Industry & Trade Summary

Wood Pulp and Waste Paper

USITC Publication 3490
February 2002

OFFICE OF INDUSTRIES
U.S. International Trade Commission
Washington, DC 20436

UNITED STATES INTERNATIONAL TRADE COMMISSION

COMMISSIONERS

Stephen Koplan, Chairman

Deanna Tanner Okun, Vice Chairman

Lynn M. Bragg

Marcia E. Miller

Jennifer A. Hillman

Director of Operations

Robert A. Rogowsky

Director of Industries

Vern Simpson

This report was prepared principally by

Fred Forstall

Animal and Forest Products Branch
Agriculture and Forest Products Division

Address all communications to
Secretary to the Commission
United States International Trade Commission
Washington, DC 20436

www.usitc.gov

ITC READER SATISFACTION SURVEY

Industry and Trade Summary: Wood Pulp and Waste Paper

The U.S. International Trade Commission (ITC) is interested in your voluntary comments (burden < 15 minutes) to help us assess the value and quality of our reports, and to assist us in improving future products. Please return survey by fax (202-205-2384) or by mail to the ITC.

Your name and title (please print; r*esponses below not for attribution):* _____

Please specify information in this report most useful to you/your organization: _____

_____

Was any information missing that you consider important? Yes (specify below) No

If yes, please identify missing information and why it would be important or helpful to you: _____

_____

Please assess the *value* of this ITC report (answer below by circling all that apply): SA—Strongly Agree; A—Agree; N—No Opinion/Not Applicable; D—Disagree; SD—Strongly Disagree

"	Report presents new facts, information, and/or data	SA	A	N	D	SD
"	Staff analysis adds value to facts, information, and/or data	SA	A	N	D	SD
"	Analysis is unique or ground breaking	SA	A	N	D	SD
"	Statistical data are useful to me/my organization	SA	A	N	D	SD
"	Subject matter and analysis are timely	SA	A	N	D	SD
"	ITC is the only or the preferred source of this information	SA	A	N	D	SD

If not, please identify from what other source the information is available _____

Please evaluate the *quality* of this report (answer below by circling all that apply): SA—Strongly Agree; A—Agree; N—No Opinion/Not Applicable; D—Disagree; SD—Strongly Disagree

"	Written in clear and understandable manner	SA	A	N	D	SD
"	Report findings or executive summary address key issues	SA	A	N	D	SD
"	Figures, charts, graphs are helpful to understanding issue	SA	A	N	D	SD
"	Analysis throughout report answers key questions	SA	A	N	D	SD
"	Report references variety of primary and secondary sources	SA	A	N	D	SD
"	Sources are fully documented in text or footnotes	SA	A	N	D	SD

Please provide further comment on any of the above performance measures, as appropriate:

Suggestions for improving this report and/or future reports: _____

_____

Other topics/issues of interest or concern: _____

Please provide your Internet address and update your mailing address below, if applicable:

OMB No.: 3117-0188

FOLD

UNITED STATES
INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC 20436

OFFICIAL BUSINESS
PENALTY FOR PRIVATE, USE $300

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12840 WASHINGTON, DC

POSTAGE WILL BE PAID BY ADDRESSEE

U.S INTERNATIONAL TRADE COMMISSION
500 E STREET, SW.
WASHINGTON, DC 20277-2840

ATTN:
OFFICE OF INDUSTRIES
ITS: Wood Pulp and Waste Paper

PREFACE

In 1991 the United States International Trade Commission initiated its current *Industry and Trade Summary* series of informational reports on the thousands of products imported into and exported from the United States. Each summary addresses a different commodity/industry area and contains information on product uses, U.S. and foreign producers, and customs treatment. Also included is an analysis of the basic factors affecting trends in consumption, production, and trade of the commodity, as well as those bearing on the competitiveness of U.S. industries in domestic and foreign markets.[1]

This report on wood pulp and wastepaper covers the period 1996-2000. Listed below are the individual summary reports published to date on the agriculture and forest product sectors.

USITC publication number	*Publication date*	*Title*
2459	November 1991	Live Sheep and Meat of Sheep
2462	November 1991	Cigarettes
2477	January 1992	Dairy Produce
2478	January 1992	Oilseeds
2511	March 1992	Live Swine and Fresh, Chilled, or Frozen Pork
2520	June 1992	Poultry
2544	August 1992	Fresh or Frozen Fish
2545	November 1992	Natural Sweeteners
2551	November 1992	Newsprint
2612	March 1993	Wood Pulp and Waste Paper
2615	March 1993	Citrus Fruit
2625	April 1993	Live Cattle and Fresh, Chilled, or Frozen Beef and Veal
2631	May 1993	Animal and Vegetable Fats and Oils
2635	June 1993	Cocoa, Chocolate, and Confectionery
2636	May 1993	Olives
2639	June 1993	Wine and Certain Fermented Beverages
2693	October 1993	Printing and Writing Paper
2702	November 1993	Fur Goods
2726	January 1994	Furskins
2737	March 1994	Cut Flowers
2749	March 1994	Paper Boxes and Bags
2762	April 1994	Coffee and Tea
2859	May 1995	Seeds
2865	April 1995	Malt Beverages

[1] The information and analysis provided in this report are for the purposes of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar subject matter.

PREFACE—*Continued*

USITC publication number	*Publication date*	*Title*
2875	May 1995	Certain Fresh Deciduous Fruits
2898	June 1995	Certain Miscellaneous Vegetable Substances and Products
2917	October 1995	Lumber, Flooring, and Siding
2918	August 1995	Printed Matter
2928	November 1995	Processed Vegetables
3015	February 1997	Hides, Skins, and Leather
3020	March 1997	Nonalcoholic Beverages
3022	April 1997	Industrial Papers and Paperboards
3080	January 1998	Dairy Products
3083	February 1998	Canned Fish, Except Shellfish
3095	March 1998	Milled Grains, Malts, and Starches
3096	April 1998	Millwork
3145	December 1998	Wool and Related Animal Hair
3148	December 1998	Poultry
3171	March 1999	Dried Fruits Other Than Tropical
3268	December 1999	Eggs
3275	January 2000	Animal Feeds
3350	September 2000	Grain (Cereals)
3352	September 2000	Edible Nuts
3355	September 2000	Newsprint
3373	November 2000	Distilled Spirits
3461	October 2001	Cured Fish
3463	October 2001	Fresh or Frozen Fish

CONTENTS

Page

Preface i

Abstract 1

Introduction 3

U.S. industry profile 4

Raw materials and processing 4
Industry structure 7
Technology 11
Environmental considerations 11

Wood pulp markets 13

Grades of wood pulp 13
Wood pulp supply and demand 16
Wood pulp pricing 18

Waste paper markets 20

Grades of waste paper 20
Waste paper supply and demand 22
Waste paper pricing 26

U.S. imports 27

Wood pulp 27
Waste paper 30

U.S. exports 31

Wood pulp 31
Waste paper 31

U.S. trade measures 35

CONTENTS—*Continued*

Page

Foreign industry profile 35

North America 40
Europe 41
Asia 41
South America 43

Foreign trade measures 45

U.S. trade balance 45

Appendixes

A. Explanation of tariff and trade agreement terms A-1
B. Statistical tables and figures B-1
C. Description of waste paper recovery, reuse, and grades C-1
D. Descriptions of chemical and mechanical pulping processes D-1
E. Descriptions of process improvements and technical innovations E-1
F. Summary of pertinent environmental law & regulations F-1

Figures

1. U.S. annual recovery of waste paper, 1997-99 6
2. Pulp and paper industry product flow 8
3. Wood pulp categories 13
4. U.S. domestic price, market de-inked pulp vs. southern bleached hardwood kraft, 1994-2000 16
5. U.S. price, 1980-2000, northern bleached softwood kraft 20
6. Midwestern waste paper prices (dollars per metric ton, f.o.b. seller's dock), 1993-2000 . . . 27

Tables

1. Wood pulp: U.S. production, exports, imports, and apparent consumption, 1996-2000 . . . 8
2. U.S. wood-pulping capacity by region, 2000 9
3. Average hourly earnings of production workers, 1995-99 10
4. Market pulp: U.S. production, exports, imports, and apparent consumption, 1996-2000 . . 17
5. Market pulp: U.S. shipments by grade, 1995-2000 17
6. U.S. producers of market pulp by capacity, 1998 18
7. Waste paper: U.S. recovery by grade, 1995-99 21
8. Waste paper: U.S. collections, exports, imports, and apparent consumption, 1996-2000 . . 23
9. Wood pulp: U.S. imports for consumption by principal source, 1996-2000 28

CONTENTS—*Continued*

Page

Tables—*Continued*

10. Wood pulp and waste paper: U.S. imports by grade, 1996-2000 29
11. Waste paper: U.S. imports for consumption by principal sources, 1996-2000 30
12. Wood pulp: U.S. exports by principal markets, 1996-2000 32
13. Wood pulp: U.S. exports by region, 1996-2000 33
14. Wood pulp and waste paper: U.S. exports by grade, 1996-2000 33
15. Waste paper: U.S. exports by principal markets, 1996-2000 34
16. Harmonized Tariff Schedule Chapter 47, Wood pulp and waste paper: Subheading, description, and rate of duty 36
17. World wood pulp and waste paper: Mills, capacity, capacity utilization, imports, exports, and apparent consumption 1996-2000 37
18. Total and market pulp production: Top 10 countries, 2000 39
19. Wood pulp: Major world importers and U.S. market share, 2000 39
20. Waste paper: Major world importers and U.S. market share, 2000 40
21. Wood pulp: U.S. trade balance, 1996-2000 46
22. Waste paper: Trade balance, 1996-2000 47

ABSTRACT

This report summarizes trade and industry conditions for the wood pulp and waste paper industry for the time period 1996-2000. Wood pulp and waste paper are both intermediate products and are used as raw materials in the manufacture of paper, paperboard, and other wood-fiber-based products.

- The U.S. pulp and paper industry benefits from abundant raw materials, extensive supporting infrastructure, and a large domestic market. Large, technically sophisticated, and capital-intensive U.S. mills produced 31 percent (57 million metric tons) of global pulp production in 2000, but have been impacted by the strength of the U.S. dollar and aggressive competition from other countries. Forest products firms, both foreign and domestic, are driving further industry consolidation.

- In 2000, market pulp (wood pulp sold in the open market), a globally traded commodity, accounted for 23 percent of world production of wood pulp. It is estimated that 68 U.S. mills produced market pulp and that U.S. capacity was approximately 8.7 million metric tons. Despite long-term demand growth, short-term economic cycles and inelastic supply caused significant price volatility. Increasing recoveries of waste paper continued during 1996-2000. Total recoveries reached 44.9 million metric tons. Approximately 240 U.S. mills use recycled fiber.

- During 1996-2000, U.S. wood pulp imports (6.6 million metric tons valued at $3.3 billion in 2000) came principally from Canada and Brazil, but U.S. exports (6.1 million metric tons valued at $3.4 billion in 2000) were shipped to more than 100 countries. Canada and Mexico supplied virtually all waste paper imports in 2000 (552,000 metric tons valued at $91 million), but imports were only a small fraction of total domestic consumption of waste paper. The United States is the world's largest exporter of waste paper. In 2000 exports were 9.9 million metric tons valued at $1.2 billion.

- In 2000, global production of wood pulp was 187 million metric tons. The top three producing regions include North America, Europe, and Asia. Due to the natural advantage afforded by fast-growing tree species and favorable growing conditions, South America is expected to continue increasing its pulp production.

- U.S. imports of wood pulp and waste paper are free of duty. In all major markets for wood pulp there is little or no duty on either wood pulp or waste paper. Likewise, trade in either wood pulp or waste paper is generally not affected by nontariff barriers. The U.S. wood pulp trade balance remained positive but declined from $696 million in 1996 to $125 million in 2000. The decrease resulted from a decrease in exports of 580,000 metric tons and an increase in imports of 1.4 million metric tons. In contrast, the waste paper trade balance has grown from $690 million in 1996 to $1.1 billion in 2000, as exports of waste paper expanded by 3.4 million metric tons during 1996-2000.

INTRODUCTION

This summary covers wood pulp and waste paper, which are classified in Chapter 47 of the Harmonized Tariff Schedule of the United States (HTS). Neither wood pulp nor waste paper is a final product; rather both are used as raw material in the manufacture of paper, paperboard, and other wood-fiber-based products. This summary outlines the structure of the U.S. pulp and paper industry and certain foreign industries, domestic and foreign tariff and nontariff measures, and the competitiveness of U.S. producers in both domestic and foreign markets. This report generally covers the time period of 1996 to 2000. Appendix A contains an explanation of tariff and trade agreement terms.

Wood pulp is the fibrous material that results when wood is separated into its constituent fibers by chemical or mechanical means. Waste paper is composed of previously discarded paper or paperboard products. Both contain cellulose fiber that can be subsequently combined with other inputs to manufacture paper, paperboard, or other wood-fiber-based products. In 2000, the U.S. industry produced 57 million metric tons of wood pulp and recovered over 44.9 million metric tons of waste paper.[1]

In 1999, wood pulp supplied 63 percent of the total fiber consumption in U.S. paper and paperboard mills. Waste paper supplied most of the rest.[2] In recent years the usage of waste paper has increased dramatically. For most applications pulp made from waste paper is combined with virgin wood pulp during the manufacture of a final product. However, some products (e.g., paperboard, containerboard, and tissue) can be manufactured entirely from recycled pulp, and recent advances in papermaking technology have greatly improved the quality of paper manufactured from 100 percent recycled pulp.

U.S. imports of wood pulp in 2000 amounted to 6.6 million metric tons, valued at $3.3 billion, and represented 11.5 percent (by quantity) of total consumption. U.S. exports of wood pulp amounted to 6.1 million metric tons, valued at $3.4 billion and were equivalent to 10.7 percent of total production. In 2000 imports of waste paper totaled 552,000 metric tons and were valued at $91 million. Imports, however, accounted for only 1.5 percent of domestic consumption (by quantity). Exports of waste paper in 2000 were significantly greater than imports, reaching 9.9 million tons valued at $1.2 billion.

[1] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 9.

[2] American Forest &Paper Association, *2000 Statistics - Data Through 1999, Paper, Paperboard, and Wood Pulp* (Oct. 2000), p. 60.

U.S. INDUSTRY PROFILE

As noted above, wood pulp and waste paper are classified in Chapter 47 of the HTS. The applicable North American Industry Classification System (NAICS) numbers and descriptions are Pulp Mills (322110) and Paper Mills (32212).[3]

Raw Materials and Processing

Sources of fiber for making paper include wood, waste paper, nonwood agricultural fibers, and inorganic fibers. In the United States the most economical and practical fibers are those derived from wood. In 1999, wood pulp supplied 63 percent of the total fiber consumption in domestic paper and paperboard mills. Waste paper supplied most of the rest; nonwood fibers supplied less than 1 percent.[4]

In the United States, both softwood (conifers) and hardwood (broad-leaved) trees are important sources of fiber for the manufacture of wood pulp. In 1996, softwoods comprised 57 percent of the country's fiber harvest for pulping.[5] Softwoods, which generally have longer fibers than hardwoods, are used when strength is a desirable quality in the finished product (e.g., paperboard). Favorable silvicultural characteristics allow softwoods to be intensively managed in tree plantations[6] throughout the timber-producing portions of the country. The shorter fibers of the hardwoods that supply the balance of fibers for pulping are used when smoothness is a desirable quality (e.g. printing and writing papers). Many species of indigenous hardwoods are represented in natural hardwood stands or mixed pine/hardwood stands that spread across the United States. Typically, the many species of hardwoods are not segregated when harvested but are sent to the mills as loads of mixed hardwood. The presence of different species increases the difficulty of pulping but does not prevent pulp mills from utilizing mixed hardwoods successfully.

For special applications or where standing trees are in short supply, other plant fibers (e.g., cotton, bagasse, rice, straw, bamboo, or kenaf) have also been utilized as a raw material for pulping. Most notably in the United States, cotton fiber is utilized for the production of bond papers and certain industrial papers. Cotton fiber accounts for less than 1 percent (by weight) of the fiber used for pulp and is not considered in this summary.

---

[3] Some paper mills, although primarily engaged in the manufacture of paper products, also manufacture pulp for sale to other manufacturers of paper products. Wood pulp and waste paper are also found in Chapter 26 of the Standard Industrial Classification (SIC 2611).

[4] AF&PA, *2000 Statistics*, p. 60.

[5] USFS, 1997 RPA Assessment, The United States Forest Resource Current Situation found at *http://www.srsfia.usfs.msstate.edu/wo/final_RPA_TABLES.pdf*, retrieved on Aug. 10, 2000.

[6] A tree plantation is a forest established by planting or seeding during the process of either afforestation or reforestation.

There are two sources for virgin wood fiber, pulpwood and residual chips.[7] Pulpwood is harvested and is cut either into short lengths (bolts) and transported or transported tree-length. Generally, mills can transport pulpwood economically a maximum distance of about 250 miles.[8] In 1999, pulpwood accounted for 78 percent of all virgin fiber used for pulp in the United States.[9] Residual chips supplied the balance. Modern sawmills recover the fiber from those portions of a sawlog that are not suitable for lumber. The material is chipped, collected, and transported to the pulp mill for subsequent use in the pulping process.

The major components of wood are cellulose (70-80 percent) and lignin (20-30 percent). Lignin is the material that bonds cellulose fibers together.[10] Wood pulp results when wood is separated into its constituent fibers by either chemical or mechanical means. Chemical pulping begins once pulpwood is debarked[11] and chipped. The chips are cooked in solutions of various chemicals, screened to remove any uncooked chips, and washed to remove the cooking "liquor." If necessary, the pulp is bleached to increase its purity, brightness, and whiteness. Chemical pulping actually separates useable cellulose fibers from the lignin. As a result, chemical pulping yields higher quality (strength and permanence) pulps albeit of lower yields (45-55 percent) than mechanical pulps.[12]

In the most straightforward form of mechanical pulping, bolts of barked pulpwood are shredded with large, rotating grindstones. The pulp produced is called groundwood. Because mechanical pulping does not separate lignin from cellulose fibers, groundwood pulp is lower in strength than chemical pulp, but mechanical methods provide higher yields. Recent technical advances combine mechanical pulping with various amounts of chemicals, heat, and pressure. Mechanical pulps are typically used for bulky papers that require high opacity and do not require permanence (e.g. newspapers, catalogs, low-end publishing). Often, they are combined with varying amounts of chemical pulps to enhance the strength of the resulting paper. Appendix D explains the various pulping processes in further detail.

Waste paper[13] is all manner of previously discarded paper or paperboard products and is the largest component of municipal solid waste (MSW) in the United States. In 1998, the United States generated 76 million metric tons of waste paper (38 percent by weight of all MSW).[14] Figure 1 illustrates the increase in U.S. annual recoveries of waste paper, which began in the early 1980's. Amid growing difficulties associated with traditional disposal methods,[15] EPA

---

[7] The term, "virgin", in this context, implies fiber that has been produced from trees harvested and transported from the forest. Trees too small to be used to produce solid wood products (e.g. lumber, plywood) are referred to as pulpwood and are used wholly for the manufacture of pulp.

[8] *Pulp & Paper, 1999 North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998), p. 137.

[9] AF&PA, *2000 Statistics*, p. 60.

[10] *Pulp & Paper, 1999 North American Factbook*, p. 138.

[11] Bark removed is typically collected and burned as fuel in the mill power boilers.

[12] *Pulp & Paper, 1999 North American Factbook*, p. 138.

[13] Waste paper is also referred to as "recovered" paper.

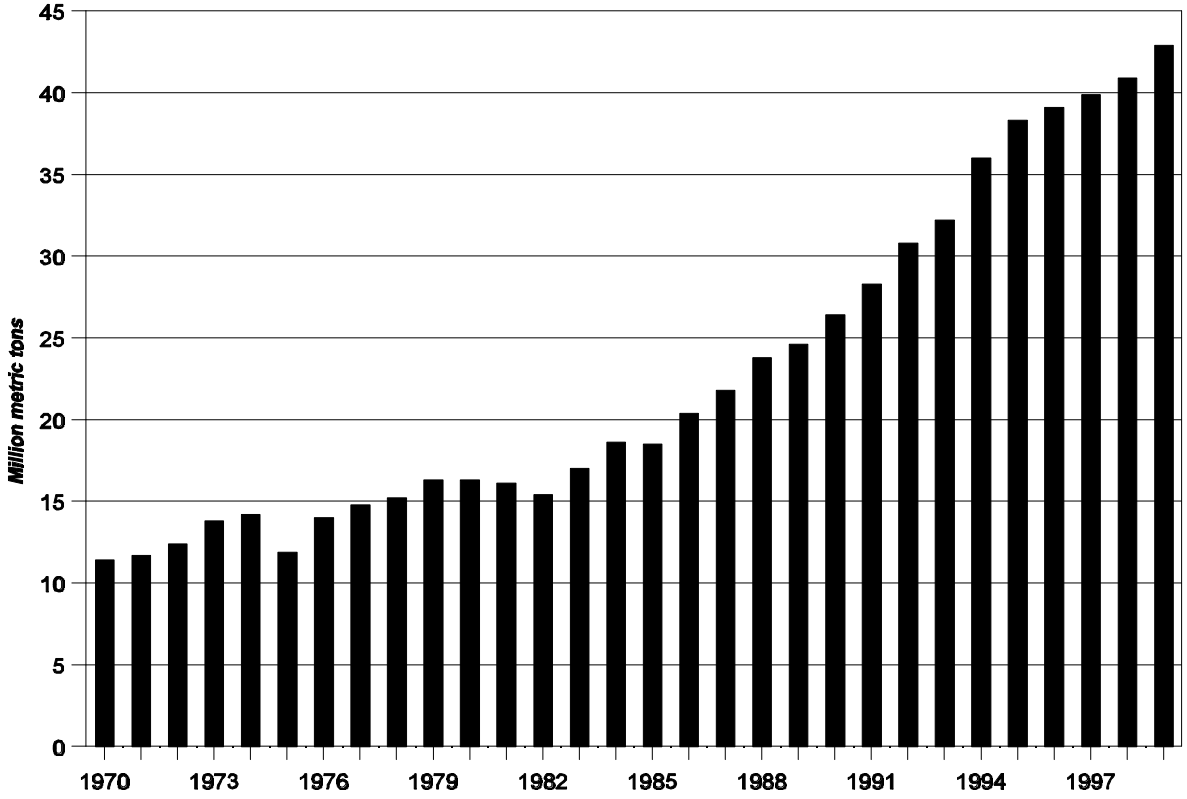
[14] U.S. Environmental Protection Agency, "Materials Generated in the Municipal Waste Stream, 1960 to 1998," found at *http://www.epa.gov/garbage/99tables.pdf*, retrieved June 27, 2001.

[15] In the 1980's, as incineration of MSW declined, potential environmental hazards associated with landfills (e.g. groundwater contamination) became evident. Environmental issues, capacity,

(continued...)

established a national goal to recycle 25 percent of all solid waste by 1992 and 50 percent by 2008,[16] and Federal, State, and municipal governments enacted various legislation to encourage recycling. During the 1970's recoveries increased by 3.6 percent annually. Since 1980, however, recoveries have increased on average 4.9 percent annually.[17]

Figure 1
U.S. annual recovery of waste paper, 1970-99



Source: American Forest & Paper Association, *2000 Statistics* , (Oct. 2000), p. 56.

