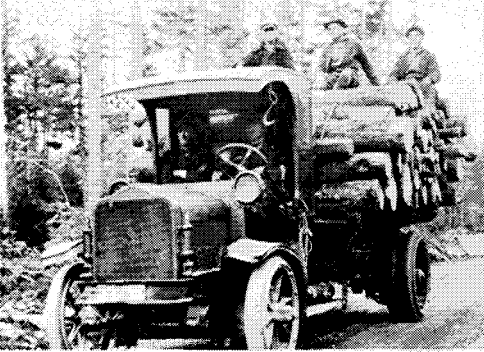
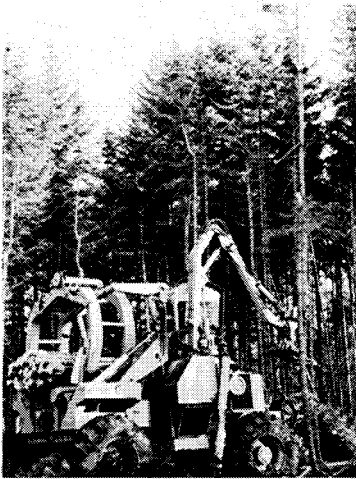
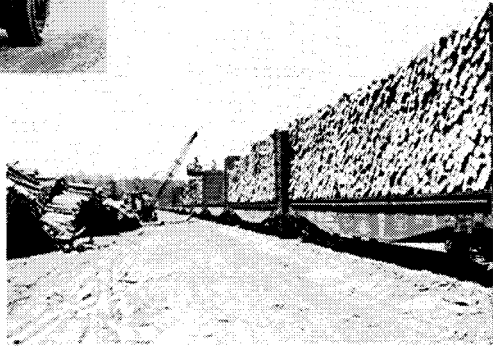


PULPWOOD **in the Northeast:**

PAST



PRESENT



& FUTURE

U.S.D.A. FOREST SERVICE RESOURCE BULLETIN NE-23

1971

**NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE
WARREN T. DOOLITTLE, DIRECTOR**

FOREWORD

SINCE 1963, the Northeastern Forest Experiment Station has conducted annual canvasses of wood-pulp mills in the Northeast to estimate the production of pulpwood in the region. The results of these canvasses are published annually by the Station. These reports are listed in the bibliography.

COVER PHOTOGRAPHS COURTESY OF MAINE FORESTRY DEPARTMENT.

PULPWOOD
in the Northeast:

PAST
PRESENT
& FUTURE

by Neal P. Kingsley

The Author

NEAL P. KINGSLEY, research forester, received his bachelor's degree in forestry from the University of New Hampshire in 1961 and his master's degree in forest economics from the same university in 1963. He joined the Northeastern Forest Experiment Station in August 1962 and has been stationed since that time in Upper Darby, Pa., where he is a resource analyst in the Station's Forest Survey unit.

A PROJECTION

THE PAPER INDUSTRY in North America began in the northeastern United States in 1690. From this beginning, the U. S. has become the largest producer—and the largest consumer—of paper in the world. The Northeast is an important part of this industry: in 1969, the Northeast produced over 6 million cords of pulpwood—more than 10% of the Nation's total.

This look at the past and present of the pulpwood industry in the Northeast has enabled us to project future demands for pulpwood and to predict how the Northeast might meet these demands.

Fourteen states comprise the Northeastern region: Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and West Virginia. In the 1963 and 1964 canvasses, data for Kentucky and Ohio were compiled by the Central States Forest Experiment Station. These data have been combined with the Northeastern Station for these years in this report.

U.S.: WORLD'S BIGGEST PAPER CONSUMER

The United States is by far the largest paper consuming nation in the world. In 1969, U. S. consumption of paper and board stood at 576 pounds per person. Per capita consumption of paper and board in the U. S. has risen steadily since 1920 when per capita consumption stood at 145 pounds. If current trends continue, consumption could conceivably reach 796 pounds by 1985 (fig. 1). A projected population of 255 million in 1985 would use about 101 million tons of paper and board compared to about 58 million tons used in 1969.

About three-fourths of the paper and board manufactured in the U. S. is made from woodpulp. Even with the recent interest in the repulping of fibrous waste materials, it is unlikely that this proportion can be reduced significantly before 1985. The demand for pulpwood will undoubtedly increase substantially over the next 15 years.

