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## Papermaking in Maine: Economic Trends from 1894 to 2000

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# PAPERMAKING IN MAINE: ECONOMIC TRENDS FROM 1894 TO 2000

BY LLOYD C. IRLAND

**D**URING the year 2002, Great Northern Paper Company shut down newsprint production at Millinocket. Thus quietly ended an era in Maine's industrial history. A century earlier, Maine's paper industry embarked on a dramatic growth spurt. In the early 1890s, Rumford Paper Company claimed the largest newsprint mill in the world, but less than a decade later in 1899 this achievement was eclipsed by Great Northern's Millinocket mill, soon to be powered by the world's largest hydroelectric dam at Ripogenus, built 1911 to power the first paper machine in the world to run at 1,000 feet a minute. From this age of superlatives to the quiet shutdown of an old paper machine, there lies a tale of industrial change that has not been told from the perspective of the entire century.

This essay reviews the major economic trends in Maine's paper industry since the late nineteenth century. It sets the context at national and regional levels, offers a broad statistical picture of the industry's production in Maine, and concludes with a focus on Maine's "mill towns." Paper production is a branch of a larger industry that converts primary fiber — logs, chips, wastepaper, rags, or market pulp — into paper. In Maine there were about thirty-five paper mills in 1900, and several more were built during the century; by 1999, however, only seventeen mills remained. In a few instances, several mills in a given community disappeared, Rumford and Jay-Livermore Falls being examples.

In late colonial times and through most of the nineteenth century, small paper mills were scattered throughout New England, often employing less than a dozen workers. In the nineteenth century, the typical paper mill was far smaller than the typical textile plant in terms of jobs and local economic impact. Town and local histories supply abundant evidence of the impact of the small mills on the social and economic life of the towns.<sup>1</sup> In contrast, standard corporate histories are usually meager sources for details on individual communities.

### The U.S. Paper Industry

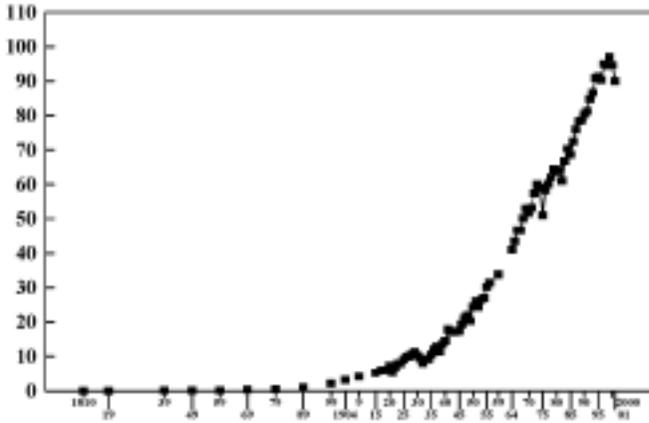
The U.S. paper industry displayed a strong record of sustained growth over the twentieth century (Fig. 1). This growth helped maintain paper manufacturing as a significant economic presence in New England, even though the prominence in total tonnage now goes to other regions in the South, Midwest, and West.<sup>2</sup> The decline in output after 1999 was the first time since records were kept that *capacity* actually fell as well. This indicates that the twenty-first century industry is restructuring and not merely weathering another business cycle.

A major driving force, especially for the Northeast up to World War I, was the newspaper industry (Table 1), which grew dramatically from 1850 to 1900. Newsprint came into its own as a paper grade after the Civil War. In the Tenth Census (1880), newsprint was not even identified as a leading grade, and production nationwide in 1870 was estimated at only 130 daily tons. By 1890, newsprint had vaulted to 700 daily tons, and it more than doubled to 1,900 daily tons in 1900. The decline in newsprint prices in the latter nineteenth century (Fig. 2) is both a cause and an effect of this upsurge in demand. Newsprint prices were inflated by Civil War shortages, and then plummeted through World War I as mills grew larger and faster, technology improved, and competition increased.

The changing mix of paper usage was of considerable importance for Maine. From the early 1900s to 1929, newsprint was the leading single grade (Table 2), having tripled from 1899 to 1919 and doubling again during the 1920s. Maine was important in this branch of the industry, and although war and depression slowed growth of all branches of the paper industry, in the two decades after 1949, newsprint and paper consumption roughly doubled. Newsprint growth since 1969 has been modest, even as paper consumption nearly doubled yet again in only thirty years.

Despite growth nationally, however, many of New England's paper mills experienced competitive pressures from newer, larger mills in Canada, the U.S. South, and even offshore. The resulting machine retirements and mill closings led to layoffs in town after town. Further, rapid mechanization and automation boosted output per worker and eliminated many labor-intensive tasks. In communities heavily dependent on paper mills, economic and social stresses were significant during periodic industry downturns.<sup>3</sup> Ominously for a state dependent on primary paper, U.S. pulpwood usage grew only 25 percent from 1969 to 1999, as end product usage was doubling. This was due to imports as well as to

**U.S. Paper and Board Production  
1810 to 2001**



Sources: Dwight Hair, SB228, p. 18; AF&PA, 1998, p. 2; and Pulp & Paper, Jan. 2002, p. 36.

