



## Developments in the Sourcing of Raw Materials for the Production of Paper

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### **Abstract**

During the past decade, there have been major changes in the trade flows of the raw materials (pulp logs, wood chips, pulp, and recovered paper) used to make paper. These changes have been driven primarily by the growth of the paper industry in China, the emergence of new suppliers of wood raw materials, and the increased importance of recovered paper as a raw material for the production of paper. China's paper industry has grown rapidly in the past 10 years, and its output now trails only that of the United States. China, however, lacks the raw materials to support much of its papermaking capacity and thus has become increasingly dependent upon imports of wood pulp, recovered paper, and wood chips. New suppliers of pulp, wood chips, and pulp logs have emerged in recent years as paper producers have looked for cheaper sources of fiber. These new suppliers, Brazil, Chile, Indonesia, Australia, Vietnam, and Russia, have become increasingly important exporters of wood raw materials. Recovered paper that is repulped and made into new paper has become an important complement to virgin fiber for papermakers throughout the world; consequently, recycling rates for recovered paper have risen in many developed countries. Some of the significant changes in the trade flows of the raw materials used to make paper include large increases in Chinese imports of recovered paper and pulp, increased exports of wood chips from Australia, Brazil, and Vietnam, and rising Russian exports of wood chips and pulp logs to Scandinavia.

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## **Introduction**

Over the past decade, there have been some significant changes in the international flows of the raw materials (pulp logs, wood chips, pulp, and recovered paper) used to make paper. These changes have been driven primarily by the growth of the paper industry in China, the emergence of new suppliers of wood raw materials, and the increased importance of recovered paper as a raw material for the production of paper.

This article will briefly describe recent trends in regional paper production and consumption to help the reader better understand the global environment within which these changes in trade flows of raw materials have occurred. The article then describes the development of a large and modern paper industry in China and the industry's consequent dependence upon imported raw materials. The next section covers new country suppliers of wood raw materials, followed by a discussion about the paper industry's increased use of recovered paper. Then, changes in the international flows of the raw materials used to make paper caused by these three developments are described. The article concludes with a discussion of the effect of the global recession on these trends and the outlook for the future.

## **Recent Trends in Regional Paper Production and Consumption**

North America and Europe have traditionally been the major centers for the production and consumption of paper products such as newsprint, printing and writing papers, tissue, linerboard and corrugating medium (to make corrugated containers), and cartonboard (to make folding cartons).<sup>2</sup>

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<sup>2</sup> Pulp logs, wood chips, pulp, and recovered paper are the raw materials used to make these paper products. Pulp logs are wood destined to be made into pulp. To make paper, trees are harvested, debarked, and chipped. At a pulp mill, the wood chips are converted into pulp, the intermediate product in the production of paper, by a chemical or mechanical process. Pulp (virgin fiber) is then processed into paper on a paper machine. Sawmills generate large amounts of residual wood chips in the production of lumber. These residual wood chips are also used to make pulp. Recovered paper, which typically consists of old newspapers, magazines, and catalogues, mixed office wastepaper, corrugated containers, and folding cartons, can be repulped (secondary fiber) and used to make new paper.

However, their predominance, particularly that of North America, has been eroded in recent years by the rapid growth in paper production and demand in other regions of the world, particularly in Asia. Fast-growing economies in these areas stimulated domestic demand for all the major grades of paper, and significant papermaking capacity was built within these areas to supply this demand (Stora Enso 2006, 6, 8, and 14–15). Between 1997 and 2007, production of paper in Asia increased by 76 percent and Asia's share of world paper production rose from 29 percent to 38 percent. Paper production in Latin America grew by 40 percent between 1997 and 2007, although the region's share of world paper production was unchanged at 5 percent. By contrast, production of paper in North America declined by 4 percent during the period, and the region's share of world paper production fell from 35 percent to 26 percent. Similar trends in the consumption of paper occurred during this period (Pulp & Paper International 1998; RISI, Inc. 2008).

## **Growth of the Paper Industry in China and Its Increasing Dependence Upon Imported Raw Materials**

Traditionally, China's paper industry consisted of thousands of paper mills, typically integrated with pulp production, scattered about the country. The fiber to make the paper came mostly from domestic agricultural residues such as wheat straw, bagasse, and reed rather than from wood, which is the source of fiber for papermaking in most countries. The capacity of many of these mills was very small, the paper-making equipment outdated, and the quality of paper poor. Although China's aggregate paper production was sizeable, it was intended primarily for the domestic market. Lacking wastewater treatment facilities, these mills were also major contributors to the pollution of rivers, lakes, and bays (He and Barr 2004, 262; USITC 1999, 5–44).