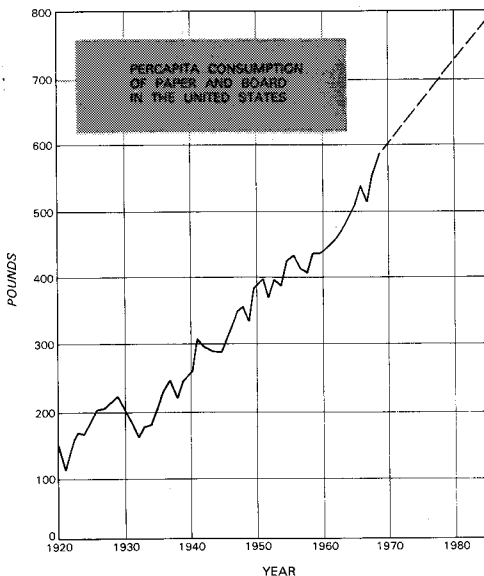
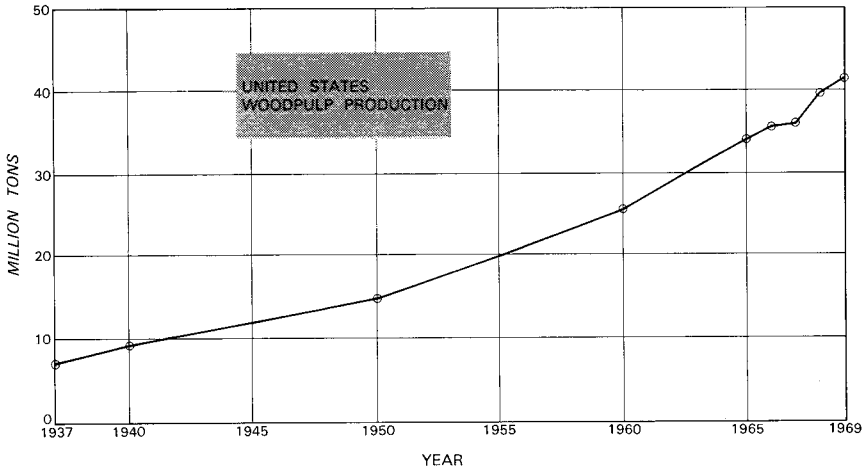


Figure. 1. — Per capita consumption of paper and board in the United States from 1920 to 1969, and projected to 1985.

Figure 2.—U. S. woodpulp production for selected years 1937-1969.



With the world's largest demand for paper and paper-board coupled with an abundant supply of wood, water, technical know-how, and capital, it is no surprise that the United States is the world's leading producer of pulp. In 1969, the U. S. produced 41.6 million tons of pulp (not counting repulped waste paper), or about 36 percent of the world total. U.S. production was 2.2 times that of its nearest rival, Canada, which produced 18 million tons in 1969.

U. S. woodpulp production rose from 6.5 million tons in 1937 to 41.5 million in 1969 (fig. 2). This 1969 production required over 63 million cords of pulpwood. Ninety-nine percent of this was from trees harvested from forests in the U. S.

THE PAST— 1690-1962

The woodpulp and paper industry in the Northeast has a long history of growth and development. The past will bear on the future and, therefore, is worthy of review.

The Northeast is the cradle of the paper and woodpulp industries in America. The Region has to its credit a long list of firsts in these industries.

- 1690—*First* paper mill in North America, built by William Rittenhouse and William Bradford on Wissahickon Creek near Philadelphia.
- 1816—*First* paper making machine used by Joshua and Thomas Gilpin at Wilmington, Del.
- 1855—*First* soda pulpmill in U. S. built at Manayunk, Pa.
- 1867—*First* groundwood mill in U. S. at Curtisville, Mass.
- 1871—*First* use of poplar in woodpulp in western Mass.
- 1882—*First* sulphite mill in U. S. at East Providence, R. I.
- 1930—*First* use of chipped sawmill slabs and edgings at Madawaska, Me.

The woodpulp industry expanded rapidly in the late 1800's and early 1900's. This is shown dramatically by the following statistics on pulpwood consumption for selected years:

1870—2,000 cords
1880—40,000 cords
1890—580,000 cords
1920—6,000,000 cords

During this period, the Northeast was the center of the U. S. woodpulp industry. From 1904 through 1923, New York was the leading pulpwood producing State in the country, averaging nearly 947 thousand cords per year or 22 percent of the U. S. production. In fact, during this same period, the New England States, together with Pennsylvania and New York, accounted for 64 percent of the U. S. total. New England alone produced 34 percent; Pennsylvania, 8 percent.

The turn of the century witnessed the birth and development of many of the giants in the industry. Notable were the formation of International Paper Company and the Great Northern Paper Company, now a division of Great Northern Nekoosa Corporation. International, now the world's largest manufacturer of paper, was born on January 31, 1898 when 20 independent mills in Maine, New Hampshire, Massachusetts, Vermont, and New York merged. This

amalgamation of companies controlled a million acres of timberland in the U. S. and 1.6 million acres in Canada. At its outset, it accounted for 90 percent of the U. S. production of newsprint. This combination has been described rather fittingly as "the successful merger of the fourdrinier and the countinghouse" (13).

In 1899, the Great Northern Paper Company was founded partly to counter International's hold on the newsprint industry. Great Northern built its mill at what is now Millinocket, Me. This mill was the largest single mill in the Northeast when it was built, and it is still the largest today. Not only did this company construct the largest mill, but it also built the city of Millinocket—"the magic city of the North" (15). When the mill began production, Millinocket had 2,000 inhabitants in a place that was wilderness a few years earlier. Millinocket, although perhaps the most famous, was not the only town built in this rapid expansion of the industry. Others include Chisholm, Rumford, and Livermore Falls in Maine.