[15] (...continued)
or high cost led to landfill closures. New sites for landfills were difficult to find, and tipping fees (the fees waste haulers pay to dump material at a landfill) increased. U.S. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States - 1996 Update Report No. EPA530-R-97-015,* June 1997, p. 113.

[16] *Pulp & Paper, 1999 North American Factbook*, p. 238.

[17] AF&PA recovery statistics reported in figure 1 are typically higher than EPA figures because the EPA figures only include postconsumer waste paper recoveries. A very high percentage of preconsumer waste paper, which includes the waste generated by manufacturers of converted paper products, is recovered by the industry. AF&PA does not distinguish between preconsumer and postconsumer waste pointing out that preconsumer waste would be placed in a landfill if it were not reused by the industry. AF&PA, *2000 Statistics*, p. 56.

In addition to the government effort to increase recycling the industry voluntarily established a goal to re-utilize 50 percent of the Nation's total stream of waste paper by the year 2000.[18] From 1996-99 industry recovery rates[19] ranged from 44 to 46 percent,[20] but the American Forest and Paper Association (AF&PA) estimated that in 2000 the recovery rate jumped to 48 percent.[21]

Preparing waste paper for reuse involves repulping [22] the paper and removing inks, adhesives, and other contaminants which were introduced during the manufacture or use of the initial product. (Further explanation of the process is included in Appendix C.) Recycled pulp is used either alone or mixed with virgin pulp to manufacture paper, paperboard, and other wood fiber products.[23]

Industry Structure

The manufacture of wood pulp and the re-use of waste paper are best understood in the context of the entire pulp and paper industry. In 2000, total global production of wood pulp was 187 million metric tons, of which the U.S. industry produced 57 million metric tons.[24] Table 1 summarizes U.S. production, exports, imports, and consumption for the summary period.

In 2000, approximately 77 percent of global wood pulp was produced and consumed at integrated paper mills.[25] The remainder, market pulp (approximately 44 million metric tons[26]), was produced at dedicated pulp mills or as incremental production at integrated mills. Market pulp (generally free of duty) is traded globally; large volumes of dried, baled pulp are shipped from producing to consuming regions.[27] The purchasers generally operate nonintegrated paper mills. Figure 2 summarizes the material flows within the pulp and paper industry.

---

[18] In 1989 the paper industry, through AF&PA, set a goal to recover 40 percent of the paper used in the United States by 1995. The goal was nearly reached by 1993, so it was extended and increased to 50 percent by 2000. Kirk Finchem, "Recovered Paper Collection Grows, but 50% Goal Remains Unlikely," *Pulp & Paper,V*ol. 72, No. 5 (May 1998), p. 85.

[19] Recovery rate is the ratio of recyclable paper collected to the new supply of paper and board.

[20] AF&PA, *2000 Statistics*, p. 56.

[21] AF&PA, *Paper, Paperboard, & Wood Pulp*, Vol. 79, No. 2, p. 1.

[22] Repulping is the process of separating and recovering the individual fibers contained in a sheet of waste paper.

[23] Subsequent papermaking cycles degrade the structure and, hence, the quality of cellulose fibers, so paper made entirely of recycled fiber is generally lower quality than that made from virgin pulp. Recycled pulp, therefore, is usually used in combination with wood pulp. However, for certain products (e.g. containerboard), recent advances in papermaking technology have tended to offset the effects of recycled fiber, permitting the production of high quality products from 100-percent recycled fiber.

[24] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 9.

[25] Integrated paper mills have both pulp and paper manufacturing capacity. Nonintegrated paper mills lack pulping capacity and purchase wood pulp on the open market.

[26] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), pp. 5-74.

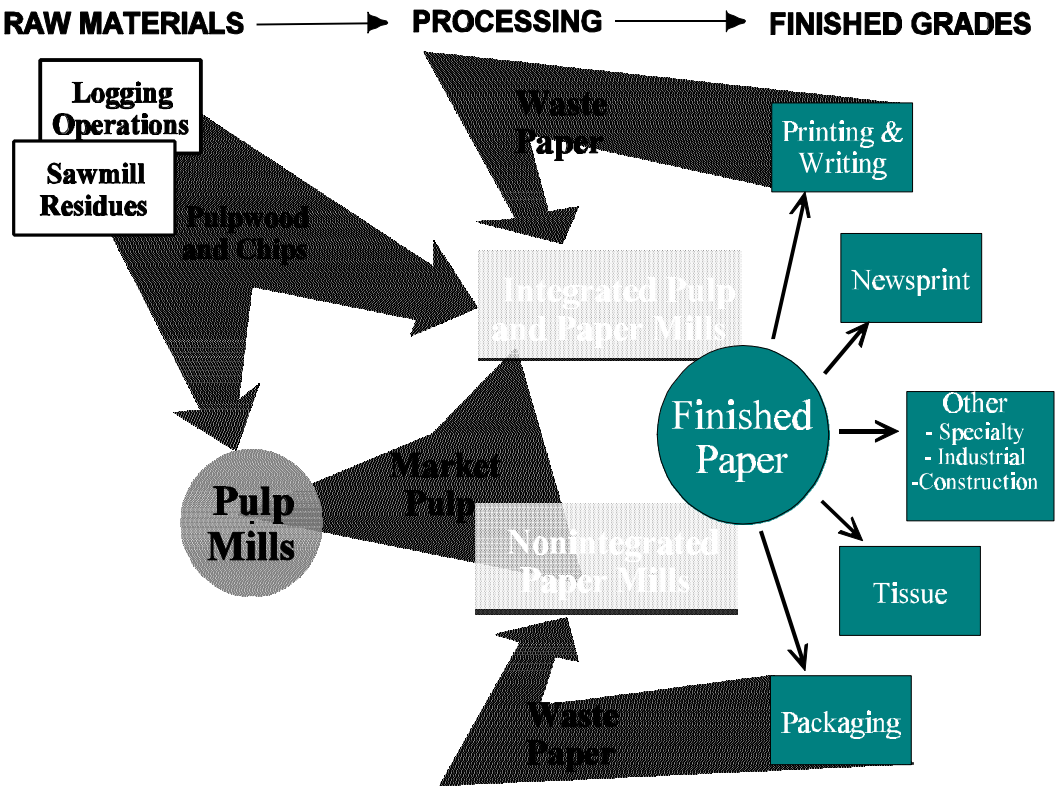
[27] *Pulp & Paper, 1999 North American Factbook*, p. 184.

Table 1
Wood pulp: U.S. production, exports, imports, and apparent consumption 1996-2000

Year	Production	Exports[1]	Imports[1]	Apparent consumption	Ratio of imports to consumption
	1,000 of metric tons				*Percent*
1996	[2]58,329	6,636	5,191	56,884	9.1
1997	[2]59,342	6,501	5,855	58,696	10.0
1998	[3]58,226	5,641	5,478	58,063	9.4
1999	[4]57,074	5,579	6,081	57,576	10.6
2000	[4]57,002	6,057	6,588	57,533	11.5

[1] U.S. Department of Commerce.
[2] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), p. 57.
[3] *Pulp & Paper International*, Vol. 42, No. 7 (July 2000), p. 53.
[4] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 45.

Figure 2
Pulp and paper industry product flow



Source: U.S. International Trade Commission staff.

Pulp and paper mills are capital-intensive operations that continue to increase in size and technical sophistication. The U.S. industry has a debt-to-capital ratio of about 40 percent, and annual capital spending was approximately 12 percent of sales in 1994.[28] Mills are often close to fiber and water supplies. Larger, newer mills generally manufacture commodity grades on very large paper machines. Many are vertically integrated, owning or controlling fiber supply, wood products facilities, and converting facilities. Nonintegrated paper mills produce a variety of specialty grades generally on smaller, somewhat older machines. As usage of waste paper has increased, smaller mills that utilize local supplies of waste paper have been built in urban areas.

With abundant raw materials, a well-developed industry with supporting infrastructure, and a large, competitive domestic market, the United States accounted for 30 percent (57 million metric tons) of global pulp production in 2000. Thirty-one States have some capacity to produce wood pulp. Eighteen States each have over 1 million metric tons of annual production capacity. Geographically the pulp-producing States may be grouped into four distinct regions: the South, the Pacific Northwest, the Midwest, and the Northeast. The top-ranked States in each region are Alabama and Georgia in the South, Washington and Oregon in the Pacific Northwest, Wisconsin and Michigan in the Midwest, and Maine and Pennsylvania in the Northeast. By far, most of the Nation's wood pulp is produced in the South, the broad expanse stretching from Virginia to Texas. In 2000, the South accounted for 71 percent of total production capacity (table 2), and 8 of the top 10 pulp-producing states are in the South. Important indigenous species and a long growing season have encouraged the growth of the forest products industry in the South. Table B-1 in appendix B summarizes the States included within each region and shows pulp-manufacturing capacity by State.

Table 2
U.S. annual wood-pulping capacity by region, 2000

Region	Total capacity	Percent
	Million metric tons	
South	39.6	71
Pacific Northwest	7.5	13
Midwest	5.3	9
Northeast	3.8	7
Total	56.2	100

Source: *2000 Lockwood-Post Directory*, (San Francisco, Miller Freeman, Inc. 1999), pp. 37-152 .

Until 1997, pulp manufacturers in the U.S. South had low production costs as compared with manufacturers in other traditional pulp-producing regions.[29] (Table B-2 in appendix B compares total delivered manufacturing cost for seven traditional pulp-producing regions). In 1997, average delivered manufacturing cost in the U.S. South was $431 per metric ton, third-lowest behind Finland and Sweden. The competitive position of U.S. manufacturers has been

[28] Parthasarathy and Dowe, "Impact of the Cluster Rule...", *Tappi Journal*, Vol. 83, No. 9 (Sept. 2000), p. 40.

[29] Pulp & Paper, *1999 North American Factbook*, p. 212.

impacted by the strength of the U.S. dollar and the devaluation of the Scandinavian currencies. Also, traditional producers, both in North America and Scandinavia, are being challenged by manufacturers in developing pulp-producing regions (e.g., South America, Asia, Iberian Peninsula). Costs of manufacture in South America may be 40 to 70 percent less than those for the U.S. South due to less expensive labor and fiber.[30]

In the 1990s, forest products companies, both foreign and domestic, drove industry consolidation, further emphasizing the global nature of the industry. Mergers included acquisition of foreign firms by domestic ones (e.g., Weyerhaeuser's acquisition of MacMillan Bloedel) and vice versa (e.g., Smurfit/Stone and Stora/Consolidated). A Finnish company, UPM-Kymmene, offered to acquire Champion International, but through a subsequent superior offer, International Paper ultimately acquired Champion. Georgia Pacific also acquired Fort James, itself a combination of James River Corp. and Fort Howard. The advantages of global acquisitions include access to new markets, access to new sources of fiber, and the ability to leverage a company's technical expertise.

In 1995, U.S. pulp mills employed 14.6 thousand workers in all capacities.[31] During 1995-99, the total of all employees working in U.S. pulp mills declined an average of 13 percent per year.[32] Industry consolidation, forward integration, increasingly efficient pulp mill control systems, and mill closures each contributed to the decline, and in 1999, U.S. pulp mills employed only 7.3 thousand workers.[33] Reversing the trend from the early 1990s, output per employee declined by an average of 8.2 percent per year during 1995-99.[34]

Table 3 shows average hourly earnings for paper and allied products and all industries in the United States over 1995-99. Hourly earnings for production workers in paper and allied products were 20 to 24 percent higher than hourly earnings for private industry as a whole. Average hourly earnings increased by approximately 3 percent annually over the period.

Table 3
Average hourly earnings of production workers, 1995-99

	1995	1996	1997	1998	1999
Paper and allied products industry (*dollars per hour*)	14.23	14.67	15.05	15.50	15.94
Total private industry (*dollars per hour*)	11.43	11.82	12.28	12.78	13.24
Difference (*dollars per hour*)	2.80	2.85	2.77	2.72	2.70
Difference *(percent)*	24	24	23	21	20
Paper and allied products (*percent change*)		3.1	2.6	3.0	2.8
Total private industry (*1982 base year*) (*dollars per hour*)	7.39	7.43	7.55	7.75	7.86
Total private industry *base change* (*dollars per hour*)		0.5	1.6	2.6	1.4

Sources: U.S. Bureau of Labor Statistics found at *http://146.142.424/cgi-bin.*

[30] Ibid., p. 213.

[31] U.S. Department of Commerce, Census Bureau, *Annual Survey of Manufactures, Industry Statistics,* (Washington, DC: GPO), p. 1-15.

[32] The last year for which data are currently available is 1999. U.S. Department of Labor, Bureau of Labor Statistics, data from Industry Productivity database, found at *http://stats.bls.gov/iprdata1.htm*, retrieved Aug. 28, 2000 and updated June 21, 2001.

[33] U.S. Department of Commerce, Census Bureau, *1999 Annual Survey of Manufactures, Statistics for Industry Groups and Industries*, M99(AS)-1, Mar. 5, 2001, p. 10.

[34] U.S. Department of Labor, BLS, Industry Productivity database.

Technology

The fundamentals of pulping remain essentially the same, but the industry continues to increase production speed, improve process control, improve product quality, and reduce effluent. Appendix E lists and describes various industry technical innovations and process improvements. In addition to the more conventional refinements, continued research in biotechnology is contributing to improved raw material. Trees are being genetically modified to decrease lignin content and increase cellulose content, to increase herbicide tolerance, and to confer insect resistance.[35] Also, enzymes are being developed for applications throughout the pulp- and paper-manufacturing process. For instance, in the 1990s enzymes were developed to reduce wood pitch content prior to pulping; others are being developed to decrease the energy required for mechanical pulping.[36]

Likewise, technical advances are also being made in the reuse of waste paper. More efficient methods of cleaning and conditioning recycled fibers are being developed. For example, in the early 1990s laser printed paper posed a significant challenge, but techniques for recycling laser printing are now well understood.[37] Biotechnology is being used to develop enzymes that will improve removal of contaminants from de-inked pulp.[38] A current challenge is to improve techniques for removing pressure sensitive adhesives (PSA) of the sort now found on self-stick postage stamps.

Environmental Considerations

Pulp and paper mills are large, highly visible facilities subject to a high degree of public scrutiny. Several important environmental regulations (summarized in appendix F) have required the industry to mitigate air and water effluents. As the understanding of adverse impacts of effluents has increased, regulations have become increasingly stringent and have a significant impact on industry cost. A Census Bureau study estimates that pollution abatement costs for the pulp and paper industry are 2.3 percent of total annual operating costs, compared to less than 0.5 percent of total annual operating costs for the U.S. manufacturing sector as a whole.[39] The same study estimates that pulp and paper industry spending of 1 percent of annual operating costs on pollution abatement decreases productivity more than 5 percent.[40] The most recent Current Industrial Report estimates that pollution abatement expenditures in 1994 were $73 million for U.S. pulp mills and $635 million for the

[35] Roger Grant and John Grant, "Another Year Brings Advances in Biotechnology," *Pulp & Paper International*, Vol. 42, No. 8 (August 2000), p. 29.

[36] Ibid., p. 30.

[37] Don McBride, "Unrealistic Thinking Spurred Office Wastepaper De-inking Dilemmas" *Pulp & Paper*, Vol. 71, No. 12 (Dec. 1997), p. 70.

[38] Grant, "Another Year ..." *Pulp & Paper International*, Vol. 42, No. 8 (Aug. 2000), pp. 30-31.

[39] U.S. Bureau of the Census, *Measuring the Productivity Impact of Pollution Abatement, SB93-13*, November 1993, (Washington, DC: GPO), p. 1.

[40] Ibid., p. 2.

pulp and paper industry as a whole.[41] During the period 1996-98, annual industry environmental expenditures averaged $629 million (figure B-1) and were estimated to be approximately $700 million during 1999-2000.[42] Individual company expenditures vary widely since capital spending is tied to cash flow.[43]

In April 1998, a major environmental regulation, the Cluster Rule, went into effect.[44] Resulting from a court-imposed consent agreement that required the U.S. Environmental Protection Agency (EPA) to enact rules controlling dioxin and furan,[45] the Cluster Rule is the first EPA attempt to integrate the control of air and water emissions from pulp and paper mills. Estimates of the cost of compliance for the U.S. industry include over $3.0 billion in capital spending[46] and increased annual operating expense of $273 million or $8.83 per ton.[47] Rather than making the necessary expenditures, some mills chose instead to idle their pulping operations and switch to the use of recycled fiber.[48]

International environmental concern has been manifest through the Kyoto Protocol to the United Nations Framework Convention on Climate Change, which was adopted on December 11, 1997.[49] Under the protocol, developed countries agreed to meet emission targets for greenhouse gases (CO_2) beginning in 2008. Should the protocol be ratified, net reduction targets might be met either by reducing emissions or enhancing absorption in terrestrial ecosystems.[50] The fact that vigorous tree plantations act as carbon sinks may actually induce increased silvicultural investments as countries work to meet CO_2 emissions targets, and such investments would likely enhance the availability of wood fiber.

---

[41] U.S. Bureau of the Census, Current Industrial Reports; *Pollution Abatement Costs and Expenditures: 1994*, MA200(94)-1, U.S. Government Printing Office, Washington, DC, 1996, p. 21.

[42] Pulp & Paper, *1999 North American Factbook*, p. 72, and Jensen, Karl P. and Rae Ann Rockhill, "Spending restraint continues, focus on environmental compliance projects, *Pulp & Paper*, Vol. 75, No. 1 (Jan. 2001), p. 54.

[43] Parthasarathy and Dowe, "Impact of the Cluster Rule...", *Tappi Journal*, Vol. 83, No. 9 (Sept. 2000), p. 40.

[44] 63 FR 18504-18751 (Apr. 15, 1998) and 63 FR 42238-42240 (Aug. 7, 1998).

[45] Dioxin, which has been detected in the effluent of bleached pulp mills, refers to a family of toxic chemicals that have similar chemical structures and similar toxic action. Included are some polychlorinated dibenzo dioxins, polychlorinated dibenzo furans, and polychlorinated biphenyls. Widely distributed in the environment in low concentrations, they are persistent and bioaccumulate. Generally, dioxins are characterized as likely human carcinogens. 2,3,7,8 TCDD, the most studied dioxin, is a known human carcinogen and has caused adverse health effects when present in animals at about 10 times the average background exposure. Those effects include changes in hormone systems (endocrine disrupters), reproductive effects, and immunosuppression. Found at *http://www.websorcerer.com/dioxin/d_what.html* and retrieved on May, 8, 2000.

[46] Pulp & Paper, *1999 North American Factbook*, p. 77.

[47] Parthasarathy and Dowe, "Impact of the Cluster Rule...", *Tappi Journal*, Vol. 83, No. 9 (Sept. 2000), p. 43.

[48] "Recovered Paper Usage Up, Costs May Be On the Rise Too", *Pulp & Paper*, Vol. 23, No. 6 (Jan. 1999), pp. 61-65.

[49] "The Convention and the Kyoto Protocol" found at *www.unfccc.int/resource/convkp.html*, retrieved Sept. 13, 2000.

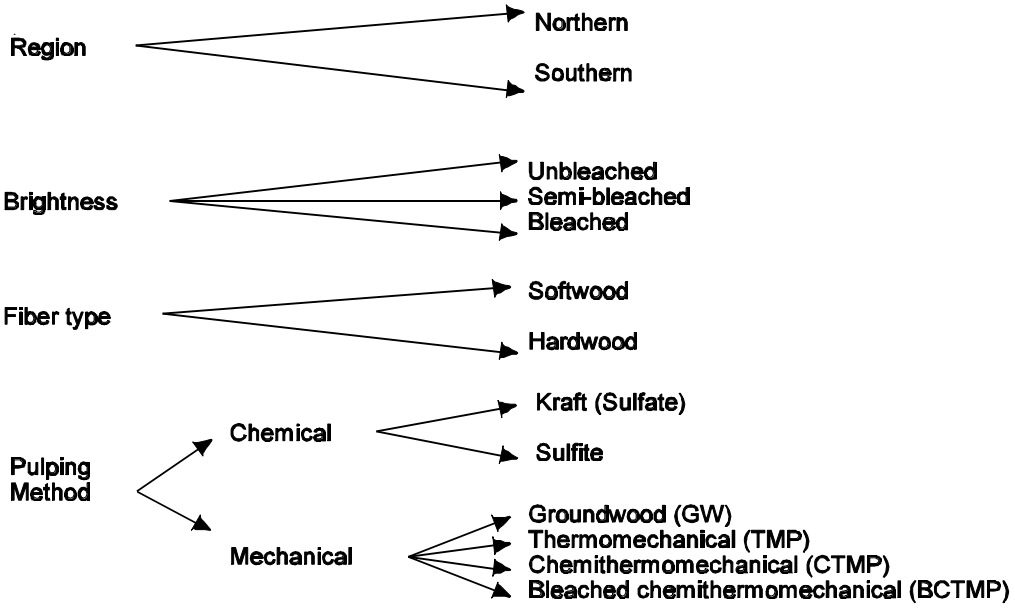
[50] Brian C. Murray, Stephen P. Prisley, Richard A Birdsey, and R. Neil Sampson, "Carbon Sinks in the Kyoto Protocol," *Journal of Forestry*, Vol. 98, No. 9 (Sept. 2000), p. 6.

WOOD PULP MARKETS

Grades of Wood Pulp

Paper-grade pulp is classified by geographic region, brightness, fiber type, and pulping method (figure 3). Both softwood (conifers) and hardwood (broad-leaved) trees are important sources of fiber. The longer fibers of softwoods provide strength; the shorter fibers of hardwoods provide smoothness and opacity. For many products, manufacturers use both softwood and hardwood pulp in proportion depending on the type of paper being produced. Domestic, kraft pulping capacity for bleached and semibleached pulps is roughly split in half between hardwood (54 percent) and softwood (46 percent).[51] The highest quality pulps are softwood, kraft pulps from northern regions (northern bleached softwood kraft or NBSK). Following NBSK on the quality spectrum are northern hardwood pulps, southern softwood pulps, and finally, southern hardwood pulps. Chemical pulp dominates the global market for wood pulp; only about 7 percent is mechanical pulp, principally bleached chemithermomechanical pulp (BCTMP).[52] Currently the U.S. industry does not have any mechanical market pulp capacity.

Figure 3
Wood pulp categories



Source: Pulp & Paper, *1999 Pulp and Paper North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998) pp. 177-181

[51] AF&PA, 2000 *Statistics*, p. 35.
[52] Pulp & Paper, *1999 North American Factbook*, p. 188.

In addition to the regular grades of market pulp there are four special grades; dissolving, eucalyptus, fluff, and market de-inked pulp (MDIP). Dissolving pulp, highly purified (95-99 percent cellulose) pulp, is used for chemically converted products such as rayon, cellophane, acetate, plastics, and chemicals. In 2000 U.S. dissolving pulp capacity was approximately 1.1 million metric tons and accounted for 12 percent of total domestic market pulp capacity.[53] From 1996-2000, U.S. dissolving pulp capacity dropped 307,000 metric tons.[54] Despite tough competition from overseas and synthetic fibers, some dissolving pulp products perform well in the market place. The trend is towards more specialized grades of dissolving pulp. The price of dissolving pulp is not as volatile as that of paper-grade pulp.