Fig. 1

Table 1  
Daily Number of Newspapers and Average Circulation, 1850-1963

Year	Number of Newspapers	Average Circulation per Issue
1850	254	758
1860	387	1,478
1870	574	2,602
1880	971	3,566
1890	1,610	8,387
1900*	2,226	15,102
1919	2,441	33,029
1939	2,040	42,966
1963	1,766	66,527
2000	1,480	55,700

\*Up to 1900 includes a small number of periodicals

Source: *Historical Statistics of the U.S.*, p. 545; Year 2000 from P&P, NAFB, p. 93.

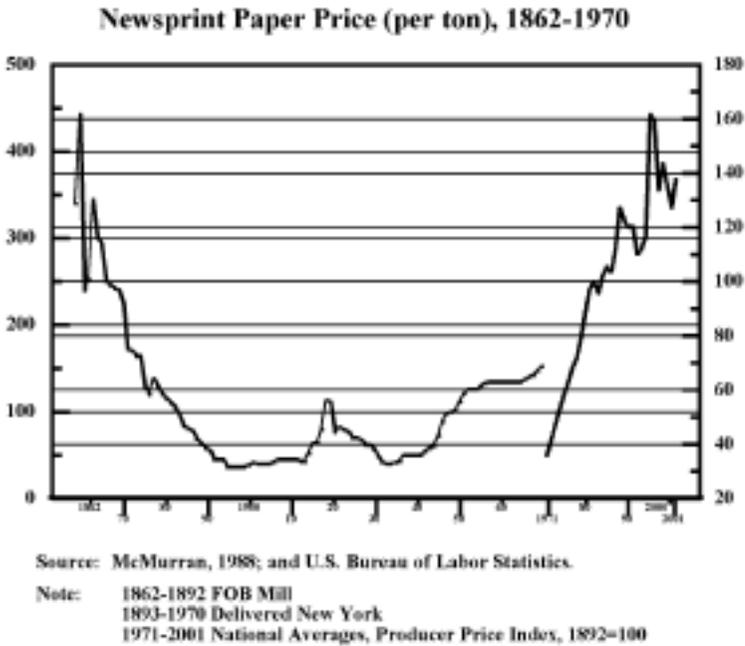


Fig. 2

Table 2  
 U.S. Apparent Consumption of Paper, Newsprint, all Paperboard, and Pulpwood

Year	Newsprint (1000 tons)	All Paper	Newsprint as % Of all Paper	All Paper and Board	All Pulpwood (1000 cords)
1899	569	1,773	32.1%	2,168	1,986
1919	1,841	4,403	41.8%	6,253	6,656*
1929	3,813	9,108	41.9%	13,411	13,989
1949	5,523	14,788	37.3%	24,694	28,464
1969	9,915	29,972	33.1%	54,498	64,577
1999	11,986	57,093	21.0%	104,051	79,972

\*Data for 1916



Source: AF&PA.

Note: Recovery rate = (tons recovered paper collected/tons "new supply")

Fig. 3

increased usage of recycled fiber (Fig. 3). U.S. pulpwood usage peaked in 1995 at 97.3 million cords and then declined. The 1999 level of pulpwood usage was about the same as it had been in 1979.

### Early Development in the Northeast

The colonial paper industry was affected by several key location factors, primarily water supply, labor force, rag supply, and markets. These favored urban locations or small nearby communities. By the late nineteenth century, wood-pulp paper mills needed larger and larger quantities of water for process use, transportation, waste discharge, and hydroelectricity, and the new mills were located on sites favorable to mainstream dams, since small side-creeks could no longer turn their machinery. Most importantly, log drives brought growing volumes of wood to their gates. The mills also needed large rivers to carry away their wastes. These needs explain the growth of late-nineteenth century mills at downstream locations such as Westbrook in Maine, Windsor Locks in Connecticut, and Holyoke in Massachusetts, and the combination of mill waste and urban wastewater was a fatal blow to New England's rivers for decades. The Tenth Census (1880) provides a snapshot of the industry on the verge of its dramatic conversion to woodpulp. In that decade New England plus New York accounted for 60 percent of the value of U.S. paper output and 55 percent of the nation's mills. From the 1890s to the 1970s, the mills' appetite for wood grew ever larger, forcing

many to locate near significant timber stands, as well as on large rivers. It was not until this period that the paper industry of northern Maine took its modern form. Here, one "mill town" after another emerged at the edge of the wilderness, Millinocket, Rumford, Woodland, and Van Buren being among them.<sup>4</sup>