Other large paper companies that came into being in the Northeast include Westvaco Corporation—1888—in Maryland, Hammermill Paper Company—1898—in Pennsylvania, Finch Pruyn Company—after 1900—in New York, and St. Croix Paper Company (now St. Croix Division of Georgia-Pacific Company)—after 1900—in Maine.

During the 1930's, a satisfactory method of pulping southern softwoods was developed. This spurred a rapid growth in pulpwood consumption as seen in the following statistics for national pulpwood consumption:

1930—	7,195,500	cords
1940—	13,724,958	cords
1950—	23,627,217	cords
1960—	40,485,000	cords

But the pulping of southern softwoods also slowed the growth of the Northeast as the south gained pre-eminence in woodpulp production.

THE RECENT YEARS— 1963-1969

The total production of pulpwood in the Northeastern region rose by 34 percent from 4,642,700 cords in 1963 to 6,062,500 cords in 1969 (fig. 3). This increase closely paralleled the national trend. In 1963, total U. S. production amounted to 44.7 million cords. By 1969, it had risen by 41 percent to 63.0 million cords. On the average over the period, the Northeast produced slightly more than 10 percent of the nation's pulpwood.

About 95 percent of the pulpwood received by mills in the Northeast is produced in the region. Of the remaining 5 percent shipped in from outside the region, Canada supplied from 85 to 93 percent, depending on the year. Most of the Canadian wood is spruce and fir from Quebec and New Brunswick. Virginia, Tennessee, and Indiana also ship pulpwood into the Northeast. Virginia supplies nearly all of the U. S.-produced softwood shipped into the region and about half of the hardwood.

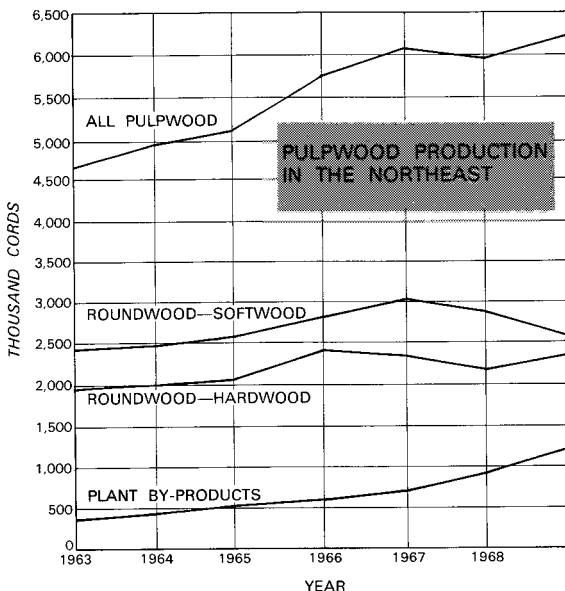


Figure 3.—Pulpwood production in the Northeast by kind of material 1963-1969.

Forms of Wood Used

Pulpwood is produced in two forms—round pulpwood and pulpwood chips. Chips are produced directly from tree stems and from by-products, which are produced principally from waste material from other forest products industries such as sawmill slabs and edgings, veneer cores, and veneer trimmings.

Roundwood accounted for about 87 percent of the pulpwood produced in the Northeast from 1963 through 1969, compared to 77 percent for the nation. However, this proportion has been generally declining as the use of chipped by-products has become more prevalent. In 1963, roundwood accounted for about 93 percent of the production in the Northeast. By 1969, roundwood had declined to 81 percent of the total. Timber industry by-products (mostly chipped slabs and edgings) rose from 7 percent of production in 1963 to 20 percent in 1969.

Species Used

Nearly all commercial species growing in the Northeast are usable as pulpwood. For the purposes of compilation, we have grouped them into three softwood groups and three hardwood groups (fig. 4). Of these groups, spruce-fir is the largest, accounting for about 33 percent of all pulpwood and about 38 percent of the roundwood over the 7-year period (1963 to 1969). However, its share of both the region's roundwood and total pulpwood production has been declining. The second most important species group, other hardwoods, accounted for an average of about 26 percent of the production since 1963. ("Other hardwoods" include all hardwood species found in the Northeast—such as the maples, birches, and beech—except aspen, yellow-poplar, the oaks, and the hickories.) The other-hardwoods group has declined from 28 percent to 24 percent of the total during the 7-year period, but it has held at 30 percent of the roundwood.