The genus, Eucalyptus, contains over 600 species of evergreen plants that range in size from shrubs to large trees, many of which are native to Australia.[55] Eucalyptus is easily and efficiently pulped; its very fine, uniform fibers provide superior opacity for printing and writing grades and superior softness for tissue grades. Over the past two decades, shipments of bleached eucalyptus kraft (BEK) pulp have expanded rapidly, increasing on average by 12 percent annually.[56] Although eucalyptus requires a mild climate, it is capable of rapid growth. Plantations have been established in South America, the Iberian Peninsula, and South Africa. Eucalyptus not only provides market pulp to meet the demand of the global industry but also provides a fiber base for expanding paper industries in producing regions. Unlike other hardwood fibers grown in southern regions, it is a premium product and commands a price similar to the very best NBHK.

Fluff pulp is used to make sanitary disposable products such as diapers, feminine napkins, and adult incontinence products. Total world production of fluff pulp (approximately 3.2 million metric tons) was generally flat over the summary period.[57] Five major U.S. manufacturers account for about two thirds of global production.[58] Fluff pulp is shipped in rolls to manufacturers of sanitary disposable products. It is more costly to produce than paper-grade pulp because tighter moisture and cleanliness control is required and because packing, handling, and transportation costs are higher. In 1989 the market for disposable diapers accounted for 81 percent of total fluff pulp demand, but by 1997 diapers and toddler training pants accounted for only 60 percent of the total. Adult incontinence products (20 percent), feminine napkins (10 percent) and nonwoven products (10 percent) accounted for the balance of demand.[59] The decrease attributable to the diaper market amounted to a drop in demand of over 1 million metric tons. Two factors contributed to the decline. First, the North American diaper market (approximately 25 percent of total world demand) and other large diaper markets in Western Europe and Japan are mature. Second, subsequent to the advent of super-absorbent polymers (SAPs) in the 1980s, disposable diapers were redesigned to use 55 to 60

---

[53] AF&PA, *2000 Statistics*, p. 35.

[54] Ibid.

[55] Robert L. Santos, "The Eucalyptus of California," found at *http://www.library.csustan.edu/bsantos/section1.htm*, retrieved June 19, 2000.

[56] Pulp & Paper, *1999 North American Factbook*, p. 180.

[57] "Fluff Pulp Market Steady; End-user Consolidations Increase Pricing Pressure," *Pulp & Paper Week*, Feb. 23, 1998.

[58] "Emerging Markets Driving Strong Fluff Pulp Demand; Producers Reaching Pricing Parity," *Pulp & Paper Week*, Aug. 28, 1995.

[59] Pulp & Paper, *1999 North American Factbook*, p. 223.

percent less fluff pulp. In the new diapers, fluff pulp serves not as an absorbent medium but as a transport medium that wicks moisture to SAPs. Not only do the new diapers contain less fluff pulp; they stay on babies longer, so usage in the 1990s dropped from 5.5 to 4.5 diapers per day per baby.[60]

Use of de-inked pulp was once limited to newsprint and tissue,[61] but technical improvements have allowed de-inked pulp to be used in printing and writing grades as well. The market expanded rapidly as manufacturers sought to include recycled fiber in their furnish. Before 1990, there were only five MDIP mills in the United States.[62] By 1994, following a wave of investment (either for new mills or reconfigured existing mills), 14 mills[63] with over 700,000 metric tons of total annual capacity were producing MDIP.[64] As a raw material, MDIP performs in roughly the same fashion as southern bleached hardwood kraft (SBHK), but in spite of that, robust demand for recycled pulp in the early 1990s allowed MDIP to sell at a premium over SBHK (figure 4). In 1993 with the pulp price at an ebb, the premium peaked at approximately 75 percent.[65] Subsequently, increasing pulp prices, performance problems, producer demand swings, and new capacity eliminated the premium by the end of 1995. The price of MDIP collapsed in 1996. By 1997, some 21 mills[66] were producing MDIP. The expanded demand for waste paper strained supply and resulted in higher prices. Profitability dropped with higher fiber cost and lower MDIP prices. By 1998, three greenfield mills and one older mill had been idled.[67] Annual capacity reached approximately 1.8 million metric tons in 1998 and is estimated to have remained flat in 1999 and 2000.[68] MDIP prices are now on par with SBHK. Compared with other paper producers, de-inked mills suffer from higher relative fiber and production costs.

---

[60] Ibid., p. 226.

[61] David Pineault, "Will De-inked Market Pulp Cause Traditional Pulp to Dip," *Pulp & Paper International,* Vol. 38, No. 11 (Nov. 1996), p. 41.

[62] Pulp & Paper, *1999 North American Factbook*, p. 216.

[63] Ibid.

[64] AF&PA, *1999 Statistics*, p. 34.

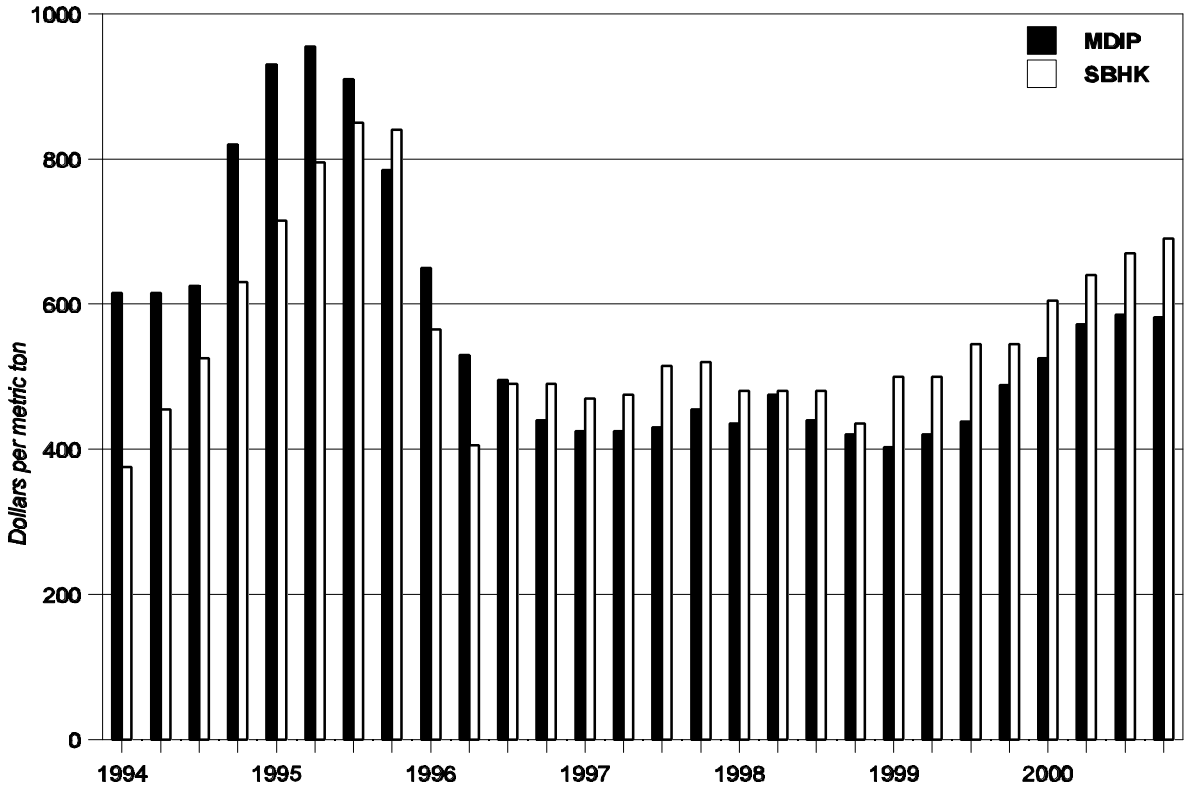
[65] Pineault, "Will De-inked Market Pulp Cause Traditional Pulp to Dip," p. 41.

[66] Pulp & Paper, *1999 North American Factbook*, p. 216.

[67] Ibid.

[68] AF&PA, *1999 Statistics*, p. 35.

Figure 4
U.S. domestic price, market de-inked pulp vs. southern bleached hardwood kraft, 1994-2000



Sources: Pulp & Paper, *1999 North Americican Factbook*, (San Francisco, Miller Freeman, Inc., 1998), pp. 201, 220.

Wood Pulp Supply and Demand

Demand for wood pulp is a function of the consumption of paper and paperboard, which follows economic activity. Demand for bleached market pulp is specifically derived from the demand for printing and writing paper. Over the last 20 years, domestic demand has increased at an average annual rate of 1.7 percent. Despite long-term growth, short-term demand is subject to cyclical fluctuations.

Market pulp is produced at dedicated pulp mills or as incremental production at integrated mills. Annual production during 1996-2000 was erratic but was estimated to be 7.8 million metric tons in 2000, 3.5 percent higher than in 1996 (table 4). Wood pulp is marketed globally through a variety of outlets. Purchasers are either nonintegrated paper mills or integrated mills that must supplement their fiber supply. Large volumes are often sold under long-term contract, but an active spot market exists also. Brokers are utilized especially to

facilitate export sales. Dried, baled pulp is shipped in bulk. The choice of transport mode (rail, truck, or ship) or combination of modes depends on rates, service requirements, and capabilities.

Table 4
Market pulp: U.S. production, exports, imports, and apparent consumption, 1996-2000

Year	Production	Exports[1]	Imports[1]	Apparent consumption
	1,000 of metric tons			
1996	[2]7,493	6,636	5,191	6,048
1997	[3]7,775	6,501	5,855	7,129
1998	[3]7,304	5,641	5,478	7,141
1999	[4]7,431	5,579	6,081	7,993
2000	[4]7,758	6,057	6,588	8,289
	Million dollars			
1996	3,844	3,289	2,593	3,148
1997	4,051	3,118	2,562	3,495
1998	3,608	2,682	2,383	3,309
1999	3,716	2,702	2,537	3,551
2000	5,144	3,415	3,290	5,019

[1] U.S. Department of Commerce.
[2] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), p. 57.
[3] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), p. 43.
[4] *Pulp & Paper International*, Vol. 43, No. 7 (July 2000), p. 45.

Table 5 summarizes annual market pulp production by grade. High quality and strength make kraft pulp the predominate grade; in 1999 bleached, kraft pulps composed 94 percent of all paper grade shipments.

The largest domestic producers of market pulp are multinational companies (table 6). The top 10 domestic producers have an annual capacity of 7.4 million metric tons or 85 percent of total U.S. capacity. In 2000, 68 facilities in the United States produced market pulp; 33 were dedicated pulp mills and 35 were integrated facilities. The total number of U.S. facilities producing market pulp peaked in 1996 at 73. U.S. capacity, 9.7 million metric tons

Table 5
Market pulp: U.S. production by grade, 1995-99

	1995	1996	1997	1998	1999
	1,000 of metric tons				
Bleached sulfite	193	142	138	78	98
Sulfate (kraft):					
- Bleached or semi-bleached	7,742	7,125	7,500	6,985	7,173
- Unbleached	230	313	338	290	339
Total	8,165	7,580	7,976	7,353	7,610

Note.—Figures do not include dissolving pulp. The grade-specific pulp production figures as reported by AF&PA and shown in this table differ slightly from those reported by *Pulp & Paper International* shown in table 4 and elsewhere in this report. They are shown here only to illustrate the predominance of kraft market pulp.

Source: American Forest & Paper Association, *Statistics 2000*, (Oct. 2000), p. 58.

in 1996, contracted at a rate of 2.2 percent annually to 8.7 million metric tons in 2000.[69] Mill closures have been driven by global financial crises, tightened environmental regulations, and poor profitability.[70] U.S. capacity is expected to grow very slowly; currently no new mills are planned in the United States. All currently planned capacity is to be built offshore.[71]

Table 6
U.S. producers of market pulp by annual capacity, 1998

Company	Capacity
	1,000 metric tons
Georgia-Pacific Corp.	1,870
International Paper Co.	1,400
Weyerhaeuser Co.	1,270
Parsons and Whittemore Inc.	840
Smurfit-Stone Corp.	505
Bowater Inc.	400
Rayonier Inc.	355
Buckeye Technologies Inc.	275
Alliance Forest Products Inc.	270
Kimberly Clark Corp	220

Source: Pulp & Paper*, 1999 North American Factbook*., (San Francisco, Miller Freeman, Inc., 1998), p. 204.

Wood Pulp Pricing

The price of market pulp is highly volatile. Because demand tends to track economic activity, prices rise and fall as the economy expands or contracts. In addition, the relative inelastic nature of pulp supply magnifies price volatility in both weak and strong markets. During weak markets, the capital-intensive nature of pulp-manufacturing tends to encourage producers to maintain full production in spite of soft demand. On the other hand, lengthy lead time for new mill construction tends to constrain supply; in the short-term, capacity is essentially fixed. Therefore, strong demand can induce large price increases before new supply is available. Further, when a period of strong demand induces more than one company to add capacity, an extended period of oversupply may result in very soft market prices. Other factors such as changing inventories or exchange rate fluctuations also exacerbate pulp pricing cycles.

[69] AF&PA, *2000 Statistics*, p. 35.
[70] Rhiannon James, "Come Join the Pulp Party," *Pulp & Paper International*, Vol. 42 No. 5 (May 2000), p. 43.
[71] Ibid., p. 44.

Figure 5 charts the historic price of NBSK[72] in the domestic market. Data from 1980 are shown to place the prices observed during 1996-2000 within the context of the wide price swings of the past two decades.[73] The economic surge of the late 1980s fueled capacity expansion, but the recession of the early 1990s brought prices below $500 per metric ton by the third quarter of 1993. At that point less than 10 percent of market pulp producers was earning profits.[74] The bottom was followed in 1994 by the largest price increase on record[75] a rise well beyond that which could be passed on to paper buyers. Beginning in June 1995, inventory rose rapidly[76] as customers purchased in anticipation of further price increases. Manufacturers made large profits in 1995, but during the summer the demand for freesheet papers in Europe fell more than usual. The market peaked in October as customers cut off orders and began to liquidate inventories. Prices plunged through most of 1996, but rallied in 1997, with North American production capping the "most volatile business cycle in history."[77] The large drop at the beginning of 1998 coincided with the Asian financial crisis. With soft Asian demand, inventory rose[78] and the price of NBSK fell to $460 per metric ton in the fourth quarter of 1998.[79] As mentioned earlier, U.S. market pulp capacity began to contract during 1996-2000 as mills were closed (either temporarily or permanently) or as forward integration removed pulp from the market. Paper consumption was strong in 1999. By October producer inventories had dropped to 1.1 million metric tons, well below the "balanced" market inventory level of 1.5 million metric tons.[80] Downtime, mill closures, and limited new capacity helped solidify the market. Early in 2000 the price of NBSK reached $650 per metric ton[81] and later $710 per metric ton, where it remained for the rest of the year.[82]

---

[72] As the preferred pulp, NBSK serves as the benchmark of pulp pricing. Prices of other grades are determined as discounts from the price of NBSK.

[73] Derivatives (futures) markets for wood pulp have been established in Europe, but as yet, they have not decreased the volatility of market pulp prices. Douglas A. Fromson, "Market Pulp Volatility Still Likely Despite Efforts to Stabilize Market," *Pulp & Paper,* Vol. 71, No. 3 (Mar. 1997), p. 101.

[74] Martin Bayliss, "Grade Review - Market Pulp" *International Papermaker,* Vol. 58, No. 2. (Feb. 1995), p. 13.

[75] Fromson, "Market Pulp Volatility ...," *Pulp & Paper,* Vol. 71, No. 3 (Mar. 1997), p. 101.

[76] Industry associations for pulp producing countries track inventory for the combined North American and Scandinavian ("Norscan") industries, the traditional producers of wood pulp. The Norscan inventory was 1.0 million metric tons at the end of June 1995, but ballooned to 2.6 million metric tons at the peak in March 1996. Pulp & Paper, *1999 North American Factbook*, p. 185.

[77] Pulp & Paper, *1999 North American Factbook*, p. 99.

[78] In 1998 the Norscan inventory peaked in August at 1.9 million metric tons of wood pulp.

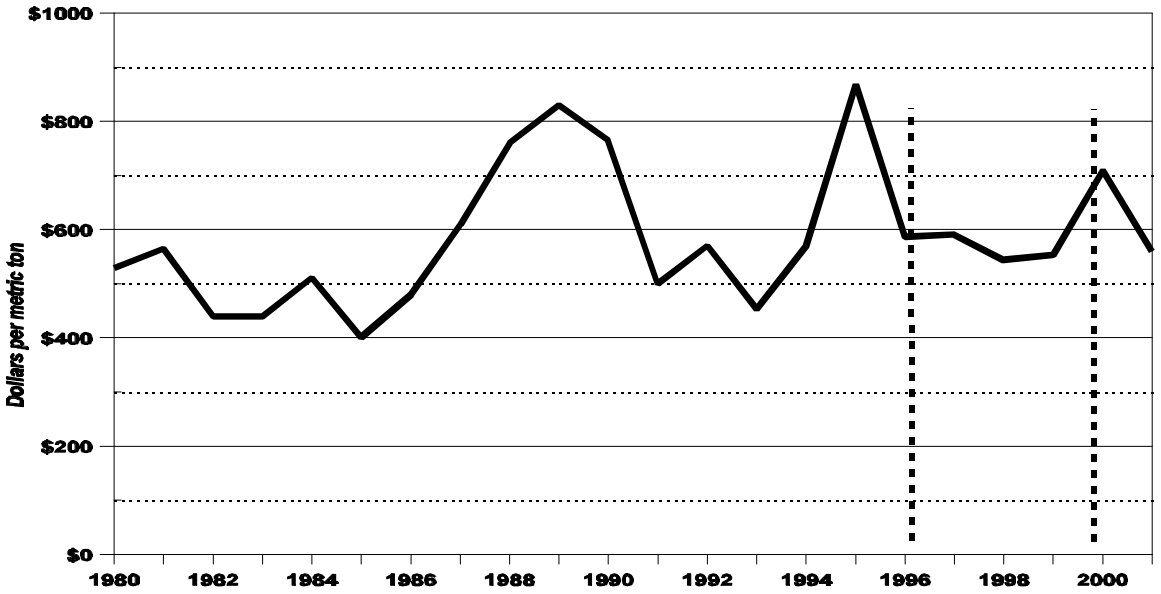
[79] Gary Thomson, "Pulp: Set for Another Wild Ride," *Pima's International Papermaker,* Vol. 82, No. 2 (Feb. 2000), p. 25.

[80] Likely, increased consumption has shifted the "balanced market" producer inventory even higher.

[81] Fraser Evans, "Market Pulp: Long Anticipated Market Pulp Upswing Could Last for as Long as Two More Years," *Pulp & Paper,* Vol. 74, No. 1 (Jan. 2000), p.39.

[82] Although the price of wood pulp recovered in 2000, the Norscan inventory exceeded 1.5 million metric tons by the end of October and was 1.8 million metric tons at the end of the summary period.

Figure 5
U.S. price, northern bleached softwood kraft 1980-2000[1, 2]



[1] Source for 1980-98 prices is: Pulp & Paper, *1999 North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998), p. 201
[2] Sources of subsequent prices were: *Pulp & Paper Magazine* Annual Pulp Grade Reviews and Paperloop.com.

WASTE PAPER MARKETS

Grades of Waste Paper

The Institute of Scrap Recycling Industries (ISRI) establishes specifications for different grades of waste paper.[83] Currently, 47 different regular grades of waste paper and 32 specialty grades are recognized. A list of these grades is shown in appendix C. Both regular and specialty grades are produced and shipped in carload or truckload quantities throughout the United States. Specialty grades have certain characteristics (e.g., chemical treatment, coatings) that require consuming mills to have special equipment in order to utilize them. The U.S. Department of Commerce includes each grade within one of five broad, benchmark categories; corrugated, newspapers, mixed papers, pulp substitutes, and de-inking.[84] Some grades (e.g., newspapers and corrugated) are relatively easy to collect and utilize; therefore, they are widely recycled, and their recovery rates are very high. Collection is more difficult for other grades (e.g., mixed papers), a fact reflected in lower utilization rates.

[83] Institute of Scrap Recycling Industries, Inc., *Scrap Specifications Circular 198 - Guidelines for Nonferrous Scrap, Ferrous Scrap, Glass Cullet, Paper Stock, Plastic Scrap* (Washington, DC: ISRI, 1998)
[84] Pulp & Paper, *1999 North American Factbook*, p. 242.

Corrugated is the largest source of waste paper. Included in this category are old corrugated containers (OCC), solid fiber boxes, container plant clippings, kraft paper and bags, bag clippings, carrier stock, and carrier stock clippings. In 1999, 20.7 million metric tons were recovered accounting for 48 percent of all recoveries in the United States (table 7). Corrugated is primarily collected from retail establishments, factories, and office buildings. The corrugated recovery rate increased steadily during 1995-99 and was estimated to be 80 percent in 2000[85] as new, nontraditional sources (e.g small retail establishments and offices, restaurants, and residences) have developed.

Newspapers are the next largest source of waste paper. The category includes old newspapers (ONP), special news, white blank news, groundwood computer printout, publication blanks, mixed groundwood and flyleaf shavings, and coated ground wood sections. In 1999, approximately 8.2 million metric tons (19 percent of the total) were recovered in the United States. Newspapers are collected principally through municipal collections.

Mixed papers are collected from office buildings (generally unsorted) by private haulers. Mixed papers include office papers (if not suitable for de-inking or pulp substitutes), magazines and catalogs, telephone directories, recycled boxboard cuttings, recycled tissue paper converting scrap, mill wrappers, and specialty grades. In 1999 recovery of mixed papers was about 7.7 million metric tons (18 percent of the total). Traditionally, lower quality mixed paper has been used for construction paper and paperboard (e.g., roofing felts and gypsum wallboard liner). It is the only largely untapped source of U.S. wastepaper remaining.[86]

Table 7
Waste paper: U.S. recovery by grade, 1995-99

	1995	1996	1997	1998	1999
	1,000 metric tons				
Corrugated	18,513	19,576	19,978	20,060	20,686
Newspaper	7,066	7,074	7,559	7,863	8,185
Mixed papers	6,099	6,145	5,983	6,744	7,659
Pulp substitutes.	2,936	2,736	2,928	2,560	2,600
High grade	3,660	3,546	3,462	3,670	3,792
Total	38,274	39,079	39,910	40,897	42,921

Note.—Total recoveries by grade as reported by A.F. & P.A. are slightly different than the figures for total collections as reported by PPI in table 8.

Source: American Forest & Paper Association, *Statistics 2000*, (Oct. 2000), p. 57.

[85] Harold M. Cody, "Recovered Paper Usage Up, Costs May Be On the Rise Too," *Pulp & Paper,* Vol. 73, No. 6 (June 1999), p. 61.

[86] Debra A. Garcia, "Wastepaper Prices Soar to New Records," *Pulp & Paper,* Vol. 69, No. 2 (Feb. 1995), p. 69.

High-grade de-inking (3.8 million metric tons in 1999) and pulp substitutes (2.6 million metric tons in 1999) are the high grades of waste paper. Print free grades are reported as pulp substitutes, and printed grades as high-grade de-inking. The traditional sources for the high grades are large office buildings with private haulers picking up sorted material. This material includes bleached chemical grade office papers and computer printout, bleached sulfite and sulfate cuttings, chemical tissue paper converting scrap, and coated book stock.