In 1900, the Northeast and Mid-Atlantic states contained 608 paper mills, accounting for 64 percent of U.S. paper capacity and 73 percent of pulp capacity. The region's pulp mills were larger than those in any other region; 74 made pulp only. By 1940, the region contained 39 percent of national paper capacity and 27 percent of its pulp capacity, but its average pulp mills were less than half the size of the average southern mill. The number of northeastern newsprint mills fell dramatically from 1900 to 1940, as Canadian competition mounted. The region's industry continued to rely heavily on producing specialties for regional customers, such as book and writing paper (112 mills); wrapping paper and paper board (230 mills), and industrial papers (94 mills). By 1990, the region still had more paper mills than any other region, but by this time it produced only about 14 percent of the nation's paper. Its 57 pulp mills accounted for only about 8 percent of the nation's pulp output.<sup>5</sup>

In 1880, the leading grades were printing and writing papers and wrapping papers. In 1905, according to that year's Manufacturing Census, Massachusetts led the region's paper industry with 11,705 wage earners and 627 salaried workers toiling in 87 establishments. This was well ahead of Maine, and just behind New York, the Northeast's leader (New York in that year had 177 mills). Massachusetts' value of paper production in that year was very nearly double that of Maine. In 1905, New England produced 39 percent of all of the nation's paper, 44 percent of its book paper, and 73 percent of its fine paper. The region's specialization in high-end grades was already well established. By 1930 newsprint production had ceased in the other states, and still accounted for about half of Maine's production. The four states shown individually in that year (Maine, Massachusetts, New Hampshire, and Vermont) manufactured 1.7 million tons of product.

By 1950, New England had well overtaken New York (2.060 million tons to 1.144) and supplied 19.4 percent of the nation's paper output. Much of this (1.3 million tons) was in Maine. Newsprint had already declined in importance in the face of Canadian competition, which supplied 60 percent of U.S. needs at that time. According to the U.S. Manufacturing Census that year, the region also supplied 30 percent of the U.S. output of uncoated groundwood, 26 percent of the fine paper, 29

**Producer Price Indexes, Selected Commodities  
Jan. 1960 to June 2002, Real Prices**

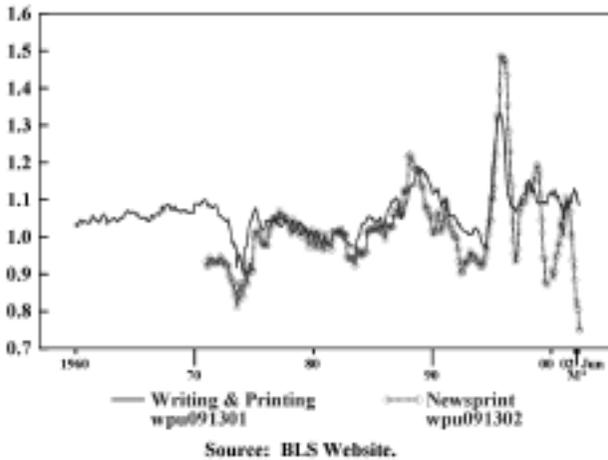


Fig. 4

percent of the special industrial paper, 42 percent of the cardboard, and 34 percent of the wet machine board.

Since the mid 1990s, the U.S. paper industry has endured severe operating and price fluctuations. Paper mill shrinkage and shutdowns have been widespread. During the decade, U.S. paper mills added 43.2 million tons of capacity, while 25.3 million tons were retired. Most retirements were in small mills, which are most common in the Northeast.<sup>6</sup> According to the Forest Resource Association, from 1989 to 1999, fifty-two U.S. pulp mills closed permanently or switched to recycled fiber.<sup>7</sup> A further tabulation for 1999 to 2001 identified forty-seven more “capacity reductions,” most of which were individual machines at large mills.<sup>8</sup> In 2001, U.S. papermaking capacity fell slightly for the first time on record, and capacity fell again in 2002. From 1999 to 2002, a total of 105 paper machines were closed in North America (Fig. 4).<sup>9</sup>

Over most of the twentieth century, the paper industry played an important role in the New England’s economy. In 1919, paper accounted for only one seventh as many the jobs as generated by the huge textile industry. There were no massive concentrations of paper-making jobs analogous to the multi-mill textile centers like Lowell and Manchester. But in 1919, paper was 3.9 percent of the region’s manufacturing jobs, and it was 4.8 percent in 1997. Of course, paper participated in the general loss of regional manufacturing jobs of recent decades.

In 1999, according to the authoritative Lockwood-Posts directory, the region contained 219 converting plants, more than half of them located in Massachusetts. The Census of Manufactures identifies a far larger number, however. These include some major national brand names. Converting is mostly located in or near population centers, because of its customer orientation and because uniform delivered pricing policies by the primary mills eliminate incentives to locate near the primary mills.<sup>10</sup> A total of forty-one communities smaller than 10,000 in population had converting plants (Table 3).