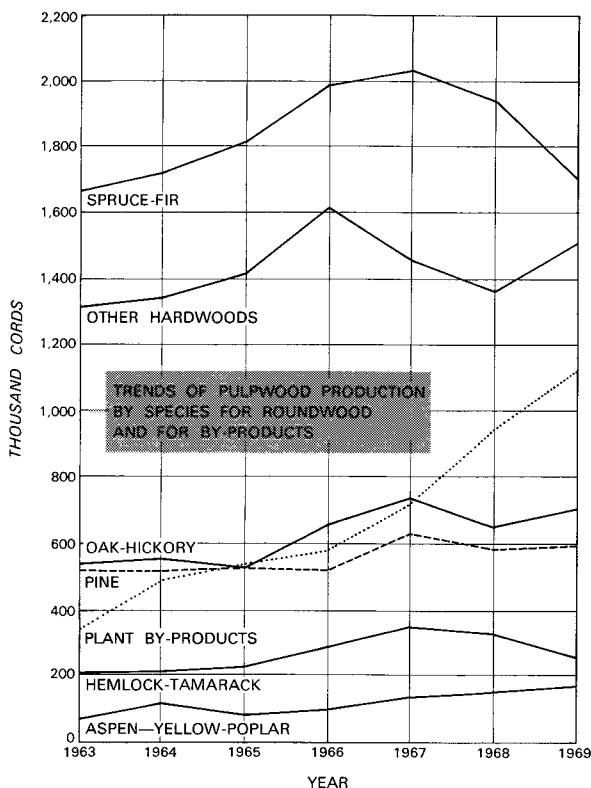


Figure 4.—The trend of pulpwood production by species for roundwood and for wood industry by-products 1963-1969.

Softwood species accounted for about 55 percent of the roundwood production in the Northeast from 1963 through 1969. However, in the nation, they accounted for 72 to 73 percent of the roundwood during the same period. Thus, hardwoods constitute a greater share of production in the Northeast than in the nation. Hardwood roundwood production rose from 44 to 48 percent of the production in the Northeast. For the nation as a whole, it held constant at about 32 percent.

Production by State

Pulpwood is produced in all of the 14 States in the Northeast. Maine is by far the largest producer. Maine's production since 1963 has consistently accounted for about one-half of

the region's total. Pennsylvania, the second largest producer, has accounted for about 13 percent of production.

The States ranked in descending order of production are:

<i>State</i>	<i>Percent of regional total (1963 to 1969)</i>
Maine	49
Pennsylvania	13
New York	8
West Virginia	7
Ohio	6
New Hampshire	5
Maryland	5
Vermont	3
Kentucky	2
Delaware	1
New Jersey	1
Massachusetts	Less than 0.5
Connecticut	Less than 0.5
Rhode Island	Less than 0.5

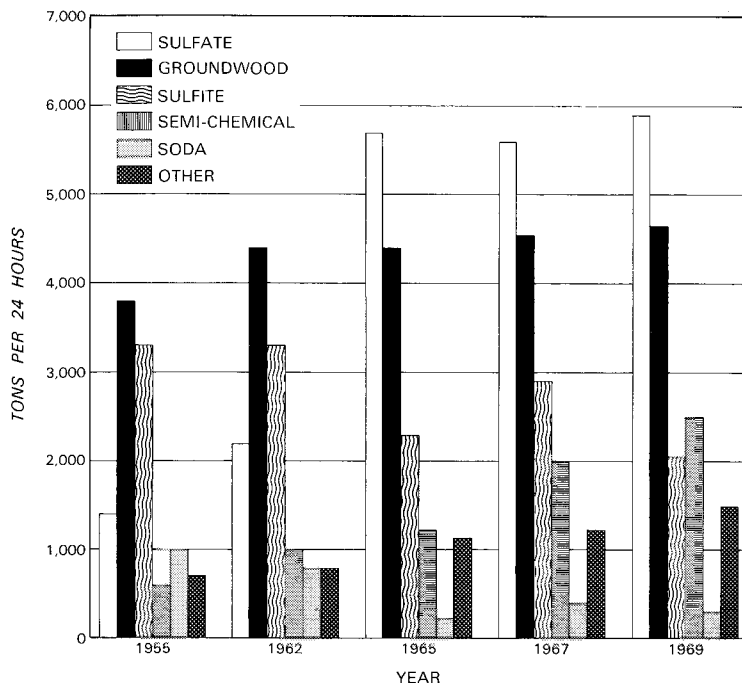
The Woodpulp Mills in the Northeast

In 1969, the Northeast had 64 operating woodpulp mills that had a total estimated daily capacity of 16,676 tons of output. These mills range in capacity from 12 tons to nearly 1,400 tons per day. The average size is about 266 tons per day, and the median size is 180 tons per day. The pulpmills in the Northeast tend to be somewhat smaller than those in the rest of the nation.

Five major woodpulping processes are used in the Northeast—sulfate (Kraft), groundwood, sulfite, semi-chemical, and soda (fig. 5). In addition, many small mills, which primarily supply the building papers and flooring materials industries, use various other processes.

Sulfate.—In 1969, about 35 percent of the Northeast's pulping capacity was in sulfate mills. This process has seen a rapid growth in popularity, rising from 1,400 tons per day (4th place) in 1955 to over 5,900 tons (1st place) in 1969. In general, the sulfate process produces a high quality pulp which can be used to produce quality papers. Sulfate pulp is

Figure 5.—Woodpulp mill capacity in the Northeast, by process for selected years, 1955-1969.



used in the manufacture of such products as bond, book, printing, and business papers as well as in corrugating medium.