Waste Paper Supply and Demand

A country's total supply of waste paper depends on its consumption of paper and paperboard products. In 2000, the United States consumed the most paper and paperboard (92.3 million metric tons) in the world, and per capita U.S. consumption ranked third in the world at 332 kilograms.[87] In addition to the EPA goal to reduce MSW and the industry's voluntary paper recycling goal, by 1992, 39 states had "supply-side" recycling laws that required separation or other provisions (e.g., landfill bans) intended to stimulate recycling.[88] The sharp increase in the recovery which began in the 1980s (figure 1) continued during 1996-2000.

In 2000, total recoveries of waste paper reached 44.9 million metric tons (table 8), and AF&PA estimated that the recovery rate was 48 percent.[89] During 1995-99 the annual recoveries of all grades except pulp substitutes increased. Corrugated registered the largest absolute annual gain, but mixed papers recorded the highest annual percentage increase and the second largest absolute increase.

There are several types of waste paper suppliers. Involuntary generators include supermarkets and large commercial, retail, or industrial facilities. Solid waste management companies handle mostly bulk grades (corrugated and newspaper) that are recovered from the waste stream. Packers and processors sort and bale waste paper, and brokers facilitate long distance purchases, trades, or exports. Prior to the early 1990s when many municipalities began public curbside collections, private recyclers formed the core of the industry. In spite of public collections, private recyclers have remained in business, and in fact, some municipalities have contracted their collection programs to private firms.

[87] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7, (July 2001), p. 9.

[88] Pulp & Paper, *1999 North American Factbook*, p. 234.

[89] AF&PA, *Paper, Paperboard, & Wood Pulp*, Vol. 79, No.2 (Feb. 2001), p. 1. "U.S. paper industry closing in on 50 percent recycling goal," found at *www.paperloop.com*, retrieved June 27, 2001. The domestic industry fell just short of it's goal because paper consumption generally expanded faster than recoveries, the cost difference between recovered and virgin fiber is now too low to drive further recycling investment, and other non-paper uses for recycled fiber (e.g., compost) have not materialized. Kirk Finchem, "Recovered Paper Collection Grows, but 50 percent Goal Remains Unlikely," *Pulp & Paper*, Vol. 72, No. 5 (May 1998), p. 85.

Table 8
Waste paper: Estimated U.S. collections, exports, imports, and apparent consumption, 1996-2000

	Collections	Exports[1]	Imports[1]	Apparent consumption	Ratio of imports to consumption
	1,000 metric tons				*Percent*
1996	[2]38,430	6,495	430	32,365	1.3
1997	[2]40,909	6,809	628	34,729	1.9
1998	[3]40,892	7,349	464	34,007	1.4
1999	[4]42,915	7,517	387	35,785	1.1
2000	[4]44,938	9,896	552	35,594	1.6
	Million dollars				
1996	[5]2,565	745	55	1,875	
1997	3,294	747	77	2,624	
1998	2,800	753	60	2,107	
1999	3,363	822	60	2,602	
2000	4,765	1,183	91	3,673	

[1] U.S. Department of Commerce.
[2] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), p. 57.
[3] *Pulp & Paper International*, Vol. 42, No. 7 (July 2000), p. 53.
[4] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 45.
[5] Values of waste paper collections were estimated from unit values compiled and reported weekly by *Official Board Markets*.

Paper companies pursue a variety of waste paper supply strategies including long term contracts, joint ventures, and direct investment. Higher recovery levels may push purchasing agreements towards more formal, long term (greater than 2 years) contracts.[90] However, many supplier/purchaser relationships are based on informal agreements, and long term relationships are important. Often, smaller, urban paperboard mills or recycling centers rely heavily on spot purchases while mills that are located a greater distance from supply use longer term, formal supply contracts. Some companies struck long term supply agreements with paper stock dealers and brokers. For example, Stone Container Company and Waste Management Inc. (WMI) formed Paper Recycling International (PRI) through a joint venture in the early 1990s. PRI brokered the paper that WMI collected, supplying a large portion of it to Stone. Weyerhaeuser Company established their own waste paper processing plants and in the early 1990s signed a supply agreement with Browning-Ferris Industries (BFI), the nation's second-largest waste hauler.[91] Other paper companies, (e.g., Jefferson Smurfit Corp.) operate their own recycled fiber procurement divisions. After a wave of consolidation in the early 1990s, volatile markets or heavy debt caused some companies to retrench in the late 1990s. Some waste haulers (e.g., BFI and WMI) sold processing plants or reduced recovery efforts, and Weyerhaeuser sold 8 of its 41 processing facilities.[92]

[90] Bill Moore, "Recovered Paper Purchasing: No Longer a Sideline," *Pima's North American Papermaker*, Vol. 80, No. 3 (March 1998), p. 26.
[91] Pulp & Paper, *1999 North American Factbook*, p. 250.
[92] Ibid., p. 251.

Service is important to many waste paper generators that have limited space in which to collect outbound scrap paper. Often, waste paper purchasers leave their own semitrailers at the loading dock of the generator to allow loading waste paper directly onto the truck as it is generated. Alternatively, purchasers may agree to provide frequent, scheduled truck pickups for out-going waste paper.

As recovery rates rise, collection cost and fiber quality become more important issues. Recovery rates for bulk grades, which are easily collected and utilized, are high. However, the other grades are harder to recover; sources are not as well defined, or grades require separation. Inherently, mixed papers are not uniform and typically contain groundwood and chemical papers, coated and uncoated papers, and colored papers.[93] If price differentials warrant, collectors pick out premium material (e.g., white ledger) to sell separately and sell the remaining fiber as mixed waste. However, collectors do not remove contaminants, so mills utilizing mixed grades must contend with increased stickies,[94] increased brown fiber, increased contaminants, and shorter fiber lengths. Some de-inked pulp mills were designed to run clean, uniform grades of waste paper and cannot run a mixed waste stream and maintain product quality.[95] Mills able to utilize lower quality fiber while maintaining product quality have a competitive advantage, because additional sorting may cost $65 to $90 per metric ton.[96]

Sorting recycled paper is largely a manual process with attendant safety, quality, and cost issues. However, Weyerhaeuser and a manufacturer of sorting equipment for recycled plastics have developed an automatic paper sorting system. Using optical, infrared, and gloss sensors, the sorter is capable of producing a white ledger grade that is over 90 percent pure. The cost savings depend upon the difference between the cost for unsorted office waste paper and the price for recovered high grades and other residuals. Compared with manual sorting, the system offers large quantitative gains as the automatic sorter operates at speeds more than ten times as fast.[97]

The demand for waste paper, like wood pulp, is driven by demand for paper and paperboard products. Until the 1980s, demand was confined to small, regional markets,[98] and consumption was limited to mills that produced recycled tissue, paperboard, or industrial paper products. However, the growing numbers of mills that use waste paper and increasing prices have eliminated regionalism and diminished the relative importance of transportation cost. Often, consuming mills lower freight with backhauls or trading arrangements. It is no longer unusual for waste paper to be shipped great distances. By 1995 the United States had just two distinct waste paper markets, east and west.

---

[93] Tom W. Woodward, "Recycled Fiber Types, Processing History Affect Pulp Behavior During Papermaking," *Pulp & Paper,* Vol. 70, No. 8 (Aug. 1996), p. 81.

[94] Stickies are small residual particles of pressure sensitive adhesives, glues, or other gummy substances.

[95] Kirk Finchem, "Capacity Imbalance, Technical Issues Still Plague De-inked Pulp," *Pulp & Paper,* Vol. 72, No. 8 (Aug. 1998), p. 59, and Kirk J. Finchem, "Inferior Fiber Equipment Limits Challenge Older Recycled Mills," *Pulp & Paper,* Vol. 70, No. 6 (June 1996), p. 49.

[96] Interview with Weyerhaeuser Co. personnel, Baltimore, MD, Oct. 3, 2000.

[97] Ibid.

[98] William P. Moore, " Hot Commodity," *American Papermaker,* Vol. 58, No. 4 (Apr. 1995), p. 45.

Regulatory requirements to use recycled material have contributed to new demand. By the early 1990s, 13 States and Washington, DC, required newsprint manufacturers to use recycled material, and 13 additional States established voluntary targets. Other regulations mandated recycled content for all paper purchased by state and federal governments. Additional factors began to encourage the rapid growth in the use of recovered paper. Advances in papermaking technology solved some of the problems associated with the use of recycled fibers. High regional costs for virgin wood pulp increased the relative competitiveness of recycled paper mills. Construction projects for minimills[99] to produce recycled containerboard or tissue enjoyed easier permitting, lower capital costs, and smaller incremental capacity than virgin fiber projects. By 2000 approximately 240 mills in the United States used some recycled fiber; over 60 percent of those mills were 100 percent recycled fiber operations.[100]

Domestic consumption of corrugated grew from 15.0 million metric tons in 1995 to 18.7 million metric tons in 1999. (Table B-4 in appendix B charts consumption by grade during 1995-99.) This increase was the highest average annual rate of increase (4.5 percent) and the largest absolute growth (3.7 million metric tons) of any grade during the summary period. In 1999 domestic consumption of corrugated was 53 percent of the total. Consuming mills typically use corrugated waste paper to manufacture paperboard, containerboard, or other packaging papers. However, at least one North American mill has developed a technique to use corrugated to manufacture fine paper.[101] Mills that use both wood pulp and waste paper can adjust recycled usage as grade mix, prices, or market conditions require.

During 1995-99, domestic consumption of newspaper increased on average by 3 percent annually growing from 5.4 million metric tons to 6.4 million metric tons. Most newspaper is consumed by paper mills to manufacture newsprint, tissue, and paperboard, but it can also be used to manufacture molded pulp products (e.g., egg cartons). During 1995-99 consumption of newspaper for this end use grew 8 percent annually, and reached 1.4 million metric tons by 1999.

During 1995-99, domestic consumption of mixed papers grew by an average of 4.5 percent annually from 4.4 to 5.5 million metric tons. As with old newspaper, most mixed papers were consumed in paper mills, but some were also consumed in the manufacture of molded pulp products. Consuming mills are still learning to cope with contaminants, but some have the flexibility to use mixed paper for up to 30 percent of their furnish. Supply interruptions are another problem; during periods of reduced demand or low prices, collections stop. Higher prices for waste paper encourage mills to substitute less expensive mixed papers when possible, but low prices for hardwood pulp diminish this incentive. Finally, demand for one end use, roofing papers, has decreased as the use of fiberglass in roofing shingles has increased. In spite of these obstacles, total domestic consumption of mixed papers increased

[99] Minimills are small, technologically advanced, generally urban recycled paper mills. They produce moderate tonnage from a single fiber line feeding an uncomplicated but state-of-the-art paper machine incorporated in a low operating cost, minimum capital plant. Charles E. Swain, "Special Report - Industry Trend or Passing Fad," *International Papermaker,* Vol. 58, No. 2. (Feb. 1995), p. 39.

[100] Estimated by USITC staff.

[101] Domtar's Cornwall, Ontario mill manufactures fine paper entirely from OCC. Once repulped, recycled fibers are actually cooked to remove residual lignin before bleaching. Caroline Cagampan-Stoute, "Crystal Clear," *International Papermaker,* Vol. 58, No. 2 (Feb. 1995), p. 30.

by 1.1 million metric tons, the second-largest increase in absolute terms during the summary period.

Domestic consumption of high-grade de-inking and pulp substitutes was relatively flat during 1995-99. Consumption of high-grade de-inking increased from 2.7 million metric tons in 1995 to 2.9 million metric tons in 1999 (1 percent per year). Usage of pulp substitutes actually dropped slightly from 2.2 million metric tons in 1995 to 2.1 million metric tons in 1999. The price of MDIP peaked in 1995 at $955 per metric ton (figure 4) but subsequently plummeted to $425 per metric ton by 1997. The crash prevented all efforts to expand usage. De-inked pulp mills are no longer economically practical; the cost of manufacture for de-inked pulp now far exceeds that for virgin fiber pulp. Even facilities adjacent to paper mills, which enjoy considerable cost synergies, are not able to match the cost of virgin pulp.[102] Given that printing and writing papers containing recycled pulp generally sell for a lower price,[103] there is little incentive at present to expand usage of the high grades. However, as pulp markets improve, so too should the markets for high grades.

Waste Paper Pricing

Waste paper is generally sold F.O.B. at the seller's dock. Controlling the freight for inbound recycled fiber allows mills to take advantage of any backhaul opportunities that arise in conjunction with outbound freight from the mill. Figure 6 illustrates the very steep increase in prices which began in 1994. Excess supply, a slumping economy, and flat export demand restrained prices early in the decade, but in 1994 export and domestic demand recovered simultaneously. Low inventories and new production capacity[104] increased demand, but supply did not expand right away. The lagged supply response contributed to the large price increase during 1994-95. However, prices fell as quickly as they had risen, once supply expanded.

Increasing waste paper recoveries and low linerboard prices resulted in relatively stable prices in the early 1990s. However, beginning in 1994, several coincident factors--a seasonal (summer) slowdown in recovery, increased export demand, decreased inventories, and increased demand from new recycled capacity--resulted in a significant price increase. Starting from $18 per metric ton in January 1994, OCC prices rose to $110 by July, before settling to $80 in November. In 1995, OCC prices reached $200 per metric ton in July before declining to $25 in December of that year.[105] Mills reacted to higher prices by increasing inventories and substituting cheaper grades.

---

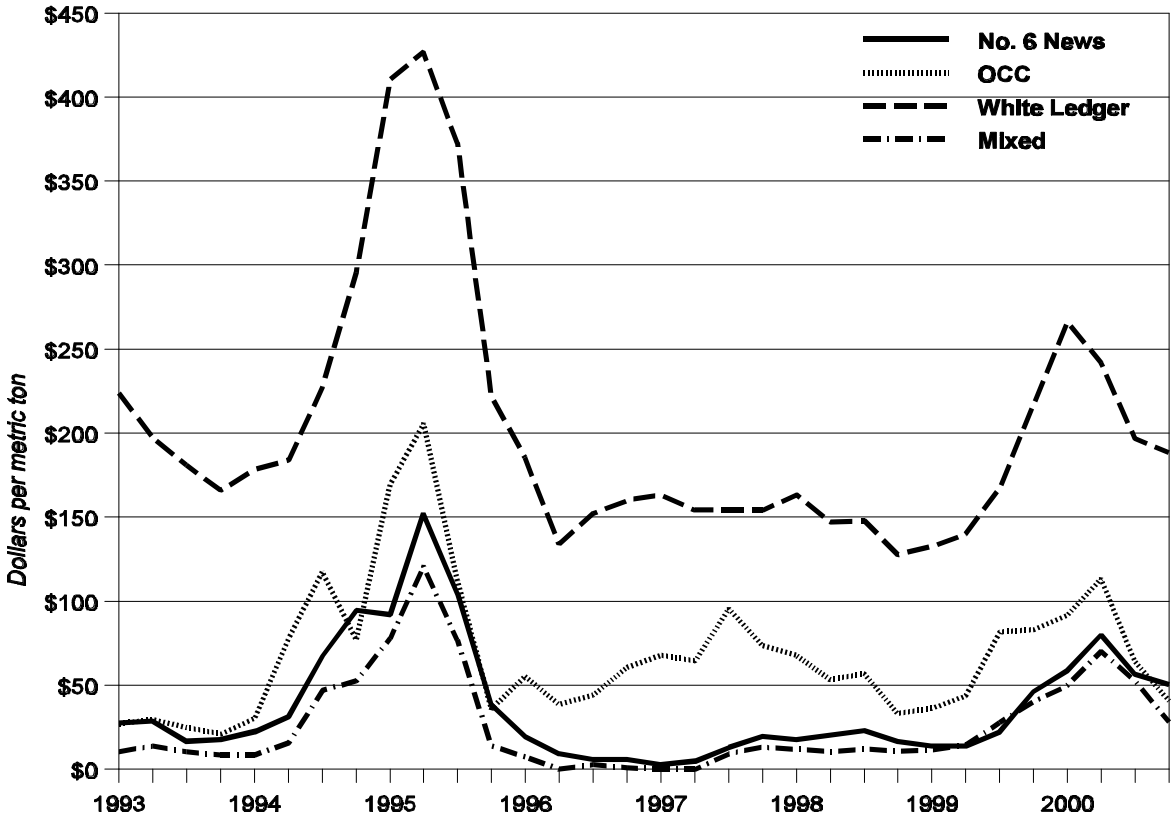
[102] The estimated manufacturing cost of a typical stand-alone facility is $100 to $150 per ton more than that for facilities adjacent to paper mills. Kirk Finchem, "Recovered Paper Collection Grows, but 50 percent Goal Remains Unlikely," *Pulp & Paper*, Vol. 72, No. 5 (May 1998), p. 85.

[103] "Capacity Imbalance, Technical Issues Still Plague De-inked Pulp" *Pulp & Paper*, Aug. 1998.

[104] New production capacity included both incremental capacity at existing mills and capacity from newly constructed mills.

[105] William P. Moore, "Volatile Market for Recovered Paper Makes Mill Use Predictions Difficult," *Pulp & Paper,* Vol. 70, No. 9 (Sept. 1996), p. 89.

Figure 6
Midwestern waste paper prices (dollars per metric ton, f.o.b. seller's dock), 1993-2000[1, 2]



[1] Source for prices prior to 1999 is: Pulp & Paper, *1999 North American Factbook*, (San Franscisco, Miller Freeman, Inc., 1998), pp. 255, 257, 258.
[2] 1999 and subsequent prices were compiled from prices reported by *Official Board Markets*.

U.S. IMPORTS

Wood Pulp

U.S. imports of wood pulp in 2000 were 6.6 million metric tons, an increase of 27 percent over the 1996 level (table 9). The value of wood pulp imports increased from $2.6 billion in 1996 to $3.3 billion in 2000. Imports accounted for 11.5 percent by weight of apparent consumption in 2000, up from 9.1 percent in 1996. All imports of wood pulp into the United States enter free of duty. U.S. imports of wood pulp come principally from two countries, Canada and Brazil. During each year of the period, imports from Canada accounted for more than 80 percent by weight of all U.S. imports. Proximity to the U.S. market, significant forest resources, and a large forest products industry all contributed to Canada's ability to supply the U.S. market. Most of the remaining balance is supplied by Brazil. In 2000, Canada and

Brazil accounted for 97 percent by weight of all U.S. wood pulp imports. During 1996-2000, Canada's share declined slightly from 84 to 81 percent, and Brazil's share increased from 11 to 16 percent.

Table 9
Wood pulp: U.S. imports for consumption by principal source, 1996-2000

Country	1996	1997	1998	1999	2000
	Value *(million dollars)*				
Canada	2,159	2,165	1,946	2,098	2,670
Brazil	277	270	296	333	476
South Africa	61	45	42	31	46
Chile	27	25	30	15	21
Sweden	9	9	7	9	19
Subtotal	2,533	2,513	2,320	2,487	3,233
All other	60	49	63	50	57
Total	2,593	2,562	2,383	2,537	3,290
	Quantity (*1,000 metric tons*)				
Canada	4,376	4,977	4,536	5,059	5,308
Brazil	545	584	674	821	1,056
South Africa	74	81	22	24	13
Chile	61	62	82	35	38
Sweden	26	17	19	27	54
Subtotal	5,081	5,722	5,343	5,965	6,469
All other	109	133	144	116	119
Total	5,190	5,854	5,478	6,081	6,588
	Unit value *(dollars per metric ton)*				
Canada	493	435	429	415	503
Brazil	508	462	439	407	451
South Africa	827	559	1,901	1,288	3,563
Chile	450	395	360	429	550
Sweden	332	496	369	326	358
Top 5-average	498	439	435	417	500
Others-average	551	367	435	428	477
All average	500	438	435	417	499

Note.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 10 shows wood pulp imports by grade. Strength and high quality allow kraft (sulfate) pulps to dominate U.S. imports and world trade in wood pulp. Kraft pulp accounted for 88 percent by weight of all U.S. wood pulp imports in 2000. Bleached softwood kraft pulp accounted for 68 percent of kraft pulp imports.[106] Imports from Canada are mainly NBSK. Bleached hardwood kraft, which includes bleached eucalyptus kraft pulp (BEK) imported from Brazil, accounts for most of the remainder.

Table 10
Wood pulp and waste paper: U.S. imports by grade, 1996-2000

Type	1996	1997	1998	1999	2000
	Value *(million dollars)*				
Groundwood pulps	32	27	28	36	30
Dissolving pulps	74	59	42	29	49
Kraft pulps	2,260	2,249	2,096	2,248	2,885
Sulfite pulps	121	97	106	106	160
Semichemical pulps	93	109	91	100	144
Recycled and other pulps	22	19	18		15
Total	2,593	2,562	2,383	2,537	3,290
Waste paper	55	77	60	60	91
Grand total	2,648	2,639	2,443	2,597	3,381
	Quantity (*1,000 metric tons*)				
Groundwood pulps	101	95	88	117	101
Dissolving pulps	92	101	18	9	12
Kraft pulps	4,478	5,081	4,830	5,356	5,806
Sulfite pulps	259	229	235	264	302
Semichemical pulps	234	299	258	296	336
Recycled and other pulps	27	51	49	40	32
Total	5,191	5,855	5,478	6,081	6,588
Waste paper	430	628	464	387	552
	Unit value (*1,000 dollars*)				
Groundwood pulps	312	281	318	306	357
Dissolving pulps	804	583	2,394	3,214	4,109
Kraft pulps	505	443	434	420	497
Sulfite pulps	469	426	452	402	530
Semichemical pulps	398	365	354	339	430
Recycled and other	467	428	387	452	469
Total pulp-average	500	438	435	417	499
Waste paper-average	128	122	130	156	165

Notes.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures. Combined wood pulp and waste paper unit values are not representative of either commodity and, therefore are not shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

[106] U.S. Department of Commerce import statistics.

Waste Paper

Imports of waste paper account for a small portion of total domestic consumption of waste paper. In 2000, only 552,000 metric tons valued at $91 million was imported and represented 1.6 percent of apparent consumption (table 8). Crossborder trade with Canada and Mexico accounts for virtually all (98 percent by weight) of 2000 waste paper imports (table 11).

Table 11
Waste paper: U.S. imports for consumption by principal sources, 1996-2000

Country	1996	1997	1998	1999	2000
	Value *(1,000 dollars)*				
Canada	50,452	67,064	54,326	55,710	84,436
Mexico	4,062	4,939	5,209	4,030	4,980
United Kingdom	47	3,041	6	78	797
Australia	106	430	336	195	439
New Zealand	0	0	0	0	186
Subtotal	54,667	75,474	59,877	60,013	90,838
All other	483	1,326	411	366	313
Total	55,151	76,800	60,288	60,379	91,150
	Quantity (*1,000 metric tons*)				
Canada	412,493	598,800	446,776	371,376	520,310
Mexico	15,065	17,666	14,633	13,036	21,704
United Kingdom	59	4,662	24	436	6,359
Australia	153	1,823	1,094	751	1,282
New Zealand	0	0	0	0	399
Subtotal	427,770	621,951	462,527	385,599	550,054
All other	1,963	6,348	1,081	909	1,457
Total	429,773	628,299	463,608	386,508	551,511
	Unit value *(dollar per metric ton)*				
Canada	122	112	122	150	162
Mexico	270	280	356	309	229
United Kingdom	798	652	237	180	125
Australia	694	523	307	259	343
New Zealand	([1])	([1])	([1])	([1])	466
Top 5 average	128	121	129	156	165
Others average	246	209	380	402	215
All average	128	122	130	156	165

Note.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures.