### **Paper Mill Towns**

Lockwood-Posts' lists eighteen primary pulp and paper mills in 1999. Of these, eleven are located in "mill towns" by reason of their size and distance from larger cities, and an additional seven cities can be identified as larger towns with a significant primary paper industry influence. This listing of traits (Table 4) is based on the author's personal familiarity and informal interviews. A number of communities that were once mill towns are no longer such, despite the persistence of a paper industry. This is because surrounding urban areas grew into more diversified economies. True paper mill towns and those strongly influenced by the industry benefitted from strong industry growth from the teens to about the 1960s. The industry then reached its employment peak, as supply limits or competitive pressures from other regions took their toll. At surviving mills, job levels declined steadily and significantly. Some mills lost 50 percent of their jobs between the 1980s and 2000. This was one cause of what is almost a diagnostic trait of the New England paper mill towns: population decline. In some instance the decline is dramatic, usually for the more isolated communities. Between 1960 and 2000, for instance, Millinocket's population fell from 7,453 to 5,203, and Rumford's fell from 10,230 in 1940 to 6,472 in 2000. For many others, population growth was subdued at best. Declining paper employment was only one factor. In some instances, residential spread with better transportation contributed, and in other instances, small wood products or other manufacturing plants closed. Virtually everywhere, railroading jobs vanished. In virtually every mill town where population has grown, it is because a suburban influence has turned surrounding areas into bedroom communities depending on jobs in nearby areas.

Since the northeast is one of the culture hearths of large-scale papermaking in North America, it contains the oldest and smallest mills. Apparently mundane traits such as machine width and speed have seen dramatic changes, putting the oldest mills at a disadvantage. Restricted

Table 3  
Maine and New England Paper converting Plants, 1999

	Maine	New England
Office Supplies	—	18
Boxes/Containers	3	95
Cutup Plants	—	8
Specialty	3	76
Paper Plates, Related	—	7
Envelopes	—	15
Total	6	219

Source: Lockwood-Post's Directory, 1997

Table 4  
Socioeconomic Traits of Mill Towns

Trait	Comment
Ethnic Mix	Varied
Geographic Isolation	Some are compact; others draw from a wide labor market
Outdoor Culture	Strong in these communities
Employer Influence	Not all are true "company towns"
Shift Work	Sets "social schedule"
Residence/Commuting	
Patterns	Residence near mills still common
High Worker Incomes	High real estate values; high standard of living for "blue collar" communities; often own "camps"
Longtime Job Tenure	Often multi-generational
Adapting to Job	
Reductions	Major source of social stress
Aging Workforce	Job shrinkage means workforce gets older
Importance of Union	Key social institution
Workers in Community	
Leadership	Increasing over time

space for expansion, the high costs of retrofitting pollution controls, and expensive energy are other challenges. Mills met these challenges in a variety of ways, mostly by up-scaling to produce more specialized, higher value grades. Many did not survive, and many others are in the high end of the industry cost rankings for their grades. In periodic industry downcycles, those mills are first to suffer layoffs and further downsizings as managers struggle to compete. Even where the surviving mills expanded output, jobs are fewer every decade, and many of the jobs are at risk in every recession. Given the challenges, it might seem surprising that the industry has endured as well as it has in this region.

### **Maine Paper Industry**

Colonial mills in Maine left little trace. With its tiny population, Maine had minimal sources of rags and a limited market. Samuel Waldo supposedly built a mill at Stroudwater in about 1731, and traces appear in court records.<sup>11</sup> A fragmentary U.S. Census in 1810 by Tench Coxe lists two mills in Maine, and L.H. Weeks, writing in 1916, notes Maine's third mill established on Cobbossee Stream by Robert Gardiner in about 1811-1812. He also notes mills at Vassalboro (1823), North Yarmouth (1816-36), and Union (1816-1843). A private directory cited by Weeks listed sixteen paper mills in Maine, the largest being Grant, Warren and Company with 100 workers.<sup>12</sup> Others sprinkled through Henry Richard's 1940 memoir were at Mechanic Falls, Gardiner, Vassalboro, Hampden, South Orrington, Waterville, Portland, Belfast, and Bloomfield.<sup>13</sup>

Mechanization allowed paper mills to pay relatively higher wages as early as the late 1800s. In the Bureau of Industrial and Labor Statistics (BILS) report of 1887, wages for paper machine men were \$3.00 per day; "girls" received 85 cents per day, and other workers, \$1.50 to \$2.75. Pulp mill wages were \$1.20 to \$1.75 per day. In contrast, woolen mills had no wages above \$1.40, and 80 cents to \$1.25 was common, depending on skill. Printers earned \$1.62, stonecutters \$2.50, and saw filers \$2.50.<sup>14</sup>

In the Tenth (1880) U.S. Census, a detailed table appears with a summary of the U.S. paper industry. In that year, Maine's paper industry, with 12 mills, stood on a par with Vermont, and had half as many mills as New Hampshire. The nation's leaders were New York, with 168 mills, and Massachusetts, with 96 mills. Massachusetts was the leader in sales volume, despite the smaller mill count. In 1880 Maine's value of sales was less than Connecticut's. By 1887, the BILS tallied 8 paper mills and 9 pulp plants.