With this process it is possible to utilize more of the hardwood species than with the other processes. The increased use of the sulfate process can be seen in the paralleling increase in the use of hardwood species. Consumption of hardwood species increased about 60 percent between 1967 and 1969, while the capacity of sulfate mills in the Northeast gained about 62 percent over the same period.

Groundwood.—The second most prevalent process in the Northeast is the groundwood process, which in 1969 accounted for 27 percent or 4,500 tons per day of the woodpulp capacity in the Northeast. Groundwood pulp production has increased only slightly since 1955, rising from 3,800 tons per

day to 4,650 in 1969. This process had grown moderately, but has lost out to the sulfate process as the leading process in the Northeast. This is reflected by the decreasing proportion of softwood consumed, while the actual volume of softwood consumed has increased.

The groundwood process uses more softwoods than do the other processes. Therefore, most groundwood mills are located in areas with an ample softwood supply. Groundwood woodpulp is used to manufacture such products as tissue and sanitary paper products, newsprint, poster, and other coarser and weaker grades of paper. Groundwood papers are generally lower in value per unit than are most others. Groundwood mills tend to be somewhat larger than other types of mills.

Sulfite.—Sulfite pulp is the third most prominent process accounting for 15 percent of the total daily mill capacity. The capacity of this process has declined in popularity from 3,300 tons per day in 1955 to 2,050 in 1969. Sulfite pulp is suitable for the manufacture of tissue and sanitary papers as well as for bond, ledger, offset, card, and cover papers. The sulfite process uses both softwoods and hardwoods.

Semi-chemical, soda, and miscellaneous processes.—The remaining processes have shown varying trends since 1955. Semi-chemical pulp capacity has increased, primarily as a result of the growing demand for packaging materials. The soda process has declined since 1955 due to the higher relative cost of production. Also, soda pulp, which is used primarily to manufacture book and printing papers, produces short, weak-fibered pulp, which must be combined with other pulps to produce sufficiently strong paper grades.

The other processes, which include the roofing and defibrated wood process, have grown primarily as a result of the growth of the home building industry.

THE FUTURE-1970-1985

What does the future portend for the pulpwood industry in the Northeast? What forms of pulpwood will be produced in the coming years? What sections of the Northeast hold the greatest potential for increased pulpwood production? How will mill closings influence pulpwood's future? What effect might the recycling of fibrous waste have in the next 15 years? We can attempt to provide answers to these questions, and we can give a projection of the future pulpwood production in the Northeast.

What Forms of Pulpwood?

What will be the composition of future pulpwood production? One thing appears certain; we can expect an increase in the proportion of hardwood in the roundwood component. The hardwood proportion of the total pulpwood production has shown a substantial increase nationally. In 1920 it accounted for only 12 percent, and in 1969 it accounted for over 30 percent of the roundwood. Hair, in his publication on projecting demand for paper and board (7), projected the hardwood component to rise to 35 percent of the national roundwood output by 1985. In the Northeast, hardwoods have been a major component of roundwood since 1950 when they accounted for 46 percent compared to the 1969 share of 49 percent.

Hardwoods will continue to increase their share of the roundwood output. If we assume present day levels of volume growth for softwoods and hardwoods and compare these with projected total timber cut for softwoods and hardwoods, it becomes evident that shortages of softwood pulpwood can be expected.

In 1967, the estimated average annual net growth of softwood growing stock in the Northeast was 872 million cubic feet and 2,391 million for hardwoods.¹ By 1985, total timber

¹ Office Report, NEFES, 1967, is the most recent year for which net annual growth and removals have been estimated for each state in the Northeast.

removals would be 2.1 billion cubic feet compared with an estimated growth of 3.3 billion, if the following assumptions are made: (1) timber products other than pulpwood continue to follow the trend established during the previous 15 years; (2) that the projected pulpwood production is added to the volume of other products; (3) that the 1985 harvest of round pulpwood is divided between hardwoods and softwoods as was the 1967 harvest, and (4) that no significant increase or decrease in average net annual growth occurs between 1967 and 1985. If these assumptions hold true, about 1.2 billion cubic feet, or 13.5 million cords, of the total timber removals in 1985 would be round pulpwood.

This growth-to-removals ratio looks acceptable, but further examination reveals some potential problems. A comparison of softwood growth and removals shows that growth in 1985 would be about 0.9 billion cubic feet while removals would stand at 0.8 billion. A State by State examination, assuming that the 1985 removals are distributed among the States as were the 1967 removals, shows that four States—Delaware, Maryland, New York, and Ohio—would be harvesting more than they would be growing. And in Maine, the growth of softwoods in 1985 would exceed removals by only 10 percent.

For hardwoods, the estimated 1985 removals would be 1.3 billion cubic feet compared to 2.4 billion feet of growth. Region wide, this is a more favorable ratio than for softwoods. This analysis clearly indicates that in order to continue to grow, the pulpwood industry in the Northeast must utilize an increasing proportion of hardwood in the coming years.