Source: Compiled from official statistics of the U.S. Department of Commerce.

U.S. EXPORTS

Wood Pulp

The quantity of U.S. wood pulp exports declined by 8.7 percent during 1996-2000, from 6.6 million metric tons in 1996 to 6.1 million metric tons in 2000. However, the total value of exports increased by 3.8 percent from $3.3 billion in 1996 to $3.4 billion in 2000 on the strength of higher prices in 2000. Downtime, reduced market pulp capacity, and the strength of the U.S. dollar all contributed to the decline in export volume. Exports in 2000 were equivalent to 10.6 percent by weight of total U.S. production.

Exports of wood pulp are widely dispersed. During 1996-2000, the United States shipped wood pulp to more than 100 countries. In 2000, the top 15 countries, which are shown in table 12, accounted for 85 percent (by weight) of all U.S. wood pulp exports. The top country in 2000, Japan, received about 13 percent of total exports. Europe and Asia were the top two regional markets during the period 1996-2000, with the top spot changing back and forth several times (table 13).

Table 14 shows U.S. pulp exports by grade during 1996-2000. Kraft pulp was at least 78 percent by weight of total wood pulp exports in each year and in 2000 comprised 80 percent of total pulp exports. Kraft pulp exports consisted of bleached softwood kraft (66 percent by weight of kraft pulp exports) and bleached hardwood kraft (31 percent by weight of kraft pulp exports).[107]

Waste Paper

The United States is the world's largest exporter of waste paper.[108] During 1996-2000 average annual growth of U.S. exports of waste paper was 8.7 percent by weight, and in 2000 U.S. waste paper exports reached 9.9 million metric tons. U.S. waste paper exports were equivalent to 17 percent by weight of collections in 1996 and 23 percent in 2000 (table 8). The value of waste paper exports increased from $745 million in 1996 to $1,183 million in 2000.

Table 15 shows the top 10 countries for waste paper exports ranked by value. Canada and Mexico are the largest markets, given the proximity of their mills to U.S. sources of waste paper. Seven of the remaining top 10 markets are Asian countries. Several factors help explain this. Asian mills may prefer U.S. waste paper because of its relatively high content of virgin fiber, may benefit from less expensive backhaul freight rates, and may have limited local supplies of waste paper.

[107] U.S. Department of Commerce export statistics.
[108] *International Fact and Price Book 1999*, p. 284.

Table 12
Wood pulp: U.S. exports by principal markets, 1996-2000

Country	1996	1997	1998	1999	2000
			Value *(million dollars)*		
Japan	521	478	409	416	494
Italy	296	312	293	245	342
Mexico	222	259	237	272	308
Korea	308	261	161	242	274
Germany	256	258	245	209	251
United Kingdom	201	195	129	128	214
Netherlands	130	137	130	95	160
China	141	103	99	124	155
France	197	183	187	121	142
Canada	122	121	105	102	137
Belgium	66	66	67	69	106
Brazil	72	84	85	90	97
Taiwan	134	112	75	82	77
Spain	70	68	54	45	70
Indonesia	94	89	28	50	50
Subtotal	2,831	2,724	2,304	2,288	2,878
All other	458	394	378	414	537
Total	3,289	3,118	2,682	2,702	3,415
			Quantity (*1,000 metric tons*)		
Japan	1,003	927	792	763	761
Italy	648	697	660	530	577
Mexico	533	731	711	768	874
Korea	735	611	406	543	496
Germany	380	355	357	316	354
United Kingdom	355	383	233	236	353
Netherlands	260	288	264	177	278
China	274	204	190	251	263
France	353	344	373	225	219
Canada	278	250	223	224	257
Belgium	115	124	145	143	189
Brazil	147	168	160	177	168
Taiwan	256	240	157	179	148
Spain	124	116	95	75	107
Indonesia	212	220	64	112	84
Subtotal	5,672	5,659	4,829	4,720	5,128
All other	964	842	812	859	928
Total	6,636	6,501	5,641	5,579	6,056
			Unit value *(dollar per metric ton)*		
Japan	520	515	516	545	649
Italy	457	447	443	461	592
Mexico	418	354	334	354	352
Korea	419	427	395	445	552
Germany	672	726	686	661	709
United Kingdom	568	509	553	540	608
Netherlands	498	475	493	535	573
China	517	506	523	495	591
France	557	533	502	539	650
Canada	441	484	469	458	536
Belgium	576	531	465	482	563
Brazil	489	498	534	508	577
Taiwan	524	465	476	458	520
Spain	568	584	572	596	651
Indonesia	443	403	436	448	596
Top 15 average	499	481	477	485	561
Other average	475	468	466	482	579
Al average	496	480	475	484	564

Note.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 13 Wood pulp: U.S. exports by region, 1996-2000

Country	1996	1997	1998	1999	2000
	Quantity (*1,000 metric tons*)				
Europe	2,375	2,454	2,309	1,899	2,302
Asia	2,880	2,501	1,874	2,182	2,071
North America	834	998	961	1,019	1,160
South America	392	441	376	392	385
Africa	109	75	84	51	106
Australia	46	31	37	35	33
Total	6,636	6,501	5,641	5,579	6,057

Note.—Because of rounding, figures may not add to totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 14
Wood pulp and waste paper: U.S. exports by grade, 1996-2000

Type	1996	1997	1998	1999	2000
	Value *(million dollars)*				
Groundwood pulps	29	53	20	38	49
Dissolving pulps	528	475	434	394	360
Kraft pulps	2,363	2,273	1,909	1,964	2,646
Sulfite pulps	195	139	110	78	86
Semichemical pulps	59	41	65	69	81
Recycled and other pulps	115	138	144	159	191
Total pulp	3,289	3,118	2,682	2,702	3,413
Waste paper	745	747	753	822	1,183
Grand total	4,034	3,865	3,435	3,524	4,596
	Quantity (*1,000 metric tons*)				
Groundwood pulps	89	161	57	124	143
Dissolving pulps	595	517	462	452	421
Kraft pulps	5,151	5,137	4,465	4,425	4,834
Sulfite pulps	495	347	269	193	193
Semichemical pulps	174	182	121	91	223
Recycled and other pulps	131	159	175	194	240
Total pulp	6,636	6,501	5,641	5,578	6,053
Waste paper	6,494	6,809	7,349	7,517	9,896
	Unit value *(dollars per metric ton)*				
Groundwood pulps	328	327	344	306	343
Dissolving pulps	887	923	940	872	855
Kraft pulps	459	442	428	444	547
Sulfite pulps	393	402	410	407	448
Semichemical pulps	340	226	306	363	365
Recycled and other pulps	877	865	821	820	796
Total pulp	496	480	475	484	564
Waste paper	115	110	102	109	120

Notes.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures. Combined wood pulp and waste paper unit values are not representative of either commodity and, therefore are not shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 15
Waste paper: U.S. exports by principal markets, 1996-2000

Country	1996	1997	1998	1999	2000
	Value *(million dollars)*				
Canada	156	187	205	220	318
Mexico	105	133	135	120	178
Korea	103	98	95	131	165
China	46	45	57	65	104
Indonesia	21	29	25	37	66
India	22	24	33	43	48
Thailand	23	20	18	23	39
Japan	53	44	33	36	39
Taiwan	62	49	39	32	37
Italy	17	8	11	21	30
Subtotal	606	637	652	728	1,022
All other	139	110	101	94	162
Total	745	747	753	822	1,183
	Quantity (*1,000 metric tons*)				
Canada	1,254	1,750	2,187	2,083	2,539
Mexico	923	1,110	1,123	916	1,056
Korea	1,031	970	965	1,207	1,158
China	645	787	1,000	1,187	1,856
Indonesia	283	345	339	373	533
India	152	164	261	287	478
Thailand	258	214	213	268	405
Japan	349	329	228	231	216
Taiwan	643	420	318	290	556
Italy	124	57	65	88	148
Subtotal	5,665	6,145	6,699	6,930	8,945
All other	832	664	650	587	951
Total	6,495	6,809	7,349	7,517	9,896
	Unit value *(dollars per metric ton)*				
Canada	125	107	94	106	125
Mexico	114	120	120	131	168
Korea	99	101	98	108	142
China	71	57	57	54	56
Indonesia	73	85	74	99	123
India	142	146	126	151	100
Thailand	90	96	83	86	98
Japan	151	135	147	157	179
Taiwan	96	116	122	110	66
Italy	134	135	171	242	201
Top 10 average	107	104	97	105	114
Other average	167	166	156	160	170
All average	115	110	102	109	120

Note.—Because of rounding, figures may not add to totals shown, and unit values were calculated with unrounded figures.

Source: Compiled from official statistics of the U.S. Department of Commerce.

U. S. TRADE MEASURES

Table 16 lists the subheadings and descriptions for Chapter 47 of the Harmonized Tariff Schedule of the United States. Since the Tariff Act of 1922, wood pulp and waste paper imports into the United States have been free of duty. In addition to their long-standing duty free status, imports of wood pulp and waste paper are not subject to any embargoes, quotas, or other nontariff barriers.

FOREIGN INDUSTRY PROFILE

In 2000 total estimated world production of wood pulp was 187 million metric tons, up 7.5 percent from 174 million metric tons in 1996. Important pulp-producing regions in 2000 included North America (40 percent of the world total), Europe (23 percent), and Asia (18 percent). These three regions accounted for 81 percent of global wood pulp production in 2000. Table 17 summarizes world pulp production by region. Approximately 23 percent of total 2000 production (44 million metric tons) was market pulp.[109]

Countries from each of the top producing regions are represented in the top 10 countries ranked by total and market pulp production (table18). In addition, South America is also represented on the lists of both top total and market pulp producers. In 2000, the top three pulp-producing countries by volume were the United States (30 percent), Canada (14 percent), and China (9 percent). The United States produced 57 million metric tons of wood pulp in 2000, almost one-third of total world production and more than twice as much as Canada, the next largest producer. However, Canada ranks first in market pulp production. Eight of the top 10 countries ranked by total production also appear in the top 10 for market pulp production. China and Japan, whose industries are oriented toward their domestic demand, are replaced on the list of top market pulp producers by Spain and Portugal, whose industries are oriented towards export markets.

Countries that import a large amount of wood pulp generally have a high consumption of paper and paperboard, and their domestic paper industry requires imports to supplement its internal supply of fiber. Europe and Asia are by far the largest regional importers of wood pulp. In 2000, Europe imported 16.5 million metric tons or 46 percent of total world imports. Asia imported 11.1 million metric tons or 31 percent of total world imports. Table 19 shows the top 10 wood-pulp importing countries and the U.S. portion of each country's imports.

[109] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001).

Table 16
Harmonized Tariff Schedule Chapter 47
Wood pulp and waste paper: Subheading, description, and rates of duty, 2000

HTS subheading	Description	Rates of duty			U.S. exports 2000	U.S. imports 2000
		General	Special	Column 2	*1,000 dollars*	
4701.00.00	Mechanical wood pulp	Free	None	Free	48,967	36,204
4702.00.00	Chemical wood pulp, dissolving grades	Free	None	Free	359,871	49,397
4703	Chemical wood pulp, soda or sulfate, other than dissolving grades:					
	Unbleached					
4703.11.00	Coniferous	Free	None	Free	41,102	63,253
4703.19.00	Nonconiferous	Free	None	Free	2,514	1,763
	Semibleached or bleached:					
4703.21.00	Coniferous	Free	None	Free	1,785,676	2,038,008
4703.29.00	Nonconiferous	Free	None	Free	816,214	781,880
4704	Chemical wood pulp, sulfite, other than dissolving grades:					
	Unbleached					
4704.11.00	Coniferous	Free	None	Free	3,918	5,276
4704.19.00	Nonconiferous	Free	None	Free	9,794	534
	Semibleached.or bleached:					
4704.21.00	Coniferous	Free	None	Free	51,627	111,375
4704.29.00	Nonconiferous	Free	None	Free	20,915	42,717
4705.00.00	Semichemical wood pulp	Free	None	Free	81,410	144,369
4706	Pulps of other fibrous cellulosic material:					
4706.10.00	Pulp from cotton linters	Free	None	Free	138,362	877
4706.20.00	Pulp from recycled fibers	Free	None	Free	31,643	9,775
	Other:					
4706.91.00	Mechanical	Free	None	Free	646	892
4706.92.00	Chemical	Free	None	Free	20,202	3,360
4706.93.00	Semichemical	Free	None	Free	1,696	87
4707	Waste and scrap of paper or paperboard:					
4707.10.00	Of unbleached kraft paper, paperboard, or corrugated	Free	None	Free	306,908	25,082
4707.20.00	Of paper or paperboard made mainly of bleached chemical pulp, not colored in the mass	Free	None	Free	283,858	13,815
4707.30.00	Of paper or paperboard made mainly of mechanical pulp	Free	None	Free	296,310	8,100
4707.90.00	Other, including unsorted scrap	Free	None	Free	296,084	44,154

Source: U.S. Department of Commerce, Harmonized Tariff Schedule of the United States.

Table 17
World wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
North America:						
Wood pulp:						
Mills (no.)	253	253	253	249	243	
			1,000 metric tons			
Capacity	91,163	93,060	93,472	92,745	92,184	1
Production	83,202	84,638	82,357	83,028	84,004	1
Capacity utilization (*percent*)	91	91	88	90	91	
Exports	15,299	15,500	14,899	15,734	16,240	6
Imports	5,774	6,632	6,055	6,710	7,186	24
Apparent consumption	73,677	75,770	73,513	74,004	74,950	2
Waste paper:						
Collections	43,106	46,051	46,047	48,274	50,655	18
Exports	7,098	7,522	7,952	8,028	10,232	44
Imports	3,762	4,211	4,199	4,126	4,319	15
Apparent consumption	39,770	42,740	42,294	44,372	44,742	13
Europe:						
Wood pulp:						
Mills (no.)	346	341	314	310	306	
			1,000 metric tons			
Capacity	54,347	54,384	55,085	53,067	51,681	-5
Production	39,324	42,527	42,871	44,511	47,756	21
Capacity utilization (*percent*)	72	78	78	84	92	
Exports	9,469	10,064	9,853	11,075	11,182	18
Imports	14,091	14,944	14,915	15,972	16,491	17
Apparent consumption	43,946	47,407	47,933	49,408	53,065	21
Waste paper:						
Collections	35,718	38,309	40,981	43,228	46,300	30
Exports	7,391	7,570	8,696	10,259	10,810	46
Imports	7,208	7,262	8,676	8,315	9,573	33
Apparent consumption	35,535	38,001	40,961	41,284	45,063	27
Asia:						
Wood pulp:						
Mills (no.)	[4]256	256	261	266	264	
			1,000 metric tons			
Capacity	48,658	45,157	46,822	47,780	47,985	-1
Production	37,036	36,208	35,244	36,477	38,285	3
Capacity utilization (*percent*)	76	80	75	76	80	
Exports	1,382	1,395	1,635	1,522	1,934	40
Imports	9,978	10,314	9,721	11,035	11,115	11
Apparent consumption	45,632	45,127	43,330	45,990	47,466	4
Waste paper:						
Collections	36,007	37,982	39,780	43,106	45,712	27
Exports	454	757	1,010	1,481	1,789	294
Imports	7,480	7,307	9,118	10,615	11,507	54
Apparent consumption	43,033	44,532	47,888	52,240	55,430	29
South America:						
Wood pulp:						
Mills (no.)	50	48	49	46	107	
			1,000 metric tons			
Capacity	11,723	11,674	11,788	12,024	12,524	7
Production	9,553	9,637	10,151	10,851	11,743	23
Capacity utilization (*percent*)	81	83	86	90	94	
Exports	3,692	3,686	4,642	5,118	4,991	35
Imports	561	666	650	711	671	20
Apparent consumption	6,422	6,617	6,159	6,444	7,423	16
Waste paper:						
Collections	3,563	3,642	4,041	4,055	4,368	23
Exports	12	12	28	25	34	183
Imports	256	354	231	220	352	38
Apparent consumption	3,807	3,984	4,244	4,250	4,686	23

Table 17—*Continued*
World wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Africa:						
Wood pulp:						
Mills (no.)	29	29	24	28	28	
			1,000 metric tons			
Capacity	3,220	3,370	3,380	3,455	3,673	14
Production	2,598	2,877	2,807	2,739	2,853	10
Capacity utilization (*percent*)	81	85	83	79	78	
Exports	958	1,109	1,077	979	995	4
Imports	306	237	261	294	330	8
Apparent consumption	1,946	2,005	1,991	2,054	2,188	12
Waste paper:						
Collections	1,011	1,063	1,209	1,246	1,313	30
Exports	8	5	1	0	2	-75
Imports	145	135	134	150	182	26
Apparent consumption	1,148	1,193	1,342	1,396	1,493	30
Australia/Oceania:						
Wood pulp:						
Mills (no.)	17	17	17	17	17	
			1,000 metric tons			
Capacity	2,814	2,814	2,814	2,814	2,914	4
Production	2,308	2,315	2,354	2,339	2,490	8
Capacity utilization (*percent*)	82	82	84	83	85	
Exports	681	589	707	629	676	-1
Imports	198	213	195	327	280	41
Apparent consumption	1,825	1,939	1,842	2,037	2,094	15
Waste paper:						
Collections	1,341	1,676	1,624	1,944	1,814	35
Exports	93	148	167	362	390	319
Imports	0	48	43	46	49	ERR
Apparent consumption	1,248	1,576	1,500	1,628	1,473	18
World total:						
Wood pulp:						
Mills (no.)	951	944	918	916	965	
			1,000 metric tons			
Capacity	211,925	210,459	213,361	211,885	210,961	-0
Production	174,021	178,202	175,784	179,945	187,131	8
Capacity utilization (*percent*)	82	85	82	85	89	
Exports	31,481	32,343	32,813	35,057	36,018	14
Imports	30,908	33,006	31,797	35,049	36,073	17
Apparent consumption	173,448	178,865	174,768	179,937	187,186	8
Waste paper:						
Collections	120,746	128,723	133,682	141,853	150,162	24
Exports	15,056	16,014	17,854	20,155	23,257	54
Imports	18,851	19,317	22,401	23,472	25,982	38
Apparent consumption	124,541	132,026	138,229	145,170	152,887	23

[1] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), p. 16-88.

[2] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), p. 10-63, and Pulp & Paper International, Vol. 41, No. 8 (Aug. 1999), pp. 29-43.

[3] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 5-74.

[4] Chinese pulp mills are not included in this figure. The total number of pulp mills in China has not been established but is estimated to be approximately 5,000.

Table 18
Total and market pulp production: Top 10 countries, 2000

Total pulp		Market pulp	
Country	**1,000 metric tons**	**Country**	**1,000 metric tons**
United States	57,002	Canada	11,123
Canada	26,411	United States	7,758
China	17,150	Sweden	3,877
Finland	11,910	Brazil	3,694
Sweden	11,517	Chile	2,076
Japan	11,399	Russia	2,000
Brazil	7,463	Finland	1,845
Russia	5,814	Indonesia	1,493
Indonesia	4,089	Spain	1,193
Chile	2,841	Portugal	1,160
Top 10 total	155,596	Top 10 total	36,219
All other	31,535	All other	7,451
Grand total	187,131	Grand total	43,670

Source: *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 5-74.

Table 19
Wood pulp: Major world importers and U.S. share of market, 2000

Country	Total imports[1]	U.S. portion[2]	Market share
	1,000 metric tons		*Percent*
Germany	4,320	354	8
China	3,356	263	8
Japan	3,096	761	25
Italy	2,991	577	19
France	2,299	219	10
South Korea	2,137	496	23
United Kingdom	1,661	353	21
Taiwan	817	148	18
Netherlands	785	278	35
Indonesia	746	84	11
Top 10 total	22,208	3,533	16
U.S. & other	13,865		
Grand total	36,073		

[1] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 5-74.
[2] U.S. Department of Commerce.

Asia and Europe are also the largest regional waste paper markets. In 2000, these two regions together accounted for 81 percent of world imports of waste paper.[110] The fact that seven of the top 10 waste-paper-importing countries (table 20) are common to the list of top wood pulp importers also indicates that those countries must supplement their domestic fiber supplies. Some countries on the list, such as Canada, also have relatively small domestic supplies of waste paper. In spite of an almost unlimited supply of virgin fiber, paper markets and content laws still compel Canada's paper manufactures to include recycled fiber in their paper products.

[110] In 2000, Asia's portion of world imports of waste paper was 44 percent, and Europe's was 37 percent.

Table 20
Waste paper: Major world importers and U.S. share of market, 2000

Country	Total imports[1]	U.S. portion[2]	Market share
	1,000 metric tons		*Percent*
China	3,563	1,856	52
Canada	2,277	[3]2,277	100
Indonesia	2,345	533	23
South Korea	1,963	1,158	59
Netherlands	1,895	41	2
Mexico	1,385	1,056	76
France	1,363	9	1
Germany	1,327	7	1
Taiwan	1,036	556	54
Thailand	952	405	43
Top 10 - total	18,106	9,448	52
Other	7,876		
Grand total	25,982		

[1] Source: *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 5-74.
[2] Source: U.S. Department of Commerce.
[3] U.S. Department of Commerce records total waste paper exports to Canada of 2539 metric tons.

The United States supplies a large share of both Canadian and Mexican waste paper imports. In 2000, waste paper from the United States accounted for all Canadian imports and 76 percent of Mexican imports. Five of the remaining eight largest waste paper markets are Asian countries (table 20). In some cases Asian countries have limited domestic supplies of waste paper, and the Pacific Rim is a natural outlet for waste paper exported from the West Coast of the United States. Europe, with strong waste- paper-recycling programs, often has surplus waste paper, which it, too, sends to Asian mills.

North America

Canada has significant forest resources and consistently leads the world in market pulp production. Canada's 48 pulp mills have a total capacity of 28 million metric tons[111] and are concentrated in Quebec, Ontario, and British Columbia. Total pulp production increased from 24.4 million metric tons in 1996 to 26.4 million tons in 2000 (table B-5). Market pulp production increased from 9.7 million metric tons in 1996 to 11.1 million metric tons in 2000. Production capacity far in excess of domestic demand and high quality products (e.g., NBSK) will likely allow the Canadian industry to maintain its current position. As is the case in the United States, environmental pressure on Canada's fiber base is increasing, particularly in coastal regions of British Columbia where there are extensive stands of old-growth timber.[112]

[111] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001)
[112] "Old-growth" refers to stands of very large, mature timber (typically in the Pacific Northwest) that have never been logged.

Mexico is not a major world producer of wood pulp. However, during 1996-2000 total pulp production increased by 71,000 metric tons to 582,000 metric tons.[113] Mexico's imports of wood pulp from the United States were fairly steady through the summary period (table 12). In 2000, Mexico was the largest U.S. customer by volume and third-largest by value (behind Japan and Italy).

Europe

In 2000, three European countries, Finland, Sweden, and Russia, ranked in the top 10 world pulp producers. The Nordic countries, traditionally an important source of forest products, are well-positioned to meet European demand. Together, Finland and Sweden produced over 23 million metric tons of pulp (13 percent of total world production) in 2000. Finland has 43 generally modern pulp mills with a total capacity of 13.6 million metric tons (table B-8). Sweden has 45 pulp mills with a capacity 11.7 million metric tons. Nordic companies have been actively restructuring; both local and international mergers have been completed recently.