In 1899, Maine's thirty-seven mills consumed 674,000 cords of

wood, of which 79 percent was domestic spruce and 14 percent poplar. Other species, and imports, were nominal. Maine enjoyed a strategic advantage among states, with minimal reliance on imported wood and a pulp surplus. In 1899 no use of rags was recorded for Maine, although some rag fiber must have been used in fine papers. By contrast, rags remained important elsewhere in the U.S, as did recycling. With 588,000 tons of used paper in 1904, this was the largest non-wood fiber, followed by 304,000 tons of straw and 294,000 tons of rags, cotton waste, and flax.<sup>15</sup>

In 1904 the U.S. grade mix was only 19 percent newsprint measured by sales dollars.<sup>16</sup> Maine had established a strong presence in this important grade, making 24 percent of U.S. tonnage in that year. This concentration in newsprint turned out to be untimely, however, as Canadian imports rushed in following the removal of a tariff in 1913. Other factors, such as newspaper chains' desire to control supplies and a highly pro-development Canadian policy, were also involved. From 1912 to 1918, Canadian shipments of paper to the U.S., largely newsprint, rose from 3.9 million tons to 37.7 million tons.<sup>17</sup> By 1934, in the depths of the Depression, the U.S. had gone from self-sufficiency to 70 percent dependence on Canadian newsprint.<sup>18</sup> The price pressures swept away small mills and forced cost-reducing improvements in the survivors.

By 1905 New York and Massachusetts were roughly even in production value, with Maine catching up, with just under 60 percent of that level of sales. At that time, mills and machines were still under construction. By 1930, Maine had far surpassed Massachusetts' tonnage, but still fell far short of New York. By 1950, however, Maine's production had surpassed New York's, partly due to contraction in that state.

In the early 1950s, Great Northern alone produced a third of the U.S. newsprint production. After that decade, the southern paper industry began installing modern newsprint machines, with the first southern newsprint mill built at Lufkin, Texas, in 1942. Maine's newsprint mills were squeezed between large, low-cost Canadian mills to the north and modern, high-speed mills in the south, and by the mid 1990s, this competitive squeeze had virtually ended Maine newsprint production, the last holdout being a single Great Northern machine. By 2000 not one of the continent's top ten newsprint producers was in Maine. The company had upgraded the rest of its production to a range of specialties and stood third in North American coated groundwood. In late 2002, newsprint production quietly winked out in Maine as GNP's last newsprint machine was taken down. Thus did Maine come full cycle,

from dominating this leading grade with world-class mills a century before.

A variety of sources permit a fairly fine-grained view of the changing paper industry over a century. Clearly, by 1894, a wave of new investment — virtually all of it in wood-based grades — had placed Maine on a growth track (Figs. 5-9) that continued at least to World War I, with growth in new mill centers offsetting shutdowns in small, marginal mills. The years 1894-1906 stand out as a period of stunning national growth in the industry.

Nineteen Maine mills made paper 1894. This number rose to thirty-two by 1931, then fell to eighteen in 1999. These figures must be read with caution, however: in the earlier years, tabulators spoke of a pulp “mill” in the same sense as we now speak of a pulp “line.” That is, a given “pulp and paper mill” might contain more than one “pulp mill,” reflecting the pulp mix used. For example, many newsprint mills manufactured both ground wood and sulfite pulp for their newsprint. Some mills made only pulp, others both pulp and paper, and still others made only paper, using purchased pulp. The “bottom line” for a paper mill is tonnage, the product of trim width, speed, and basis weight. Since weights have declined over time, and since paper is sold by the ton, tonnage is the general measure for output. In the 1894 state listing the average pulp line (called a mill in those days), produced 25 tons per day. The state’s entire output at that time (in nineteen mills) could be produced by a single modern paper machine. By 1961, the average Maine pulp line produced almost ten times as much, or 218 tons per day.

Production estimates for pulp and paper in Maine diverge for the 1890-1900 period, probably due to weakness in the sources (Fig. 10). But the trends shown highlight several key facts. First, Maine was in pulp surplus from 1894 to the early 1920s, based on its extensive timber and power resources. This emphasized the state’s similarities to nearby Canada. Second, the volume of production does not seem to have risen as much as might be supposed, given the large number of mills built from 1894 to 1914. This is partly due to the small size of many of those mills and may also reflect data weaknesses. According to this information, paper output fell after 1914, which is consistent with rising Canadian imports of newsprint after 1913.

