total softwoods	0	0	0	0	0
Ash	74	0	0	0	74
Basswood	0	0	0	0	0
Beech	32	0	0	0	32
Sweet birch	0	0	0	0	0
Yellow birch	0	0	0	0	0
Black cherry	511	31	0	31	542
Cucumbertree	0	0	0	0	0
Elm	0	0	0	0	0
Black gum	0	0	0	0	0
Hickory	1,448	1,448	0	1,448	2,896
Red maple	0	0	0	0	0
Sugar maple	6	0	0	0	6
White oak	74	0	0	0	74
Chestnut oak	0	0	0	0	0
Red oak	5,989	2,206	0	2,206	8,195
Black oak	0	0	0	0	0
Other red oaks	0	0	0	0	0
Black walnut	0	0	0	0	0
Yellow-poplar	89	0	0	0	89
Other hardwoods	0	0	0	0	0
Total hardwoods	8,223	3,685	0	3,685	11,908
All species	8,223	3,685	0	3,685	11,908

^aInternational 1/4-inch rule

Table 19.--Production of pulpwood from roundwood, by species and destination of shipments, Pennsylvania, 1988

Species	Retained within the state	Exported to other states			Total production
		Northeastern states	Other states	All exports	
-----standard cords-----					
Spruce/fir	0	0	0	0	0
Hemlock/tamarack	0	528	0	528	528
Pine	24,460	17,685	0	17,685	42,145
Total softwoods	24,460	18,213	0	18,213	42,673
Aspen and poplar	29,323	1,486	0	1,486	30,809
Oak and hickory	197,711	18,038	0	18,038	215,749
Other hardwoods	407,076	19,005	0	19,005	426,081
Total hardwoods	634,110	38,529	0	38,529	672,639
All species	658,570	56,742	0	56,742	715,312

Table 20.--Consumption of pulpwood from roundwood, by species and origin of shipments, Pennsylvania, 1988

Species	Retained within the state	Imported from other states			Total consumption
		Northeastern states	Other states	All imports	
-----standard cords-----					
Spruce/fir	0	0	0	0	0
Hemlock/tamarack	0	0	0	0	0
Pine	24,460	59,062	48,282	107,344	131,804
Total softwoods	24,460	59,062	48,282	107,344	131,804
Aspen and poplar	29,323	1,205	0	1,205	30,528
Oak and hickory	197,711	14,249	11,008	25,257	222,968
Other hardwoods	407,076	28,492	0	28,492	435,568
Total hardwoods	634,110	43,946	11,008	54,954	689,064
All species	658,570	103,008	59,290	162,298	820,868

Wharton, Eric H.; Bearer, John L. 1993. **The timber industries of Pennsylvania, 1988.** Resour. Bull. NE-130. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 40 p.

Evaluates regional timber output of Pennsylvania. Results are based on a survey of primary processing mills located in the state, and of mills in other states that used wood from Pennsylvania. Contains statistics on industrial timber production and mill receipts and the production and final end use of manufacturing residues. Comparisons are made between historical and current data, and trends in industrial wood output are noted. Contains graphics and statistical tables.

Keywords: Forest survey, production, consumption, industrial forest products, manufacturing residue.

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