Russia has 35 pulp mills with a total estimated capacity of 6 million metric tons but recently has diverted some market pulp to the domestic manufacture of paper and paperboard; currency devaluations have made imported pulp prohibitively expensive for Russian paper mills.[114]

Eucalyptus plantations are being established on the Iberian Peninsula. Both Portugal and Spain are in the top 10 countries ranked by market pulp production, and the European industry has access to a local supply of high-quality bleached eucalyptus kraft (BEK) pulp. In 1998 Portugal had 600,000 hectares (ha) or 1.5 million acres of Eucalyptus plantation.[115] Portugal has 7 pulp mills with a total capacity of 1.8 million metric tons.

Annual per capita consumption of paper and paperboard in the European Union grew by more than 4 percent annually during 1996-2000 and in 2000 averaged 210.5 kg. In spite of the availability of pulp from traditional Nordic suppliers and the new Iberian producers, Europe should remain an important market for U.S. producers as consumption of paper and paperboard in eastern Europe, (per capita consumption of 29.1 kg in 2000) increases.

Asia

Asia's portion of the world's total pulp production increased steadily during the first half of the 1990s and was 38.3 million metric tons (20 percent of world production) in 2000. Major producing countries in Asia include China, Japan, and Indonesia.

China's production of wood pulp declined slightly during 1996-2000 to 17.2 million metric tons in 2000 (table B-7). Its total pulp capacity in 2000 was estimated to be 20 million metric tons. The total number of pulp mills in China has not been established definitely but is

[113] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p.9

[114] Ibid., p. 35.

[115] "The State of the Industry," FAO Advisory Committee on Paper and Wood Products, found at *http://www.fao.org/forestry/fop/fopw/gfsm/acpwp/40/indus.htm*, retrieved June 20, 2000, p 45.

estimated to be approximately 5,000. Many are small mills[116] that lack the scale necessary to compete effectively now that China has entered the WTO. Chinese manufacturers, therefore, are making large investments to upgrade capacity. Foreign competition (through foreign investment in Chinese mills) is already changing the complexion of pulp production in China. Limited raw material supply is a significant impediment to further growth as China's industry shifts away from paper products made with imported, virgin fiber paper towards those made with domestic, recycled paper.[117] Although China ranks third in total pulp production, it ranks twenty-third in market pulp production. Expanding domestic demand will likely continue to absorb China's increasing output.

Japan's 44 pulp mills have an estimated pulping capacity of 15.6 million metric tons. Like China, domestic wood fiber supply is constrained in Japan, and most of Japan's production goes towards meeting domestic demand. Japan's industry has become adept at using recycled fiber, especially in higher, value-added grades of paper. Its industry is moving toward elemental-chlorine-free bleaching more in response to pending environmental restrictions rather than to changing consumer preferences as in Europe.[118] Japanese pulp and paper companies are consolidating (e.g., Nippon and Daishowa). Japan is thirteenth when ranked by market pulp production.

In 1990 Indonesia had an estimated 1.1 million metric tons of pulp capacity.[119] By 2000, however, the country's 14 very large, generally modern pulp mills had an estimated capacity of 5.2 million metric tons. Unlike other Asian nations, Indonesia has a large wood fiber base, and pulp and paper production was an integral part of its national land and forest resource management plan.[120] Fiber from native forests was to be supplemented and ultimately supplanted by the establishment of plantations of fast-growing tree species, particularly of the genus, *Acacia.*[121] "Conversion forests" were allocated to major producers for harvesting and planting.[122] Annual growth or mean annual increment (MAI) of the plantations was initially reported to be 15-20 cubic meters per hectare per year but generally improved to 20-25 cubic meters per hectare per year.[123] Industry growth was aided by the restructuring of the banking

---

[116] China's small mills are estimated to have an average production capacity of 2,500 metric tons per year. "Annual Review," *Pulp & Paper International,* Vol. 42, No. 7 (July 2000), p. 55.

[117] Zhenlei Cao, "China: Now and in the Future", *Tappi Journal*, Vol. 79, No. 5 (May, 1996), p. 68.

[118] "Waste Paper: Rising Demand Raises Problems," *International Papermaker*, Aug. 1996

[119] Pulp & Paper International, *1999 International Price and Factbook*, p. 36.

[120] Coleman, Matthew J., "Tropical Forestry: Acacia Plantations in Indonesia," *Tappi Journal*, Vol. 81, No. 12, (Dec. 1998), p. 43.

[121] Most plantations were established with either *Acacia mangium* or *Acacia crassicarpa*, but *Gmelina arborea* and *Eucalyptus deglupta* were also planted. Barr, Christopher, "Profits on Paper: The Political-Economy of Fiber, Finance, and Debt in Indonesia's Pulp and Paper Industries," to be published as a chapter in the forthcoming book, *A Critical Assessment of Structural Adjustment in Indonesia's Forest and Estate Crop Industries*, CIFOR and WWF-International, Nov. 2000.

[122] Barr, Christopher, "Profits on Paper: The Political-Economy of Fiber, Finance, and Debt in Indonesia's Pulp and Paper Industries," to be published as a chapter in the forthcoming book, *A Critical Assessment of Structural Adjustment in Indonesia's Forest and Estate Crop Industries*, CIFOR and WWF-International, Nov. 2000.

[123] Ibid.

system and a period of relative civil and political stability which lasted until 1998.[124] Indonesian pulp producers reacted to the subsequent political and financial storms by shifting production to export markets as domestic demand for wood pulp contracted.[125] Recently, however, they have staggered under the very heavy debt incurred during the wave of expansion. Current operations as well as plans for further expansion are threatened as allegations of financial mismanagement and wrongdoing have emerged.[126]

Moreover, the fiber supply at some Indonesian mills is in question. Fiber available from plantations is uncertain because mills have allegedly overstated the area of plantations actually established, because soil degradation resulting from intensive plantation management has inhibited the growth of subsequent rotations, and because local villagers have reclaimed for oil palm production some of the land previously allotted to industry for fiber production.[127] Fiber available from natural forests is uncertain because forest fires have reduced the lawful production from native forests and because mills have allegedly obtained wood fiber from undocumented sources, particularly native forests which have been logged unlawfully.[128] It has recently been reported that pulp production in Indonesia is being constrained by the supply of wood chips.[129] The alternative for Indonesian mills facing inadequate local fiber supplies is to import relatively expensive wood chips from New Zealand or Australia.

Asia is likely to remain an important market for U.S. producers of wood pulp. Domestic supplies of wood fiber are limited in several Asian markets (e.g., Japan, Taiwan, and Korea) that have well-developed paper industries and high per capita consumption of paper and paperboard products.[130] Also, China's per capita consumption of paper and paperboard has risen quickly and is expected to continue rising.[131] As its paper industry grows to meet the new demand, China is expected to remain a major importer of softwood pulp.[132]

---

[124] "Annual Review," *Pulp & Paper International*, Vol. 42, No. 7 (July 2000), p. 58.

[125] Richard Altwarg and Matthew Coleman, "Indonesian Update: A Country in Change, An Industry in Recovery," *Tappi Journal*, Vol. 81, No. 9 (Sept. 1998), p. 53.

[126] Barr, "Profits on Paper ...," CIFOR, Nov. 2000.

[127] Brian Stafford, "Indonesia Debt and Disappearing Wood Challenge Pulp and Paper Mills," Pima's Asia Pacific Papermaker, Vol. 10 No. 9 (Sept. 2000), pp. 19-22.

[128] Barr, "Profits on Paper ...," CIFOR, Nov. 2000.

[129] "APRIL starts up 700,000 tonne/yr bleached hardwood pulp line in Indonesia," found at *http://www.paperloop.com* and retrieved on June 1, 2001.

[130] *Pulp & Paper International*, Vol. 42, No. 7 (July 2000), p. 8.

[131] During the 1990s' China's per capita consumption increased on average by 8.4 percent per year. *Pulp & Paper International*, Vol. 42, No. 7, (July 2000), p. 8. *Pulp & Paper International*, Vol. 33, No. 7, (July 1991), p. 268.

[132] Zhenlei Cao, "China: Now and in the Future", *Tappi Journal*, Vol. 79, No. 5 (May, 1996), p. 68.

South America

As production of wood fiber from natural forests throughout the world is constrained either by depletion or increased regulations, those countries that can grow wood fiber the fastest will have a significant natural advantage in the production of wood pulp.[133] The natural advantage afforded by the combination of fast-growing tree species and the highly favorable growing conditions inherent to parts of the continent has long been recognized, but development of a South American wood pulp industry was constrained by lack of a supporting infrastructure. Slowly, this obstacle has been overcome, and at present, all large South American companies have announced wood pulp capacity expansions. Were all announced projects to be completed, an extra 2.5 million metric tons of capacity would be added in the next 2 or 3 years. Future expansion plans will likely focus on Brazil and Argentina, both of which have available land resources.[134]

During the 1990s, Brazil's total pulp production grew at an average annual rate of 5 percent. Most of Brazil's production is exported.[135] By 2000, Brazil ranked seventh in total pulp production and fourth in market pulp production and had total wood-pulping capacity of 7.9 million metric tons (table B-6). Brazil's capacity will continue to expand as current expansion projects reach completion. It is estimated that by 2005 Brazil's capacity will top 11 million metric tons.[136]

Plantations of exotic, fast-growing eucalyptus trees provide the wood fiber for Brazil's expanding production. The country's eucalyptus plantations increased from less than 1 million hectares (1.7 million acres)[137] in 1990 to 1.6 million hectares (4 million acres) in 1999.[138] In addition to the increasing land base committed to production of eucalyptus, genetic improvement of the growing stock has also increased the already high yields of eucalyptus plantations. Eucalyptus clones that exhibit both disease resistance and low nutritional demand are favored. In 1990 MAI was estimated to be about 35 cubic meters per hectare per year (5 cunits per acre per year).[139] By 1999, MAI had increased to 45-50 cubic meters per hectare per year (6.5-7 cunits per acre per year), and it is expected to reach 80 cubic meters per hectare per year (11 cunits per acre per year) within a decade.[140] By contrast average productivity in the Southeastern United States is less than 1 cunit per acre per year,[141] and that

[133] "Global Outlook for Plantations," FAO Advisory Committee on Paper and Wood Products, found at *http://www.fao.org/forestry/fop/fopw/gfsm/acpwp/40/carne.htm*, retrieved June 20, 2000, p. 9.

[134] Comments of Sergio Almeida at the Market Pulp Symposium 2000 in Brussels found at *www.paperloop.com/inside/stories/wk05_15_2000/14.shtml*, retrieved June 19, 2000.

[135] Alarcon, Victor, "Aracruz: A view from the top," Pima's International Papermaker, Vol. 83, No. 5 (May 2001), p. 40.

[136] "Annual Review," *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), p. 63.

[137] One hectare equals 2.471 acres.

[138] Almeida, Market Pulp Symposium comments.

[139] One cunit equals 100 cubic feet ro 2.83 cubic meters.

[140] Almeida, Market Pulp Symposium comments and "The State of the Industry," FAO Advisory Committee on Paper and Wood Products, found at *http://www.fao.org/forestry/fop/fopw/gfsm/acpwp/40/indus.htm*, retrieved June 20, 2000.

[141] D. N. Wear, 1996. Forest Management and Timber Production in the U.S. South [Document prepared for Canada/United States lumber consultations]. SCFER Working

of intensively managed plantations in the U.S. Southeast is approximately two cunits per acre per year.[142]

Other factors contributing to Brazil's competitive position and, hence, the continued growth of its wood pulp industry are rising domestic demand, devaluation of the real against the dollar, and continued cost control. Cost cutting efforts include lower fiber costs through mechanized harvesting, lower logistics costs, reduced head counts, increased scale of mills, and consolidations. It was estimated that in 1999, some 5 million metric tons of South American wood pulp were produced at a cash cost of less than $300 per ton (based on delivery to the Northern European market).[143]

Chile's industry has also grown very rapidly. During the 1990s, Chile's wood pulp production increased on average 12 percent per year, and by 2000 Chile ranked 10th in total world pulp production (2.8 million metric tons) and fifth in market pulp production (2.1 million metric tons). Chile's 11 pulp mills had a capacity of 2.7 million metric tons in 2000. By 1996 a total of approximately 1.9 million hectares (5 million acres) of plantations had been established. Approximately 300,000 hectares (741,000 acres) were eucalyptus, but most, 1.3 million hectares (3 million acres),[144] were an exotic softwood species, Radiata Pine (*Pinus radiata*).[145] Growth rates range from 10-40 m^3 per hectare per year (1.5-5.7 cunits per acre per year). Chile is also establishing plantations of southern yellow pines[146] for both wood pulp and solid wood products. Growth averages from 30-33 m^3 per hectare per year.[147]

FOREIGN TRADE MEASURES

Although wood pulp is processed wood fiber, it is nonetheless regarded as a raw material. In all major markets for wood pulp, there is little or no duty on imports. Likewise, wastepaper generally is free of duty. Shipments to the European Union, Indonesia, and Japan are duty-free. China has a tariff rate of 1 percent. Taiwan duties on wood pulp and waste paper range from free to 2.5 percent. Trade in wood pulp and waste paper is generally not affected by nontariff barriers.

Paper(82):1-40. Southeastern Center for Forest Economics Research, Research Triangle Park, NC.

[142] F. W. Cubbage, Siry, R. Abt, D. Wear, and S. Moffat. 1999 Forest Productivity and Timber Supply Modeling in the South. pp. 285-290 IN: Ek, A. R. and B. Zumbahlen. Duluth MN. Conference Proceedings: Improving Forest Productivity for Timber, Dec. 1, 1998.

[143] Almeida, Market Pulp Symposium comments.

[144] "The Chilean Forestry Sector of Today and Its Projections for the Coming Century," found at *www.dicelpa.cl/iproyec.htm*, retrieved June 21, 2000.

[145] Known also as Monterrey Pine, *Pinus radiata* is a species indigenous to California that has been widely planted as an exotic for pulp and wood products production in South America, New Zealand, and Australia.

[146] Southern yellow pines are 11 species of pine indigenous to the Southern United States, the most commercially important of which are loblolly pine (*Pinus taeda*) and slash pine (*Pinus elliottii*). These species are now being planted as exotics in South America.

[147] Maria Rosario, "Arauco Makes the Most of Difficult Times," *Pima's Papermaker*, Aug. 2000, p. 25.

U.S. TRADE BALANCE

Table 21 summarizes the annual trade balance for wood pulp during 1996-2000. The trade balance remained positive in spite of a 2-million-metric-ton swing in volume.[148] The trade balance dropped in each year of the period from almost $700 million in 1996 to $125 million in 2000. Given the cyclical nature of the industry, however, it is not clear that this trend will continue. Wood pulp prices recovered in 2000 from the relatively low prices observed earlier in the period, and demand for wood pulp will continue to grow with the increased consumption of paper and paperboard particularly in regions such as Asia and Eastern Europe.

Table 21
Wood pulp: U.S. trade balance, 1996-2000

Country	1996	1997	1998	1999	2000
	Exports by principal market *(million dollars)*				
Japan	521	478	409	416	494
Italy	296	312	293	245	342
Mexico	222	259	237	272	308
Korea	308	261	161	242	274
Germany	256	258	245	209	251
United Kingdom	201	195	129	128	214
Netherlands	130	137	130	95	160
China	141	103	99	124	155
France	197	183	187	121	142
Canada	122	121	105	102	137
Belgium	66	66	67	69	106
Brazil	72	84	85	90	97
Taiwan	134	112	75	82	77
Spain	70	68	54	45	70
Indonesia	94	89	28	50	50
Subtotal	2,831	2,724	2,304	2,288	2,878
All other	458	394	378	414	537
Total	3,289	3,118	2,682	2,702	3,415
	Imports for consumption by principal source (*million dollars*)				
Canada	2,159	2,165	1,946	2,098	2,670
Brazil	277	270	296	333	476
South Africa	61	45	42	31	46
Chile	27	25	30	15	21
Sweden	9	9	7	9	19
Subtotal	2,533	2,513	2,320	2,487	3,233
All others	60	49	63	50	57
Total	2,593	2,562	2,383	2,537	3,290
	Trade balance *(million dollars)*				
Total exports	3,289	3,118	$2,682	2,702	3,415
Total imports	2,593	2,562	2,383	2,537	3,290
Trade balance	696	556	299	165	125

Note.—Because of rounding, figures may not add to totals shown. Import values are based on customs value; export values are based on f.a.s. values.

Source: Compiled from official statistics of the U.S. Department of Commerce.

[148] During 1996-2000 , exports decreased by 580,000 metric tons, and imports increased by 1.4 million metric tons.

Table 22 summarizes the annual trade balance for waste paper 1996-2000. After remaining relatively stable during the first 3 years of the period, the balance for waste paper increased about $400 million from $690 million in 1996 to $1.1 billion in 2000. Given the large U.S. domestic supply of waste paper, it is unlikely that the waste paper trade balance will be negative, at least in the foreseeable future. Future export levels will likely be determined by total demand for pulp and paper products and the growing domestic demand for waste paper.

Table 22
Waste paper: U.S. trade balance, 1996-2000

Country	1996	1997	1998	1999	2000
	Exports by principal market *(million dollars)*				
Canada	156	187	205	220	318
Mexico	105	133	135	120	178
Korea	103	98	95	131	165
China	46	45	57	65	104
Indonesia	21	29	25	37	66
India	22	24	33	43	48
Thailand	23	20	18	23	39
Japan	53	44	33	36	39
Taiwan	62	49	39	32	37
Italy	17	8	11	21	30
Subtotal	606	637	652	728	1,022
All other	139	110	101	94	162
Total	745	747	753	822	1,183
	– Imports for consumption by principal source (*million dollars*) –				
Canada	50.5	67.1	54.3	55.7	84.4
Mexico	4.1	4.9	5.2	4.0	5.0
United Kingdom	(1)	3.0	(1)	0.1	0.8
Australia	0.1	0.3	0.3	0.2	0.4
New Zealand	0.0	0.0	0.0	0.0	0.2
Subtotal	54.7	75.5	59.9	60.0	90.8
All other	0.5	1.3	0.4	0.4	0.3
Total	55.2	76.8	60.3	60.4	91.2
	Trade balance *(million dollars)*				
Total exports	745	747	753	822	1,183
Total imports	55	77	60	60	91
Trade balance	690	670	693	762	1,092

Note.—Because of rounding, figures may not add to totals shown. Import values are based on customs value; export values are based on f.a.s. values.

Source: Compiled from official statistics of the U.S. Department of Commerce.

APPENDIX A
EXPLANATION OF TARIFF AND TRADE AGREEMENT TERMS

TARIFF AND TRADE AGREEMENT TERMS

In the ***Harmonized Tariff Schedule of the United States*** (HTS), chapters 1 through 97 cover all goods in trade and incorporate in the tariff nomenclature the internationally adopted Harmonized Commodity Description and Coding System through the 6-digit level of product description. Subordinate 8-digit product subdivisions, either enacted by Congress or proclaimed by the President, allow more narrowly applicable duty rates; 10-digit administrative statistical reporting numbers provide data of national interest. Chapters 98 and 99 contain special U.S. classifications and temporary rate provisions, respectively. The HTS replaced the *Tariff Schedules of the United States* (TSUS) effective January 1, 1989.

Duty rates in the ***general*** subcolumn of HTS column 1 are normal trade relations rates, many of which have been eliminated or are being reduced as concessions resulting from the Uruguay Round of Multilateral Trade Negotiations. Column 1-general duty rates apply to all countries except those listed in HTS general note 3(b) (Afghanistan, Cuba, Laos, North Korea, and Vietnam) plus Serbia and Montenegro, which are subject to the statutory rates set forth in column 2. Specified goods from designated general-rate countries may be eligible for reduced rates of duty or for duty-free entry under one or more preferential tariff programs. Such tariff treatment is set forth in the ***special*** subcolumn of HTS rate of duty column 1 or in the general notes. If eligibility for special tariff rates is not claimed or established, goods are dutiable at column 1-general rates. The HTS does not enumerate those countries as to which a total or partial embargo has been declared.

The ***Generalized System of Preferences*** (GSP) affords nonreciprocal tariff preferences to developing countries to aid their economic development and to diversify and expand their production and exports. The U.S. GSP, enacted in title V of the Trade Act of 1974 for 10 years and extended several times thereafter, applies to merchandise imported on or after January 1, 1976 and before the close of September 30, 2001. Indicated by the symbol "A", "A*", or "A+" in the special subcolumn, the GSP provides duty-free entry to eligible articles the product of and imported directly from designated beneficiary developing countries, as set forth in general note 4 to the HTS. Eligible products of qualifying sub-Saharan African countries may qualify for duty-free entry under the ***African Growth and Opportunity Act*** (AGOA), under the terms of general note 16 to the tariff schedule, through September 30, 2008, as indicated by the symbol “D” in the special subcolumn and as set forth in subchapter XIX of chapter 98.

The ***Caribbean Basin Economic Recovery Act*** (CBERA) affords nonreciprocal tariff preferences to developing countries in the Caribbean Basin area to aid their economic development and to diversify and expand their production and exports. The CBERA, enacted in title II of Public Law 98-67, implemented by Presidential Proclamation 5133 of November 30, 1983, and amended by the Customs and Trade Act of 1990, applies to merchandise entered, or withdrawn from warehouse for consumption, on or after January 1, 1984. Indicated by the symbol "E" or "E*" in the special subcolumn, the CBERA provides duty-free entry to eligible articles, and reduced-duty treatment to certain other articles, which are the product of and imported directly from designated countries, as set forth in general

note 7 to the HTS. Eligible products of qualifying beneficiary countries may qualify for duty-free or reduced-duty entry under the ***Caribbean Basin Trade Partnership Act*** (CBTPA), under the terms of general note 17 to the tariff schedule, through September 30, 2008, as indicated by the symbol "R" in the special subcolumn and in subchapter XX of chapter 98.

Free rates of duty in the special subcolumn followed by the symbol "IL" are applicable to products of Israel under the ***United States-Israel Free Trade Area Implementation Act*** of 1985 (IFTA), as provided in general note 8 to the HTS.

Preferential nonreciprocal duty-free or reduced-duty treatment in the special subcolumn followed by the symbol "J" or "J*" in parentheses is afforded to eligible articles the product of designated beneficiary countries under the ***Andean Trade Preference Act*** (ATPA), enacted as title II of Public Law 102-182 and implemented by Presidential Proclamation 6455 of July 2, 1992 (effective July 22, 1992), as set forth in general note 11 to the HTS.

Preferential free rates of duty in the special subcolumn followed by the symbol "CA" are applicable to eligible goods of Canada, and rates followed by the symbol "MX" are applicable to eligible goods of Mexico, under the ***North American Free Trade Agreement***, as provided in general note 12 to the HTS and implemented effective January 1, 1994 by Presidential Proclamation 6641 of December 15, 1993. Goods must originate in the NAFTA region under rules set forth in general note 12(t) and meet other requirements of the note and applicable regulations.