The impact of the Depression is clear in the data: in 1931 six of the state’s forty-two mills were idle or dismantled. But the industry experienced a substantial postwar growth spurt. Production reached about 4 million tons by 1994, then receded until a final late 1990s resurgence

**Pulp, Paper & Leather Board Mills, 1899**



Fig. 5

**Pulp, Paper and Board Mills, 1931**



Fig. 6

**Maine Woodpulp Mills, 1961**



Fig. 7

**Pulp and Paper Mills, 1983**

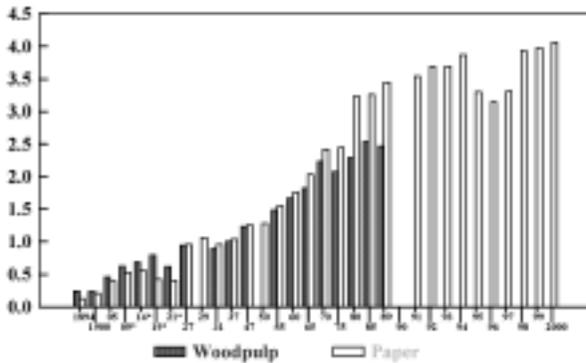


Fig. 8



Fig. 9

### Maine Woodpulp and Paper Production 1894 to 2000



\* = Partial data.

Sources: 1894 from Maine Bur. Ind. & Labor Stats, 1894, p. 123 (tpd x 3 pd days);  
 Atlas of the Resources of Maine, Supplement, Feb. 1907;  
 The Forest of Maine; Current Ind. Rept. MA26A(89)-1 to 1989;  
 and Paper 1991-99 from AF&PA (Pulp data not available after 1989).

Fig. 10

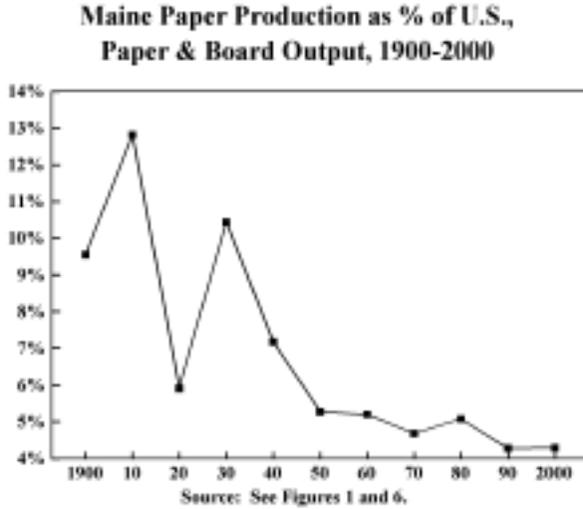


Fig. 11

caused by high industry-wide operating rates. By the 1980s the smaller, slower machines were being closed and the mills slimmed down. In 1900 International Paper ran four mills in the Jay area with fourteen machines, making 235 tons per day; in 1999, IP's giant "Andro" mill at Livermore Falls produced 1,600 tons on just five machines. Great Northern was down to six machines, and the newest mill in Maine, Sappi's Hinckley mill, produced 500 tons on just three machines. In this process, some of the mills cut their tonnage significantly. Newsprint mills were somewhat insulated from this process, having an advantage in uniform fiber mix and specialization. They rapidly outdistanced other grades in annual tonnage. In 1894, the six newsprint mills were among the state's largest. By 1931, the average Maine newsprint mill was four times the size of the average non-news paper mill. As of 2000, production estimates suggest that machine closures were offset by output growth at surviving machines. Maine's share of U.S. production changed dramatically, but part of the decline is due to the emergence of the paper board industry (for boxes), which is concentrated in the South (Fig.11).

### Equipment and Technological Change

Through the mid-nineteenth century, paper mills were very small — at times no larger than a large house. In the basement, women and girls sorted rags; on the main floor, beaters and vats prepared stock and formed sheets; and in the second floor or attic, sheets were dried. Histo-

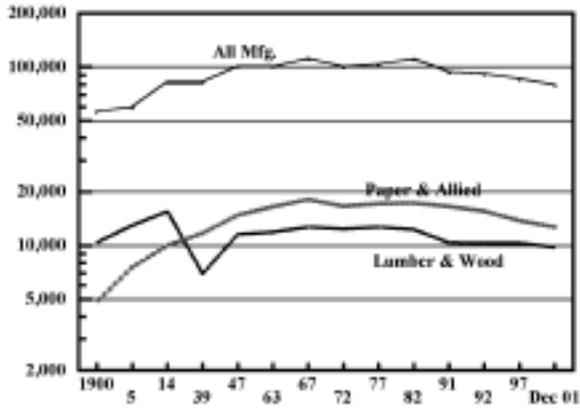
rians despair of keeping track of these “garage businesses” as they washed out in freshets and burned regularly. Not until the widespread introduction of the fourdrinier paper machine did mills grow significantly in size and begin to require large hydro dams and substantial brick and stone buildings. As firms grew, they added lines or built additional mills nearby. Ownership across states was uncommon until the 1880s and 1890s.