The use of residues from other wood-using industries (plant by-products) as pulpwood has shown outstanding growth in the past 7 years. The most notable growth has been in the development of chipped plant by-products. In 1963, pulpwood chip production accounted for the equivalent of about 325 thousand cords; by 1969 production reached the equivalent of 1,265 thousand cords, most of which, 69 percent, was hardwood.

We do not expect the same growth in the use of chipped residues in the next 15 years as occurred in the preceding 15 years. The reason for this is that lumber production, the principle source of chippable residues, is not expected to keep pace with the growth of the pulpwood industry. Also, the growth in the use of chipped residues has been much greater than the growth of those industries that provide raw material.

Based upon expected growth of the other wood-using industries in the Northeast, a theoretical maximum limit for pulpwood chip production from residues appears to be equivalent to about 2.5 million cords of roundwood. This limit assumes that all suitable material would be chipped for pulpwood. Allowing for other uses of chips such as in metallurgy and agriculture and for unchipped residues, the maximum that might be available for pulpwood would be in the neighborhood of 1.9 million cords. Since present production is 1.2 million cords, it would appear that the practical limit is in sight.

This is not to say pulpwood chips will necessarily decline in relative importance as a raw material. Remote stationary chipping plants that chip roundwood before shipment to the consuming mill have already been established in the Northeast. Portable chippers are being explored and developed. Remote chipping of roundwood offers many advantages in terms of handling and shipping costs. Also, some sawmills that have chippers debark and chip low grade sawlogs, tops, and even large limbs, though the economics of such practices are not well established. These developments presage changes in the handling of raw material rather than an expansion in the use of residue.

In 1969, pulpmills in the Northeast began using sawdust in woodpulp manufacture. Although sawdust has been used successfully as a raw material for a number of years in the Northwest, it is too soon to assess its future in the Northeast. However, it would not appear to have a future comparable to chips. There are two important reasons for this. First, because the sawmill industry is not as large as in other regions,

sawdust is not as abundant. Secondly, sawdust seems to be a natural raw material for such possible future products as pressed or molded wood products.

Growth Areas

Although the future growth of the pulpwood industry in the Northeast can be expected to be fairly well distributed throughout the heavily forested sections of the region, certain areas show a greater potential for growth than do others. The analysis of growth and removals discussed earlier shows that three States stand out as having particularly favorable ratios of growth and removal. These States—Pennsylvania, West Virginia, and Kentucky—each have large volumes of timber; and, by 1985, growth in these States would still be $1\frac{1}{2}$ to $2\frac{1}{4}$ times the removals.

In addition to a large lightly tapped hardwood resource, these States have the advantage of being fairly close to the major population centers of the East. This area does not now appear to be endowed with many suitable mill sites, primarily because of a lack of adequate water sources and because the mountainous terrain makes harvesting and transporting pulpwood more expensive than in other parts of the region. Technological developments in water recycling (stimulated primarily by pollution control requirements) may make many presently unacceptable sites economically and socially feasible. Also, as demand for paper and competition for timber increase, paper manufacturers may accept the higher costs of harvesting and transportation in order to obtain a sustainable supply of wood.

Several States would have better growth-to-removals ratios in 1985 than Pennsylvania, West Virginia, and Kentucky; but two considerations work against these States as potential future suppliers of large volumes of wood. These States—Connecticut, Massachusetts, New Jersey, and Rhode Island—are all small and heavily populated. The primary purpose of forest land in this region in the years to come will be

recreation and esthetics. It would be unrealistic to look at these States as a sustained source of pulpwood.

Mill Closings?

The pulpmills in the Northeast are, on the average, smaller and older than those in other sections of the nation. Thus, from the standpoint of physical plant, the Northeast is not in a strong competitive position. Over the next few years, we can expect more mill closings and shutdowns as more and more of the region's older mills become too costly to operate profitably. The recent public demand for clean air and water may also add to the problem, as the necessary pollution control devices add appreciably to the cost of operations. While these closings have had, and will continue to have, serious economic implications in the areas in which they occur, the total effect is expected to be short lived, and these temporary losses will be replaced by larger, more profitable, and more stable mills.

The regionwide effects of mill closings over the past 15 years have been more than offset by new pulpmill installations. In 1955, the Northeast had an estimated daily capacity of 10,800 tons of woodpulp per day compared with 16,900 tons in 1969. Thus, capacity rose despite a decrease in the number of pulpmills from 109 in 1955 to 74 in 1969. This, simply stated, means that small, old, unprofitable mills closed and their capacity was replaced by larger, new mills. We can look forward to a continuation of this trend.

Recycling?

About 20 percent of the paper produced in the U. S. is recycled (16). Some authorities have predicted that it will be necessary to recycle 25 to 30 percent by 1980 just to meet the demand for paper (16).