Other special tariff treatment applies to particular ***products of insular possessions*** (general note 3(a)(iv)), ***products of the West Bank and Gaza Strip*** (general note 3(a)(v)), goods covered by the ***Automotive Products Trade Act*** (APTA) (general note 5) and the ***Agreement on Trade in Civil Aircraft*** (ATCA) (general note 6), ***articles imported from freely associated states*** (general note 10), ***pharmaceutical products*** (general note 13), and ***intermediate chemicals for dyes*** (general note 14).

The ***General Agreement on Tariffs and Trade 1994*** (GATT 1994), pursuant to the Agreement Establishing the World Trade Organization, is based upon the earlier GATT 1947 (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) as the primary multilateral system of disciplines and principles governing international trade. Signatories' obligations under both the 1994 and 1947 agreements focus upon most-favored-nation treatment, the maintenance of scheduled concession rates of duty, and national treatment for imported products; the GATT also provides the legal framework for customs valuation standards, "escape clause" (emergency) actions, antidumping and countervailing duties, dispute settlement, and other measures. The results of the Uruguay Round of multilateral tariff negotiations are set forth by way of separate schedules of concessions for each participating contracting party, with the U.S. schedule designated as Schedule XX. Pursuant to the **Agreement on Textiles and Clothing** (ATC) of the GATT 1994, member countries are phasing out restrictions on imports under the prior "Arrangement Regarding International Trade in Textiles" (known as the **Multifiber Arrangement** (MFA)). Under the MFA, which was a departure from GATT 1947 provisions, importing and exporting countries negotiated bilateral agreements limiting textile and apparel shipments, and importing countries could take unilateral action in the absence or violation of an agreement. Quantitative limits had been established on imported textiles and apparel of cotton, other vegetable fibers, wool, man-made fibers or silk blends in an effort to prevent or limit market disruption in the importing countries. The ATC establishes notification and safeguard procedures, along with other rules concerning the customs treatment of textile and apparel shipments, and calls for the eventual complete integration of this sector into the GATT 1994 over a ten-year period, or by Jan. 1, 2005.

APPENDIX B
STATISTICAL TABLES AND FIGURES

Table B-1
Wood pulp: U.S. total and market capacity by State and region, 2000

Country	Total	Market	Country	Total	Market
	1,000 metric tons				*1,000 metric tons*
South:			**Mid-West**:		
Alabama	6,533	1,382	Wisconsin	1,785	0
Georgia	6,354	1,746	Michigan	1,489	279
Louisiana	4,114	111	Minnesota	1,288	0
South Carolina	3,507	641	Ohio	545	25
Mississippi	2,926	1,255	Indiana	95	35
North Carolina	2,725	950	Iowa	48	0
Florida	2,723	735	Missouri	19	0
Arkansas	2,665	149	Regional total	5,268	340
Virginia	2,407	0	Percent of total	9	3
Texas	2,158	396			
Tennessee	1,767	200	**North East**:		
Kentucky	756	282	Maine	1,878	456
Oklahoma	699	0	Pennsylvania	1,002	0
Maryland	280	0	New York	587	0
Delaware	6	0	New Hampshire	321	111
Regional total	39,619	7,847	Regional total	3,788	567
Percent of total	71	81	Percent of total	7	6
Pacific Northwest:			Grand total	56,159	9,779
Washington	3,677	533			
Oregon	2,476	238			
Montana	508	0			
Idaho	413	51			
California	410	203			
Regional total	7,483	1,026			
Percent of total	13	10			

Source: *2000 Lockwood Post's Directory*, (San Francisco, Miller Freeman, Inc., 1999), pp. 37-152.

Table B-2
Regional comparison of total delivered manufacturing costs for bleached softwood kraft

	British Columbia		Eastern	United States			
Year	**Coast**	**Interior**	**Canada**	**West**	**South**	**Finland**	**Sweden**
	Dollars per metric ton						
1997	524	447	437	437	431	393	400
1996	596	525	473	537	417	479	519
1995	664	619	466	592	398	507	529
1994	487	476	406	507	369	426	403

Source: Pulp & Paper, *1999 North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998), p. 212.

Table B-3
Market pulp: Canadian, U.S., Finnish, and Swedish manufacturing costs for bleached softwood kraft, 1997

	British Columbia		Eastern	United States			
Year	Coast	Interior	Canada	West	South	Finland	Sweden
	Dollars per metric ton						
Wood fiber	171	134	179	125	159	233	210
Chemicals	51	51	45	63	49	41	43
Energy	37	25	23	36	24	(1)	12
Labor	92	73	68	58	70	32	48
Other	105	80	57	57	53	51	40
Total mill costs	455	363	372	338	355	356	353
S.G. & A.	14	21	20	24	11	0	8
Delivery	55	61	45	74	65	37	40
Total delivered cost	524	447	437	437	431	393	400

Source: Pulp & Paper, *1999 North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998), p. 211.

Table B-4
Waste paper: U.S. consumption by grade, 1995-99

	1995	1996	1997	1998	1999
	1,000 metric tons				
OCC	14,981	16,994	17,818	17,718	18,697
ONP	5,378	5,527	5,865	5,975	6,380
Mixed	4,424	4,694	4,624	5,320	5,514
Pulp substitutes	2,231	2,204	2,396	2,125	2,097
High grade deinking	2,725	2,757	2,681	2,856	2,892
Total	29,738	32,175	33,384	33,993	35,581

Source: American Forest & Paper Association, *Statistics 2000*, (Oct. 2000), p. 56.

Table B-5
Wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, Canada and Mexico, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Canada:						
Wood pulp:						
Mills (*number*)	51	49	48	48	48	
Capacity (*1,000 metric tons*)	27,908	28,089	28,291	28,347	28,247	1
Production (*1,000 metric tons*)	24,352	24,850	23,602	25,396	26,411	8
Capacity utilization (*percent*)	87	88	83	90	94	
Exports (*1,000 metric tons*)	9,852	10,187	9,895	10,801	10,847	10
Imports (*1,000 metric tons*)	260	268	189	168	183	-30
Apparent consumption (*1,000 metric tons*)	14,760	14,931	13,896	14,763	15,747	7
Waste paper:						
Collections	2,840	3,110	3,051	3,174	3,438	21
Exports	568	688	577	500	650	14
Imports	2,089	2,088	2,198	2,292	2,277	9
Apparent consumption	4,361	4,510	4,672	4,966	5,065	16
Mexico:						
Wood pulp:						
Mills (*number*)	8	8	8	8	8	
Capacity (*1,000 metric tons*)	965	776	750	758	800	-17
Production (*1,000 metric tons*)	511	442	526	546	582	14
Capacity utilization (*percent*)	53	57	70	72	73	
Exports (*1,000 metric tons*)	18	1	0	0	0	-100
Imports (*1,000 metric tons*)	385	505	448	506	455	18
Apparent consumption (*1,000 metric tons*)	878	946	974	1,052	1,037	18
Waste paper:						
Collections	1,696	1,885	1,963	2,043	2,137	26
Exports	0	0	0	0	0	
Imports	1,152	1,393	1,432	1,349	1,385	20
Apparent consumption	2,848	3,278	3,395	3,392	3,522	24

[1] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), pp. 16-88.

[2] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), pp. 10-63, and *Pulp & Paper International*, Vol. 41, No. 8 (Aug. 1999), pp. 29-43.

[3] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), pp. 5-74.

Table B-6
South American wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producer, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Brazil:						
Wood pulp:						
Mills (*number*)	5	5	5	5	69	
Capacity (*1,000 metric tons*)	7,109	7,109	7,447	7,522	7,915	11
Production (*1,000 metric tons)*	6,201	6,342	6,687	7,209	7,463	20
Capacity utilization (*percent*)	87	89	90	96	94	
Exports (*1,000 metric tons)*	2,161	2,385	2,699	3,014	2,917	35
Imports (*1,000 metric tons)*	221	279	301	355	324	47
Apparent consumption (*1,000 metric tons)*	4,261	4,236	4,289	4,550	4,870	14
Waste paper:						
Collections	2,201	2,157	2,295	2,416	2,612	19
Exports	5	3	3	2	4	-20
Imports	29	23	22	34	24	-17
Apparent consumption	2,225	2,177	2,314	2,448	2,632	18
Chile:						
Wood pulp:						
Mills (*number*)	6	6	6	12	11	
Capacity (*1,000 metric tons)*	2,600	2,600	2,350	2,587	2,674	3
Production (*1,000 metric tons)*	2,060	2,040	2,210	2,397	2,841	38
Capacity utilization (*percent*)	79	78	94	93	106	
Exports (*1,000 metric tons)*	1,340	1,100	1,744	1,905	1,834	37
Imports (*1,000 metric tons)*	0	0	0	14	17	
Apparent consumption (*1,000 metric tons)*	720	940	466	506	1,024	42
Waste paper:						
Collections	50	50	233	230	235	370
Exports	0	0	14	12	22	
Imports	0	0	2	0	18	
Apparent consumption	50	50	221	218	231	362

[1] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), pp. 16-88.

[2] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), pp. 10-63, and *Pulp & Paper International*, Vol. 41, No. 8 (Aug. 1999), pp. 29-43.

[3] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), pp. 5-74.

Table B-7
Asian wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producers, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
China:						
Wood pulp:						
Mills (*number*)	5,000	5,000	5,000	5,000	5,000	
Capacity (*1,000 metric tons*)	24,500	19,750	19,750	20,000	20,000	-18
Production (*1,000 metric tons*)	19,030	17,380	16,520	16,425	17,150	-10
Capacity utilization (*percent*)	78	88	84	82	86	
Exports (*1,000 metric tons*)	24	25	19	13	34	42
Imports (*1,000 metric tons*)	1,486	1,549	2,199	3,107	3,356	126
Apparent consumption (*1,000 metric tons*)	20,492	18,904	18,700	19,519	20,472	-0
Waste paper:						
Collections	9,309	9,485	12,100	12,868	13,158	41
Exports	5	4	8	5	5	0
Imports	1,486	1,713	1,915	2,555	3,563	140
Apparent consumption	10,790	11,194	14,007	15,418	16,716	55
Indonesia:						
Wood pulp:						
Mills (*number*)	13	13	14	16	14	
Capacity (*1,000 metric tons*)	2,986	3,906	4,300	4,900	5,200	74
Production (*1,000 metric tons*)	2,560	2,979	3,430	3,695	4,089	60
Capacity utilization (*percent*)	86	76	80	75	79	
Exports (*1,000 metric tons*)	1,127	1,186	1,357	1,179	1,493	32
Imports (*1,000 metric tons*)	836	1,100	840	957	746	-11
Apparent consumption	2,269	2,893	2,913	3,473	3,342	47
Waste paper:						
Collections	980	1,163	1,355	1,683	1,978	102
Exports	0	0	0	0	22	
Imports	1,297	1,133	2,034	2,036	2,345	81
Apparent consumption	2,277	2,296	3,389	3,719	4,301	89
Japan:						
Wood pulp:						
Mills (*number*)	48	46	45	44	44	
Capacity (*1,000 metric tons*)	15,053	15,029	15,792	15,792	15,565	3
Production (*1,000 metric tons*)	11,199	11,490	10,919	10,990	11,399	2
Capacity utilization (*percent*)	74	76	69	70	73	
Exports (*1,000 metric tons*)	81	63	42	83	133	64
Imports (*1,000 metric tons*)	3,420	3,450	3,204	3,078	3,096	-9
Apparent consumption	14,538	14,877	14,081	13,985	14,362	-1
Waste paper:						
Collections	15,916	16,546	16,131	16,893	18,331	15
Exports	21	312	561	288		-100
Imports	431	362	294	300	278	-35
Apparent consumption	16,326	16,596	15,864	16,905	18,609	14
Korea:						
Wood pulp:						
Mills (*number*)	4	4	4	4	4	
Capacity (*1,000 metric tons*)	728	836	836	836	836	15
Production (*1,000 metric tons*)	618	590	418	587	595	-4
Capacity utilization (*percent*)	85	71	50	70	71	
Exports (*1,000 metric tons*)	0	0	0	3	0	
Imports (*1,000 metric tons*)	2,241	1,960	1,745	2,196	2,137	-5
Apparent consumption (*1,000 metric tons*)	2,859	2,550	2,163	2,780	2,732	-4
Waste paper:						
Collections	3,944	4,530	3,869	4,687	5,003	27
Exports	0	0	0	0	7	
Imports	1,425	1,452	1,963	2,325	1,963	38
Apparent consumption	5,369	5,982	5,832	7,012	6,959	30

Table B-7—*Continued*
Asian wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producer, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Taiwan:						
Wood pulp:						
Mills (*number*)	2	2	2	2	2	
Capacity (*1,000 metric tons*)	420	420	420	420	420	0
Production (*1,000 metric tons*)	326	346	339	368	385	18
Capacity utilization (*percent*)	78	82	81	88	92	
Exports (*1,000 metric tons*)	1	3	1	14	19	1,800
Imports (*1,000 metric tons*)	909	1,021	954	821	817	-10
Apparent consumption (*1,000 metric tons*)	1,234	1,364	1,292	1,175	1,183	-4
Waste paper:						
Collections	2,465	2,789	2,790	2,814	2,944	19
Exports	0	0	0	0	0	
Imports	1,656	1,306	1,306	1,110	1,036	-37
Apparent consumption	4,121	4,095	4,096	3,924	3,980	-3
Thailand:						
Wood pulp:						
Mills (*number*)	3	3	6	6	6	
Capacity (*1,000 metric tons*)	626	626	928	950	956	53
Production (*1,000 metric tons*)	502	572	684	756	764	52
Capacity utilization (*percent*)	80	91	74	80	80	
Exports (*1,000 metric tons*)	131	103	216	230	255	95
Imports (*1,000 metric tons*)	344	349	240	354	359	4
Apparent consumption (*1,000 metric tons*)	715	818	708	880	868	21
Waste paper:						
Collections	978	943	869	868	909	-7
Exports	0	0	0	2	0	
Imports	582	622	725	935	952	64
Apparent consumption	1,560	1,565	1,594	1,801	1,861	19

[1] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), pp. 16-88.
[2] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), pp. 10-63, and *Pulp & Paper International*, Vol. 41, No. 8 (Aug. 1999), pp. 29-43.
[3] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), pp. 5-74.

Table B-8
European wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producer, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Finland:						
Wood pulp:						
Mills (*number*)	45	45	45	43	43	
Capacity (*1,000 metric tons*)	12,190	12,765	13,235	13,497	13,635	12
Production (*1,000 metric tons*)	9,693	11,089	11,355	11,581	11,910	23
Capacity utilization (*percent*)	80	87	86	86	87	
Exports (*1,000 metric tons*)	1,551	1,739	1,645	1,889	1,676	8
Imports (*1,000 metric tons*)	44	43	51	74	74	68
Apparent consumption (*1,000 metric tons*)	8,186	9,393	9,761	9,766	10,308	26
Waste paper:						
Collections	563	607	665	697	734	30
Exports	40	49	91	93	113	183
Imports	89	84	59	81	82	-8
Apparent consumption	612	642	633	685	703	15
France:						
Wood pulp:						
Mills (*number*)	20	20	19	19	18	
Capacity (*1,000 metric tons*)	3,327	3,300	3,290	3,200	2,900	-13
Production (*1,000 metric tons*)	2,517	2,832	2,677	2,591	2,469	-2
Capacity utilization (*percent*)	76	86	81	81	85	
Exports (*1,000 metric tons*)	361	445	415	469	426	18
Imports (*1,000 metric tons*)	1,944	2,048	2,038	2,117	2,299	18
Apparent consumption (*1,000 metric tons*)	4,100	4,435	4,300	4,239	4,342	6
Waste paper:						
Collections	3,907	4,270	4,614	5,037	5,302	36
Exports	748	750	838	997	887	19
Imports	1,083	998	1,155	1,235	1,363	26
Apparent consumption	4,242	4,518	4,931	5,275	5,778	36
Germany:						
Wood pulp:						
Mills (*number*)	20	19	13	23	22	
Capacity (*1,000 metric tons*)	1,943	1,987	2,350	2,070	2,294	18
Production (*1,000 metric tons*)	1,816	1,958	1,973	1,942	2,317	28
Capacity utilization (*percent*)	93	99	84	94	101	
Exports (*1,000 metric tons*)	348	395	363	390	447	28
Imports (*1,000 metric tons*)	3,637	3,842	3,820	4,143	4,320	19
Apparent consumption (*1,000 metric tons*)	5,105	5,405	5,430	5,695	6,190	21
Waste paper:						
Collections	10,912	11,279	12,164	12,904	13,570	24
Exports	2,958	2,739	3,311	3,727	3,905	32
Imports	934	918	1,064	1,130	1,327	42
Apparent consumption	8,888	9,458	9,917	10,307	10,992	24
Italy:						
Wood pulp:						
Mills (*number*)	17	16	16	16	12	
Capacity (*1,000 metric tons*)	635	635	700	700	750	18
Production (*1,000 metric tons*)	540	548	585	577	600	11
Capacity utilization (*percent*)	85	86	84	82	80	
Exports (*1,000 metric tons*)	18	12	13	15	20	11
Imports (*1,000 metric tons*)	2,789	3,044	3,098	3,146	2,991	7
Apparent consumption (*1,000 metric tons*)	3,311	3,580	3,670	3,708	3,571	8
Waste paper:						
Collections	2,530	2,784	3,304	3,629	4,096	62
Exports	34	53	42	128	218	541
Imports	1,019	926	854	706	741	-27
Apparent consumption	3,515	3,657	4,116	4,207	4,619	31

Table B-8—*Continued*
European wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producer, 1996-2000

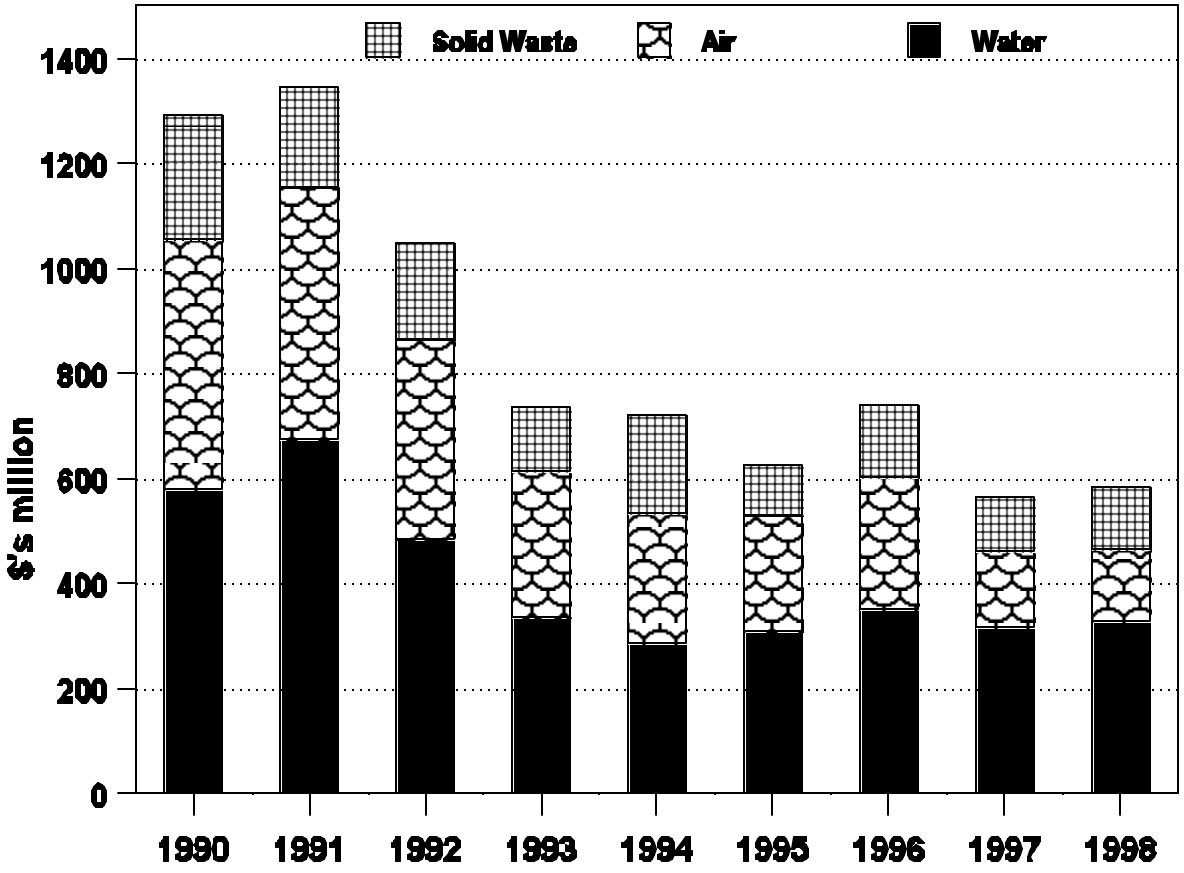
	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Netherlands:						
Wood pulp:						
Mills (*number*)	2	2	2	2	2	
Capacity (*1,000 metric tons*)	174	174	175	175	175	1
Production (*1,000 metric tons*)	125	138	129	117	137	10
Capacity utilization (*percent*)	72	79	74	67	78	
Exports (*1,000 metric tons*)	166	162	157	145	288	73
Imports (*1,000 metric tons*)	643	659	676	692	785	22
Apparent consumption (*1,000 metric tons*)	602	635	648	664	634	5
Waste paper:						
Collections	2,056	2,150	2,540	2,525	2,653	29
Exports	1,150	1,200	1,344	1,600	1,572	37
Imports	1,100	1,100	1,070	1,451	1,895	72
Apparent consumption	2,006	2,050	2,266	2,376	2,976	48
Norway:						
Wood pulp:						
Mills (*number*)	19	18	13	14	14	
Capacity (*1,000 metric tons*)	2,835	2,605	2,797	2,679	2,668	-6
Production (*1,000 metric tons*)	2,269	2,336	2,420	2,354	2,448	8
Capacity utilization (*percent*)	80	90	87	88	92	
Exports (*1,000 metric tons*)	549	520	569	582	605	10
Imports (*1,000 metric tons*)	102	137	133	155	154	51
Apparent consumption (*1,000 metric tons*)	1,822	1,953	1,984	1,927	1,997	10
Waste paper:						
Collections	367	432	453	535	535	46
Exports	182	217	219	275	247	36
Imports	47	42	53	33	63	34
Apparent consumption	232	257	287	293	351	51
Portugal:						
Wood pulp:						
Mills (*number*)	7	7	7	7	7	
Capacity (*1,000 metric tons*)	1,745	1,830	1,824	1,860	1,849	6
Production (*1,000 metric tons*)	1,594	1,703	1,708	1,755	1,774	11
Capacity utilization (*percent*)	91	93	94	94	96	
Exports (*1,000 metric tons*)	1,005	1,070	1,037	1,186	1,026	2
Imports (*1,000 metric tons*)	91	106	97	107	96	5
Apparent consumption (*1,000 metric tons*)	680	739	768	676	844	24
Waste paper:						
Collections	329	362	392	433	499	52
Exports	42	55	53	84	148	252
Imports	28	15	13	15	29	4
Apparent consumption	315	322	352	364	380	21
Russia:						
Wood pulp:						
Mills (*number*)	45	45	45	35	35	
Capacity (*1,000 metric tons*)	10,500	9,500	9,500	7,600	6,000	-43
Production (*1,000 metric tons*)	3,821	3,895	3,993	4,750	5,814	52
Capacity utilization (*percent*)	36	41	42	63	97	
Exports (*1,000 metric tons*)	1,078	983	1,029	1,350	1,646	53
Imports (*1,000 metric tons*)	35	49	39	66	55	57
Apparent consumption (*1,000 metric tons*)	2,778	2,961	3,003	3,466	4,223	52
Waste paper:						
Collections	600	615	615	615	615	3
Exports	na	na	na	na		
Imports	na	na	na	na		
Apparent consumption	600	615	615	615	615	3