Equipment advanced in many respects. By 1860 handmade paper had virtually vanished, and the history of machine speeds since then demonstrates the technological advances in the industry. In the late 1860s machines produced paper at a rate of 100 feet per minute; this increased to 200 feet per minute in 1880; 1,000 feet per minute in the early 1920s, and by the late 1990s, 5,000 or more feet per minute. Over the past century, speeds have increased by a factor of ten. Paper widths have also increased. The Richards mill at Gardiner in the mid-nineteenth century had machines 58 inches wide. The widest machine noted in Maine’s 1899 BILS report was the 162-inch newsprint machine at the Rumford International Paper mill. Machine widths rose significantly over the twentieth century, although not nearly as much as machine speeds. Many new machines now exceed 300 inches. Mill sizes have increased as well. In 1899 larger mills had four to six paper machines, but by mid-century some large specialty mills were running a dozen or more machines. As early as 1894, there were several multi-plant firms, with twenty-eight companies running a total of fifty mills. The number of companies fell to seventeen by 1959, and since then there have been other consolidations and several mill closings.

Chemical processes evolved dramatically over the century as well. In a 1900 newsprint mill, the mix was often 80 percent groundwood and 20 percent soda pulp. The soda process fell out of favor in time, however, as did the sulfite process. The kraft process used byproduct waste for fuel and enabled mills to recover process chemicals. It also produced a high-strength pulp. From 20 percent of U.S. production in 1929, kraft rose to 84 percent by 1999 (Table 5). Reflecting weaker U.S. competitiveness in commodity groundwood grades, that form of pulp declined in total production from 1983 to 1999, even as total U.S. pulp output rose.

Maine mills between 1920 and 1960 shifted to producing printing and writing papers, which were growing rapidly in demand. These mills staked out leading positions in supplying high-profile publications such as *National Geographic* and *Sports Illustrated*. The industry left commodity grades, newsprint, packaging, and market pulp largely to other

**Maine Forest Industry Employment, 1900-1997**



Sources: Census of Mfrs., U.S. Bureau of the Census with Census of Maine Mfrs. for 1982a and 1991 to 1997; and MDOL, March, 2002.

Note: Using different sources probably jolts the comparison from 1992 to 1993 a bit.

Fig. 12

Table 5  
U.S. Changing Pulping Processes, 1914 to 1999  
(In 1000 tons)

	Total	Sulfite	Sulfate	Groundwood	Semi-Chemical
1914	3,566	—	—	1,511	—
1929	6,690	2,805	1,358	1,911	97
1955	22,413	4,163	11,952	2,961	2,856
1960*	35,154	2,579	14,156	3,247	3,294
1983	54,808	1,729	40,351	5,529	3,516
1999	57,075	996	48,404**	3,643	3,643

\*Soda omitted

\*\* Estimate

Source: TRR, p. 437.

regions. Despite the age of its mills, the Maine industry compared favorably to mills in the same grades by machine widths and speeds in the mid 1980s.<sup>19</sup> Investment had not been neglected; it occurred in the less dramatic form of machine upgrades and replacements. This strategy yielded impressive production growth for the state's industry from the late 1940s to the 1980s, but Maine remained true to its groundwood roots, with about half of its pulp capacity in 1961 still in groundwood.

### **Fiber Sources**

The paper industry was already straining raw material sources — rags in this case — before the Civil War. As demand rose and mill sizes increased, fiber supply went from a problem to a crisis. The U.S. imported 8 million pounds of rags, mostly from Italy, in 1847; these imports rose to 21 million in 1850, 44 million by 1857, and 128 million pounds in 1872. By then, the United Kingdom was the leading source, and the U.S. produced one-third of the world's output. Imports remained high until 1914.<sup>20</sup> In 1880 the small Maine industry relied almost entirely on rags. In the Tenth Census of that year, wood was not tallied as a material source, despite the introduction of groundwood pulps in preceding years.

With its extensive timberlands, the Maine industry was in a favorable supply position for decades after 1920. This began to change in the 1970s. First, the 1972-1985 spruce budworm outbreak dramatically turned inventory surpluses into deficits. The salvage efforts of that period briefly increased supplies, but when the dust settled it was evident that inventories would only recover after decades, and only if significant improvements in forest management occurred.<sup>21</sup> A second development was new sawmilling technology that enabled lumber production from ever-smaller logs. By the early 1990s, over much of northern Maine, logs were going straight to a sawmill. Chips from the sawmills came back, often on long hauls in specially designed chip vans, to the paper mills. A new competitor now skimmed off a significant share of a declining resource. In the late 1950s, chips accounted for 30,000 cords of pulpwood; this rose in 1977 to 900,000 cords, and it continues to increase. In the 1990s buyers were asking for recycled content, and Maine mills moved to adapt. As the spruce-fir supply peaked, the Maine mills turned to the abundant and low-cost hardwoods that formerly had not been needed. This represented a sea change in a state whose industry was built on spruce-fir. By the later 1980s, hardwood overtook spruce and fir in the mix, and by the close of the 1990s, hardwood was more than half of the wood fiber input. In 2001 spruce-fir roundwood accounted for only 20