The question appears to be, will the recycling of waste paper be sufficiently widespread by 1985 to reduce the demand for pulpwood to a measurable degree? Many factors

indicate that it will not be. At the present time, waste pulps are more expensive, in many instances, than are new woodpulp because waste paper fibers cannot be collected, transported, and processed more economically than new wood fibers (17). Another limiting factor is consumer preference for products made from new woodpulp because of price advantage, quality, functionality, or appearance.

Few paper products are made entirely from waste pulps. Most of the waste paper pulps are mixed with new woodpulp. This creates a problem because the largest source of waste paper for recycling is in and around major population centers. Most woodpulp mills are located in remote forested regions. Because most modern papermills are integrated with woodpulp mills, waste paper or pulps must be shipped from the populated areas to the papermill. This transportation problem adds appreciably to the cost of using waste paper pulps.

Van der Eb (17) lists four factors which will determine how rapidly the use of recycled fibers will develop:

- How quickly the economics turn in its favor,
- How heavily the industry invests in the new and efficient production equipment which is now available,
- How extensively environmental concern encourages the acceptance of recycled products,
- And how fast substantially new products and new markets can be developed.

It is doubtful the general public is willing to accept goods that cost more as the price for environmental improvement. But, given the emerging concern for environmental problems, there is little doubt that, when the economics of recycling are right, the growth of recycling will be rapid. Because of economic obstacles, we are forced to conclude that recycling probably will not cause a substantial reduction in the demand for pulpwood before 1985.

Fifteen Million Cords in 1985?

Projected demands for pulpwood in the U. S. to 1985 were developed by Dwight Hair (7). Hair's national projection for pulpwood in 1985 is 118.7 million cords, 100.7 million cords of which is roundwood. These projections have been used here as a basis for arriving at an assessment of the 1985 production of pulpwood in the Northeast.

In recent years, the Northeast has produced slightly more than 10 percent of the nation's pulpwood. If we apply 10 percent to Hair's projection this would indicate that in 1985 the Northeast can be expected to produce about 12 million cords. This would mean nearly doubling production in the next 15 years. Historical precedent for such growth has been established. From 1950 to 1965, roundwood pulpwood production in the Northeast rose from 2.5 million to 4.6 million cords, an 84 percent increase. Were it not for the fact that chipped residues as a source of pulpwood rose from a negligible volume in 1950 to more than 10 percent of the 1965 total, the increase would have been about 104 percent. There is no reason to believe that the Northeast is not capable of similar performance in the next 15 years.

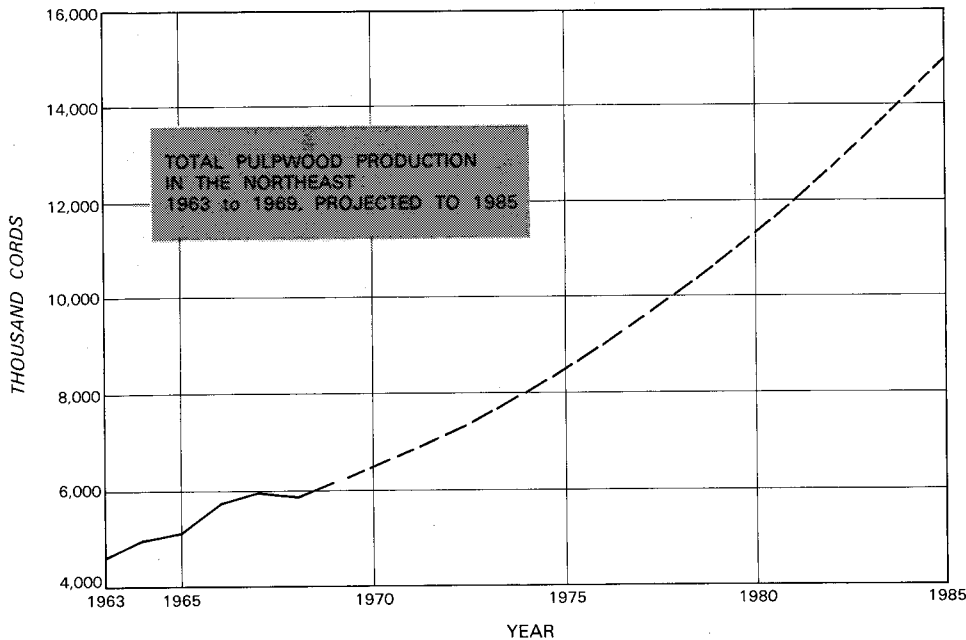
On the contrary, there is considerable evidence to indicate an even greater growth in the next 15-year period. If we compare Hair's projection of national pulpwood production and anticipated demands for other forest products with projected allowable cuts and growth rates shown in "Timber Trends in the United States" (16), it becomes evident that critical shortages of wood are likely to develop in the South. This assumes that each producing region will produce the same relative share of the various forest products (lumber, veneer and plywood, pulpwood, and miscellaneous other products) in 1985 as in 1970. Because pulpwood is one of the lower valued forest products, on a unit basis, the demand for sawlogs, veneer logs, turnery bolts, and other higher valued products will take precedence over the demand for pulpwood.