Table B-8—*Continued*
European wood pulp and waste paper: Mills, capacity, production, capacity utilization, exports, imports, and apparent consumption, by major producer, 1996-2000

	1996[1]	1997[1]	1998[2]	1999[3]	2000[3]	Change during period
						Percent
Spain:						
Wood pulp:						
Mills (*number*)	20	20	14	14	15	
Capacity (*1,000 metric tons*)	1,800	1,828	1,850	1,900	1,900	6
Production (*1,000 metric tons*)	1,461	1,571	1,620	1,680	1,749	20
Capacity utilization (*percent*)	81	86	88	88	92	
Exports (*1,000 metric tons*)	673	750	743	851	827	23
Imports (*1,000 metric tons*)	494	558	566	602	664	34
Apparent consumption (*1,000 metric tons*)	1,282	1,379	1,443	1,431	1,586	24
Waste paper:						
Collections	2,125	2,354	2,634	2,964	3,318	56
Exports	43	38	53	60	104	142
Imports	692	716	815	706	660	-5
Apparent consumption	2,774	3,032	3,396	3,610	3,874	40
Sweden:						
Wood pulp:						
Mills (*number*)	46	46	46	46	45	
Capacity (*1,000 metric tons*)	10,892	11,363	11,484	11,394	11,651	7
Production (*1,000 metric tons*)	9,847	10,497	10,549	10,694	11,517	17
Capacity utilization (*percent*)	90	92	92	94	99	
Exports (*1,000 metric tons*)	2,628	2,802	2,787	3,018	3,066	17
Imports (*1,000 metric tons*)	213	238	250	265	293	38
Apparent consumption (*1,000 metric tons*)	7,432	7,933	8,012	7,941	8,744	18
Waste paper:						
Collections	1,159	1,323	1,379	1,384	1,467	27
Exports	178	193	169	185	197	11
Imports	523	559	549	620	553	6
Apparent consumption	1,504	1,689	1,759	1,819	1,823	21
United Kingdom:						
Wood pulp:						
Mills (*number*)	5	5	5	5	5	
Capacity (*1,000 metric tons*)	766	779	780	564	595	-22
Production (*1,000 metric tons*)	575	623	584	474	517	-10
Capacity utilization (*percent*)	75	80	75	84	87	
Exports (*1,000 metric tons*)	14	5	18	23	8	-43
Imports (*1,000 metric tons*)	1,606	1,639	1,594	1,658	1,661	3
Apparent consumption (*1,000 metric tons*)	2,167	2,257	2,160	2,109	2,170	0
Waste paper:						
Collections	4,552	5,030	5,028	4,815	5,305	17
Exports	274	446	424	443	547	100
Imports	45	34	29	62	124	176
Apparent consumption	4,323	4,618	4,633	4,434	4,882	13

[1] *Pulp & Paper International*, Vol. 40, No. 7 (July 1998), pp. 16-88.
[2] *Pulp & Paper International*, Vol. 41, No. 7 (July 1999), pp. 10-63, and *Pulp & Paper International*, Vol. 41, No. 8 (Aug. 1999), pp. 29-43.
[3] *Pulp & Paper International*, Vol. 43, No. 7 (July 2001), pp. 5-74.

Figure B-1
Annual environmental spending of the U.S. pulp and paper industry, 1990-98



Source: Pulp & Paper, *1999 North American Factbook*, (San Francisco, Miller Freeman, Inc., 1998), p. 72

APPENDIX C
DESCRIPTION OF WASTE PAPER RECOVERY, REUSE, AND GRADES

Repulping

Repulping separates waste paper into individual fibers. Bales of waste paper are blended with water to a prescribed fiber/water ratio (3-16 percent). Fibers are separated by mechanical agitation. The water may be heated if the paper has been coated or treated. Because traditional low-consistency repulping often breaks contaminants into smaller pieces, new methods (e.g., high-consistency batch pulping or continuous drum pulping) are being developed that separate fibers without breaking larger contaminants into smaller ones.[1]

Contaminant removal

Many different nonpaper contaminants can be found in waste paper. Heavy contaminants include metals, sand, rocks, and glass. Light contaminants include Styrofoam, plastics, waxes, hot-melt glues, adhesives, and wood. Contaminants might also include unwanted waste paper such as colored grades, unbleached grades, or groundwood grades. Waste paper may be manually sorted to pick out premium material. Mechanical removal systems typically are combinations of screens and centrifugal cleaners that remove contaminants before they are broken into smaller pieces that are more difficult to remove. Cleaning techniques are continuing to develop and improve. In the early 1990s laser printing posed a significant challenge, but the techniques for its removal are now well understood. A current challenge is to develop a technique to remove the stickies resulting from pressure sensitive adhesives (PSAs). With the increase in the use of such products as nonlick stamps, post-it notes, and self-sealing envelopes, PSAs are an increasing problem in all grades of waste paper[2] and are particularly difficult because they disperse but then re-agglomerate elsewhere within the water cycle. A task force including members from USPS, mills, testing labs, stamp manufacturers, and adhesive suppliers continues to seek solutions.

De-inking

Inks are generally removed by one of two methods. Washing (dispersion) systems wash ink from pulp with large amounts of water. Flotation (collector) systems are used once ink is in suspension. Injected air creates bubbles that carry ink to the surface away from fiber. Flotation systems are more common in North America with the onset of laser printing, xerography, and ultraviolet cured inks. If both inks and filler are to be removed, both processes may be used in combination. Flexographic inks favor washing systems due to high dispersion. Dispersion devices combine thermal and mechanical energy to break residual stickies and ink into ultrafine particles.

---

[1] Ed Glass, "Deinked Pulp Mills Struggle with 'More of the Same' Contaminants," *Pulp & Paper*, Vol. 74, No. 12 (Dec. 2000), p. 44.

[2] Ibid., p. 43.

Institute of Scrap Recycling Industries - Waste Paper Grades[3]

Regular Grades

1. Soft Mixed Paper
2. Mixed Paper
3. Not currently used
4. Boxboard Cuttings
5. Mill Wrappers
6. News
7. News, De-ink Quality
8. Special News De-ink Quality
9. Over-Issue News
10. Magazines
11. Corrugated Containers
12. Double Sorted Corrugated
13. New Double-Lined Kraft Corrugated Cuttings
14. Not currently used
15. Used Brown Kraft
16. Mixed Kraft Cuttings
17. Carrier Stock
18. New Colored Kraft
19. Grocery Bag Scrap
20. Kraft Multi-Wall Bag Scrap
21. New Brown Kraft Envelope Cuttings
22. Mixed Groundwood Shavings
23. Telephone Directories
24. White Blank News
25. Groundwood Computer Printout
26. Publication Blanks
27. Flyleaf Shavings
28. Coated Soft White Shavings
29. Not currently used
30. Hard White Shavings
31. Hard White Envelope Cuttings
32. Not currently used
33. New Colored Envelop Cuttings
34. Not currently used
35. Semi-Bleached Cuttings
36. Manila Tabulating Cards
37. Sorted Office Paper
38. Sorted Colored Ledger
39. Manifold Colored Ledger
40. Sorted White Ledger
41. Manifold White Ledger
42. Computer Printout
43. Coated Book Stock
44. Coated Groundwood Sections
45. Printed Bleached Board Cuttings
46. Misprinted Bleached Board
47. Unprinted Bleached Board
48. #1 Bleached Cup Stock
49. #2 Printed Bleached Cup Stock
50. Unprinted Bleached Plate Stock
51. Printed Bleached Plate Stock

[3] Institute of Scrap Recycling Industries, Inc., *Scrap Specifications Circular 198 - Guidelines for Nonferrous Scrap, Ferrous Scrap, Glass Cullet, Paper Stock, Plastic Scrap* (Washington, DC: ISRI, 1998), pp. 34-38.

Specialty Grades

1-S White Waxed Cup Cuttings
2-S Printed Waxed Cup Cuttings
3-S Plastic Coated Cups
4-S Polycoated Bleached Kraft-Unprinted
5-S Polycoated Bleached Kraft-Printed
6-S Polycoated Milk Carton Stock
7-S Polycoated Diaper Stock
8-S Polycoated Boxboard Cuttings
9-S Waxed Boxboard Cuttings
10-S Printed and/or Unprinted Bleached Sulphate containing foil
11-S Waxed Corrugated Cuttings
12-S Wet Strength Corrugated Cuttings
13-S Asphalt Laminated Corrugated Cuttings
14-S Beer Carton Scrap
15-S Contaminated Bag Scrap
16-S Insoluble Glued Free Sheet Paper and/or Board
17-S White Wet Strength Scrap
18-S Brown Wet Strength Scrap
19-S Printed and/or Colored Wet Strength Scrap
20-S File Stock
21-S New Computer Print Out (C.P.O.)
22-S Ruled White
23-S Flyleaf Shavings containing Hot Melt Glue
24-S Carbon Mix
25-S Books with Covers
26-S Unsorted Tabulating cards
27-S Colored Tabulating Cards
28-S Carbonless Treated Ledger (N.C.R.)
29-S Not currently used
30-S Plastic Windowed Envelopes
31-S Textile Boxes
32-S Printed TMP
33-S Unprinted TMP

APPENDIX D
DESCRIPTIONS OF CHEMICAL AND MECHANICAL PULPING PROCESSES

Chemical Methods

Sulfate (kraft) and Soda

The soda process was the first chemical pulping process developed and is so called because wood chips are cooked in a solution of sodium hydroxide (caustic soda) at a pH of 12. The kraft process, commercialized in 1885, improved on the soda process with the addition of sodium sulfide to the soda, which accelerates delignification and minimizes pH drop. The result is a pulp of greater strength. Kraft pulping is suitable for many species, the pulps are easily bleached, and the process is economical since the energy value of the spent cooking liquor (black liquor) can be recovered and utilized. Disadvantages include the expense of building mills (due to the special metals necessary to handle the temperatures, pressures, and caustic chemicals), low yields, and odors. The kraft process represents 70 percent of all North American pulping capacity.[1]

Sulfite

This process, dating from the 1870s, cooks chips in acid conditions in a solution of sulfur dioxide in water. The sulfur dioxide combines with lignin, and both are removed by the addition of a base (e.g. ammonium, sodium, or magnesium). Sulfite pulp is not as strong as kraft so is not used in strength applications, but good sheet formation, softness, bulk, and absorbency make it suited to tissue and sanitary papers, bond, and reproduction. Unbleached sulfite, brighter than unbleached kraft, can be used where high brightness is not required. Sulfite pulping capacity has declined since the 1930s,[2] but more and more sulfite pulp is now being bleached with oxygen, peroxide, or ozone. New alkaline sulfite technology yields pulp that has comparable strength to kraft and that is easily bleached without chlorine compounds.

Semichemical

This process was developed in the 1920s for hardwoods, and although the pulp is lower quality, yield is much higher (60-80 percent). Wood chips are subjected to mild chemical treatment followed by mechanical defibrating. The pulp thus produced is characterized by intermediate strength and good stiffness and has been widely used for corrugating medium, the paper used for the fluted inner ply of a corrugated container.

---

[1] Pulp & Paper, *1999 North American Factbook*, p. 139.

[2] Ibid., pp. 139 and 145.

Solvent

Solvent pulping, first patented in 1931 as the Kleinert ethanol process, replaces water in the cooking liquor with an organic solvent.[3] Generally a process for pulping hardwoods, the industry has shown renewed interest recently in the solvent process. Its inherent advantages include lower capital costs, operating costs comparable to kraft, easily bleached pulps, high yield, byproduct potential (from lignins and sugars), sulfur and chlorine free operations, low water use, and low effluent BOD[4] and toxicity. One company, Repap, has developed a proprietary process (Alcell) but has abandoned plans for further development. Disadvantages are the lack of markets for lignin by-products, expensive construction due to the necessity for explosion proof designs, and lack of suitable cooking schemes and bleaching sequences.

Mechanical Pulping Methods

Groundwood or stone groundwood

Typically, bolts of pulpwood are ground into fiber by large, cylindrical, rotating grindstones. Softwood species are preferred for groundwood pulping.

Pressurized groundwood (PGW)

This process is the same as groundwood pulping except that the addition of heated shower water softens the lignin, thereby reducing the damage to the wood fibers during separation.

Refiner mechanical (RMP)

Developed in the late 1950s, refiner mechanical pulping produces longer fibers in the resulting pulp while decreasing its opacity to some degree. Unlike straight groundwood pulping techniques, the pulpwood is chipped first. The chips are squeezed to remove the water and are then ground between metal disks.

Thermomechanical (TMP)

It was discovered in the late 1960s that by presteaming chips prior to refiner mechanical pulping, the resulting pulp would be stronger.

---

[3] Young, Jim, "Solvent Pulping Symposium Looks at Current, Future Technology," *Pulp & Paper*, February 1993 found at *www.paperloop.com*, retrieved Aug. 15, 2001.

[4] Biologic Oxygen Demand.

Chemithermomechanical (CTMP)

In a further refinement of the process in the late 1970s, chemicals were applied to the chips prior to refining. This refinement provided important advantages such as increased content of longer fibers; decreased shive content;[5] more flexible fibers; higher density, tensile strength, and burst strength of the resulting sheet; and better opacity than kraft pulp. The additional strength of CTMP pulps allows newsprint producers to cut back or forego entirely the addition of kraft pulp. Bleached board and tissue are other important markets. Bleached hardwood CTMP (BCTMP) can be bleached to a very high brightness using mainly hydrogen peroxide. Disadvantages of both TMP and CTMP are lower tensile strength than kraft, color reversion, and high energy demands.

Alkaline Peroxide Mechanical Pulping (APMP)

In 1989 this process was introduced. The bleaching and pulping stages are combined, which decreases both the cost of mill installation and operation.

Defibrator Pulping

This process requires that chips are steamed under high pressure and released from the steaming vessel via a gun or nozzle. The resulting pressure drop causes the chips to explode into individual fiber masses. The process is simple, high yield, and relatively nonpolluting, but the resulting low strength pulp is used only to make coarse grades of paper, board, and wood products (e.g. hardboard).

[5] A shive is a bundle of incompletely separated fibers.

APPENDIX E
DESCRIPTIONS OF PROCESS IMPROVEMENTS AND TECHNICAL INNOVATIONS

Techniques to Improve Wood Pulping

- Development of extended digesting regimens - multiple applications of cooking liquors over extended periods allow gentler cooking resulting in stronger, better delignified pulp.
- Closer monitoring and control of the chemistry of the digesting process.[1]
- Reduction in water use, increased conservation and reuse of water. The goal is total "closure" of a mill's water cycle, but so far, this has only been accomplished at recycled mills.[2]
- Oxygen delignification - considered a bleaching sequence but capable of extending delignification also.
- Development of additives to cooking liquor - improve/preserve yields by retaining hemicellulose, shortening cooking times.
- Development of biopulping - treating chips with lignin-degrading fungi before chemical pulping.

Techniques to Improve Bleaching

- Substitution of chlorine dioxide for elemental chlorine (elemental chlorine free or ECF bleaching).
- Development of oxygen or ozone bleaching
- Development of enzyme additives to reduce bleaching requirements
- Improvement of techniques and sequences for totally chlorine free (TCF) bleaching
- Development of techniques, additives (e.g., anthraquinone) to reduce adsorbable organic halides (AOX) emissions and increase delignification.[3]
- Development of prebleaching agents for kraft pulps
- Elimination of all effluent from bleached plants.

Techniques to Improve Stock Preparation

- Development of refining techniques to roughen, shorten fibers to increase chemical bonding.
- Chemical additives to improve strength, sizing, pigments, fillers, drainage or retention
- Improved segregation, stratification of pulps to increase recycled fiber content.
- Improved fractionation of pulps to allow multi-ply head boxes to improve final product performance.

[1] "Fine-Tuned Kraft," *American Papermaker,* Vol. 59 No. 3 (Mar. 1996), p. 27.

[2] Charles E. Swann,"Fresh Water: Can Mills Keep Turning Off the Spigot," *North American Papermaker,* Vol. 81, No. 10 (Oct. 1999), p. 28.

[3] Gerald W. Kutney, "Low-Cost Bleaching Sequence Changes Yield Low AOX Pulp Mill Emissions," *Pulp & Paper,* Vol. 69, No. 1 (Jan. 1995), p. 85.

Emerging Technologies to Improve the Reuse of Waste paper

- Development of enzyme enhanced deinking
- Improvements in fiber separation and fiber bonding strength
- Improved removal of stickies, particularly pressure sensitive adhesives (PSA)
- Enhancements in reuse and recirculation of process water and recovery of fillers

APPENDIX F
SUMMARY OF PERTINENT ENVIRONMENTAL LAWS AND REGULATIONS

The Clean Air Act[1]

Originally passed in 1955 and wholly replaced by the Air Quality Act of 1967, this law is still known simply as the Clean Air Act (CAA). Significant amendments were passed in 1970, 1977, and 1990.[2] Its purpose is to preserve and enhance the quality of the nations's air resources. It identifies maximum achievable control technology (MACT) and provides for permit systems for emissions standards for certain hazardous chemicals. A variety of chemicals present in pulp and paper manufacturing are controlled including nitrogen and sulfur oxides, acetone, methanol (EPA hazardous air pollutant - HAP), chlorine, chlorine dioxide, chloroform, hydrochloric and sulfuric acids, and particulates. Methanol is the industry's biggest concern.

The Clean Water Act[3]

Although initial legislation dates to 1948, the Clean Water Act (CWA) was rewritten and passed as the Federal Water Pollution Control Amendments of 1972. Its purpose is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The law provides for a system of State-issued permits that limit the amount of pollutants released by industrial dischargers[4] and identifies best available technology (BAT). Further amendments in 1987 and 1990 addressed persistent levels of toxic pollutants and non-point sources.

The Cluster Rule[5]

The Cluster Rule resulted from a court-imposed consent agreement that required EPA to enact rules controlling dioxin and furan in the effluent of bleached pulp mills. Subsequently, the EPA extended the rule to include the entire pulp and paper industry and conventional pollutants as well. It represents the first attempt to address both air and water emissions in an integrated fashion, and by attempting to reduce or eliminate pollutants at their source, it changes the focus from emissions treatment to process modification.[6] The air portion of the rule is intended to reduce emissions of hazardous air pollutants, odorous sulfur, volatile organic compounds, and particulate. The water portion is intended to reduce discharge of chloroform and discharge and sludge loading of dioxin and furan. Over 4 years of debate and revision preceded publication of the first portion of the rule on April 15, 1998. It included new

---

[1] *42 U.S.C. § 7401 et seq.* (1970).

[2] Pulp & Paper, *1999 North American Factbook*, p. 71.

[3] *33 U.S.C. § 1251 et seq.* (1977).

[4] Pulp & Paper, *1999 North American Factbook*, p. 71.

[5] The final air rule amended 40 CFR Part 63 and Part 261 and the final water rule amended 40 CFR Part 430. 63 FR 18504-18751 (April 15, 1998) and 63 FR 42238-42240 (Aug. 7, 1998).

[6] Charles E. Swann, "Cluster Rule Update," *International Papermaker*, Vol. 58, No. 11 (Nov. 1995) p. 23.

air regulations based on MACT that regulate air emissions at 155 U.S. mills.[7] It also included phase I of the water quality regulations, which apply to bleached paper-grade kraft pulp mills, soda pulp mills, and paper-grade pulp sulfite mills (96 of the 155 U.S. mills).[8] Affected mills had 3 years from the date of publishing, or until April 15, 2001, to comply with the new rule.[9] As with prior regulations, water requirements are based on best available technology. The EPA-proposed rule would have required oxygen delignification bleaching technology, but the rule as published endorses elemental chlorine free (ECF) bleaching for most pulp mills. Industry successfully pressed for this change arguing that requiring oxygen delignification would lead to as many as 30 mill closures and that ECF would be just as effective in eliminating dioxin from the effluent stream. From 1988 to 1994 the amount of dioxin discharged into waterways by the North American industry dropped by 96 percent.[10] Since 1990, there has been a twentyfold increase in ECF bleaching as individual mills moved to remove dioxin from their effluent prior to the release of the Cluster Rule.[11] Phases II and III will include the water regulations for the pulp mills not included phase I. Compliance deadlines for the new rules are staggered. Cost of compliance for the United States industry may exceed $3.0 billion,[12] and AF&PA has estimated additional annual operating costs of $273 million.

Great Lakes Initiative (GLI)[13]

The GLI is intended to control the release of bioaccumulative, industrial chemicals, pesticides, and metals in eight States that border the Great Lakes. The initiative limits the release of 22 persistent toxic pollutants or bioaccumulative chemicals of concern (BCCs). Chief among industry concerns about the GLI is the capital necessary for compliance. AF&PA estimates the initial capital outlay to be approximately $1.25 billion and the addition annual operating cost to be approximately $43 million.[14] The industry is also concerned about test methodologies, antidegradation measures, restrictions for pollutants in mixing zones (intake waters), development of permits for chemicals that yet lack health and safety data.

---

[7] "Cluster Rule Finalized; ECF Pulping Approved," *Pima's North American Papermaker,* Vol. 80, No. 1 (Jan. 1998), p. 28.

[8] Ibid.

[9] Charles E. Swann, "Water Chemistry: Dealing with a Cluster of Rules," *Pima's North American* Papermaker, Vol. 80, No. 10 (Oct. 1998), p. 30.

[10] Pulp & Paper, *1999 North American Factbook*, p. 144.

[11] Ibid., p. 78.

[12] Ibid., p. 77.

[13] "Final Water Quality Guidance for the Great Lakes System" amended 40 CFR 9, 122, 123, 131, and 132. 60 FR 15365-15366 (Mar. 23, 1995).

[14] Pulp & Paper, *1999 North American Factbook*, p. 73.

Resource Conservation and Recovery Act[15]

The Resource Conservation and Recovery Act (RCRA) passed in 1976 and deals with solid waste disposal issues including hazardous waste that requires both "cradle to grave" tracking and permits for disposal. The pulp and paper industry generates about 12 million tons per year of dewatered primary and biological sludge that have traditionally been disposed of in onsite landfills.

Endangered Species Act (ESA)[16]

First passed in 1973 and amended in 1988, the Endangered Species Act protects the Nation's flora and fauna. Potential impacts include reductions to the industry fiber base as lands are withdrawn from timber production in order to protect threatened species. Threatened aquatic species could potentially limit the use of rivers and waterways by adjacent mills.

Global Warming Treaty

Potentially significant international regulation, the Global Warming Treaty, was drafted in Kyoto, Japan in 1997, and signed by the United States, the 39th nation to do so, in Buenos Aires (November 1998). The treaty requires nations to reduce emissions of carbon dioxide, but the impact to the industry is unclear. The schedules and mechanisms to meet the treaty targets had yet to be completed, when it was announced that the United States would not implement the agreement.

[15] *42 U.S.C. § 6901 et seq.* (1976).
[16] *7 U.S.C. § 136;16 U.S.C. § 460 et seq.* (1973).