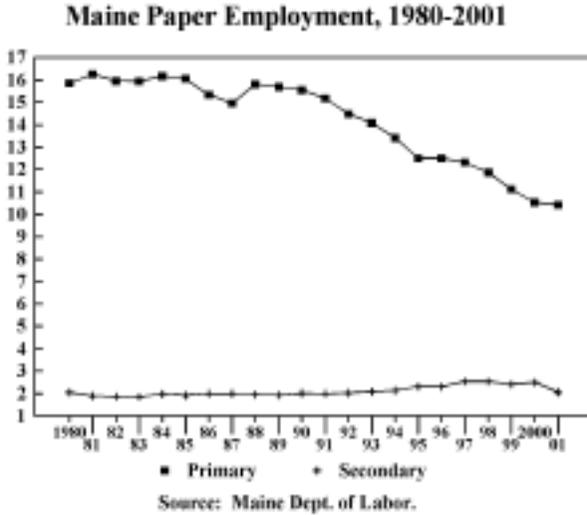


Fig. 13

percent of Maine's pulpwood harvest. This situation suggests a significant challenge in reliance on hardwoods, when other parts of the world have advantages in hardwood pulp costs.

Maine's paper industry accounted for a significant volume of economic activity in the 1997 Census of Manufactures. Maine's overall papermaking sector accounted for 13,800 jobs and about \$4.7 billion in product shipments in that year. The industry accounted for 32 percent of manufacturing shipments and 16.8 percent of the manufacturing employees. The industry's share of manufacturing jobs is less than 5 percent in all other New England states. Paper industry workers enjoy among the very highest wages and fringe benefits of any industry (Table 6). Until the late 1990s, the paper industry's share of all manufacturing remained fairly steady (Figs. 12-13). Maine stands by itself not only in the size and relative importance of its paper industry, but in the sustained role the industry has played.

### Reflections

As the twentieth century opened, Maine's paper industry enjoyed a burst of expansion, quickly assuming a leading place in the state's economy. Not for nothing did the Commissioner of Industrial and Labor Statistics term it "the imperial industry" of Maine in his 1899 report (p. 33). But today, many paper mill towns are enduring painful re-adjustments as mills downsize in the face of timber supply limits, international

competition, and ongoing technological changes. Income levels remain high for workers still on the payroll, as skill needs continue to increase. But the stability expected by past generations is gone. The “true” mill towns — remote towns with heavy paper industry dependence — have in many cases endured dramatic population shrinkages since the 1960s. The many ways in which the social fabric of these towns is being torn need much more sympathetic attention from a range of social science disciplines, and policymakers need to carefully consider the implications.

It is striking that, despite the strains of the 1990s, the worst has not hit Maine. Of forty-seven “capacity reductions” nationwide listed in *Pulp and Paper Magazine* in 2001, only four were in Maine, and they were small machines.<sup>22</sup> At that time, Maine had not lost a single large, integrated, wood-fiber based pulp and paper mill in many years. The January 2003 bankruptcy filing of Great Northern indicates how severe are current market conditions, and how fragile the position of single-unit companies in this intensely competitive, globalized industry.

#### NOTES

*A Note on Statistics: At the turn of the century, many compilations listed machines and pulp lines separately. Thus, in 1899 the BILS compilation listed thirty-eight pulp mills and twenty-eight paper mills at thirty-seven “plants” or establishments. The data usually do not show the paper or net pulp balance in these mills, thus adding up production totals is frustrating if not impossible. Individual mills are commonly cited with different capacities or outputs in different sources.*

*Also, in the early nineteenth century production data hardly exist. Mill volumes were tallied in reams, later in pounds, then in tons. It was common practice to list mills by daily capacity, but mills ran fifteen-hour days in the late nineteenth century, then reduced production to ten to twelve hours in the early twentieth century. Six-day weeks were common until well into the twentieth century, well after twenty-four-hour operating with two shifts was well established.*

*Turning daily capacity or output into annual totals is problematic. Today, authors state outputs in annual terms for mills and machines just often enough to confuse later analysts. Late in the twentieth century, especially for market pulp and news, it became more common to state capacities and production in metric tons (designated “Mtons” or “tonnes”). Different authors used different numbers. Even in speaking of individual machines, they may speak total (felt) width, or of “trim” width.*

*By the 1950’s, disclosure problems were obscuring details for Maine in census and industry tabulations, and this is compounded by different data disclosure rules in state and federal statistical agencies. In many counties where the paper industry is the leading single employer, the tables of employment, shipments, firms, wages,*

and other economic data display rows of “d’s” — the statistical agency code meaning “cannot be published due to disclosure rules.” This renders the industry “invisible” in the local economic statistics unless analysts are able to directly obtain private data.

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