One region that is still likely to have a surplus of wood, under this analysis, is the Northeast. Therefore, it appears

reasonable to conclude that some of the southern deficit will be met by shifting production into the Northeast.

However, it is not reasonable to conclude that all of the deficit will be met by shifting production. Much of the shortage will undoubtedly be met through stepped up forest management, particularly on the more productive sites in the South, and through a higher level of woods utilization. Substantial volumes of usable cellulose are left in the woods in the form of limbs, tops, and uncut rough trees. Economical means will likely be found to utilize this material. The development of these techniques awaits only the added stimulus of an increased demand. With these considerations in mind, the 12 million cord projection derived from Hair's work appears to be too conservative. Pulpwood production in the Northeast will probably reach, and may even exceed, 15 million cords in 1985 (fig. 6).

Figure 6.—Total pulpwood production in the Northeast 1963-1969, and projected to 1985.



Bibliography

1. Anonymous.
1965. GROWING TREES FOR A GROWING WORLD: HOW PAPER SERVES AMERICA. New York Times, Sept. 16 (Advertising supplement prepared by the American Paper Institute).
2. Bones, James T., and Neal P. Kingsley.
1969. PULPWOOD PRODUCTION IN THE NORTHEAST—1968. USDA Forest Serv. Resource Bull. NE-15, 33 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
3. Bones, James T., and David R. Dickson.
1970. PULPWOOD PRODUCTION IN THE NORTHEAST—1969. USDA Forest Serv. Resource Bull. NE-22, 34 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
4. Coolidge, Philip T.
1963. HISTORY OF THE MAINE WOODS. Furbush-Roberts Printing Co., Inc., Bangor, Me., 805 pp., illus.
5. Gansner, David A.
1964. PULPWOOD PRODUCTION AND CONSUMPTION IN THE CENTRAL STATES, 1962 and 1963. U. S. Forest Serv. Resource Bull. CS-23, 8 pp., illus. CS. Forest Exp. Sta., Columbus, Ohio.
6. Gansner, David A.
1965. CONSUMPTION AND HARVEST OF PULPWOOD IN THE CENTRAL STATES—1964. USDA Forest Serv. Resource Bull. CS-40, 8 pp., illus. CS. Forest Exp. Sta., Columbus, Ohio.
7. Hair, Dwight.
1967. USE OF REGRESSION EQUATIONS FOR PROJECTING TRENDS IN DEMAND FOR PAPER AND BOARD. USDA Forest Serv. Forest Resource Rpt. No. 18, 178 pp., illus.
8. Kellogg, R. S.
1923. PULPWOOD AND WOOD PULP IN NORTH AMERICA. McGraw-Hill, N. Y. 273 pp., illus.
9. Kingsley, Neal P.
1966. PULPWOOD PRODUCTION IN THE NORTHEAST—1963. USDA Forest Serv. Resource Bull. NE-3, 26 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
10. Kingsley, Neal P.
1967. PULPWOOD PRODUCTION IN THE NORTHEAST—1964. USDA Forest Serv. Resource Bull. NE-5, 27 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
11. Kingsley, Neal P., and David R. Dickson.
1967. PULPWOOD PRODUCTION IN THE NORTHEAST—1965. USDA Forest Serv. Resource Bull. NE-6, 36 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
12. Kingsley, Neal P.
1968. PULPWOOD PRODUCTION IN THE NORTHEAST—1966. USDA Forest Serv., Resource Bull. NE-11, 33 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
13. Kingsley, Neal P.
1969. PULPWOOD PRODUCTION IN THE NORTHEAST—1967. USDA Forest Serv. Resource Bull. NE-13, 34 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
14. Lockwood Trade Journal.
1940. 250 YEARS OF PAPER MAKING IN AMERICA. Lockwood Publishing Co., Inc., N. Y. 180 pp., illus.

15. Smith, David D.
1966. WOOD PULP PAPER
COMES TO THE NORTHEAST—
1865-1900. Forest History
10(1): 12-25, illus.
16. U. S. Forest Service.
1965. TIMBER TRENDS IN
THE UNITED STATES. Forest
Resource Rpt. No. 17, 235
pp., illus.
17. Van der Eb., H. G.
1970. RECYCLING WASTE
PAPER INTO PAPER AND
PAPERBOARD PACKAGING.
Waste Paper Recycling Semi-
nar. Amer. Paper Inst., Wash-
ington, D. C., Oct. 16, 1970.
18. Williams, W. C.
1970. USE IT/RE-USE IT!
POLITICAL, ECONOMIC PRES-
SURES BRIGHTEN FUTURE FOR
WASTE. Pulp & Paper, 44(10):
61-65, illus.
19. Williams, W. C., and L. Haas.
1970. THE DECADE OF THE
'60's CLOSED STRONG: '70's
HOLD PROMISE FOR PULP,
PAPER. Pulp & Paper 44(7):
5-14, illus.





THE FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.