Within the past two decades, however, major changes have occurred in China's paper industry. The Chinese government closed thousands of state-owned paper mills (and adjoining pulp mills), reportedly to reduce water pollution. Chinese provinces also took steps in this regard. For example, the provinces of Shandong, Henan, Jiangsu, and Hunan shut down hundreds of mills (RISI 2007). Many other mills shut down due to competitive pressures from imported paper and from growing domestic

demand for higher quality paper (White et al. 2006, 4). Nonetheless, many of these older paper mills remain in business and continue to account for a sizeable portion of China's aggregate paper production. Their output serves primarily low-end domestic demand.

Concurrent with the decline in capacity of the old paper mills has been rapid and significant growth in new papermaking capacity, driven by the desire of the Chinese government to modernize the paper industry as well as by foreign investment by paper companies eager to participate in China's expanding market for paper.<sup>3</sup> This new capacity consists principally of mills with large, modern papermaking machines using wood fiber, rather than fibers from agricultural residues. Many of these machines are among the fastest and most technologically advanced in the world, and their output serves high-end domestic demand and export markets (Flynn 2006).<sup>4</sup> Within the past six years, China has accounted for more than one-half of all the new orders placed worldwide for paper machines (Metso 2006, 30).<sup>5</sup> The paper industry in China thus consists of a mix of small, old mills and new, modern mills. In some paper mills, old paper machines make paper alongside new paper machines (Rooks 2005, 25–27). Annual output from the new paper machines has likely surpassed that from the old paper machines.

The growth in China's paper capacity and production over the past decade, and particularly within the past several years, has been remarkable. This growth is even more noteworthy given the closure of so many paper mills during the same period. The magnitude of these increases, on both an absolute and relative basis, can be gauged by a comparison with the changes in capacity and production for other major paper producers and worldwide (tables 1 and 2). Between 2002 and 2007, China's paper capacity rose by 78 percent (35 million metric tons) compared with an increase in paper capacity for the rest of the world of just 3 percent (9.5 million metric tons). As a percent of world paper capacity, China's capacity rose from 12 percent to 19 percent.<sup>6</sup> By contrast, the United States and

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<sup>3</sup> China's booming economy created strong demand for paper. Chinese paper consumption rose rapidly during the past decade, and in 2007 China lagged only the United States in paper consumption (RISI, Inc. 2008).

<sup>4</sup> The world's largest coated mechanical paper machine and three of the world's five largest coated freesheet paper machines are located in China. Coated mechanical and coated freesheet are major grades of printing and writing paper (RISI, Inc. 2006, 205).

<sup>5</sup> By contrast, in the United States, there have been very few orders for new paper machines in the past six years.

<sup>6</sup> The growth in China's wood pulp capacity has lagged the growth of its paper capacity during the past decade (*Pulp & Paper International* 1998; RISI, Inc. 2008).

**TABLE 1** Paper: Capacity for selected countries and the world, 2002 and 2007

Country	2002	2007	% change, 2002–07	% share of world total	
				2002	2007
Thousand metric tons					
United States	93,577	88,044	−6	24	21
China	45,000	80,000	78	12	19
Japan	34,296	33,809	−1	9	8
Germany	20,634	24,014	16	5	6
Canada	21,377	18,800	−12	6	4
Finland	14,870	15,215	2	4	4
All countries, except China	338,431	347,972	3	88	81
World	383,431	427,972	12	100	100

Sources: *Pulp & Paper International* 2003; RISI, Inc. 2008.

Japan experienced declines in capacity in absolute and relative terms during this same period. China's paper production almost doubled between 2002 and 2007, while production in the rest of the world rose by only 10 percent. Within a few years, China will likely surpass the United States to become the world's largest paper producer.

China's demand for imported fiber has historically been very small because, as mentioned earlier, its paper industry relied upon domestically produced pulp made from agricultural residues such as wheat straw and reed (nonwood pulp) and, to a lesser extent, the repulping of domestic recovered paper. However, China's modern paper capacity is designed to run on pulp made from wood and recovered paper, not from agricultural residues, and consequently the composition of the fiber consumed by China's paper industry has changed over the past several years. The percentage share of total fiber consumed that is accounted for by domestically produced nonwood pulp and domestic recovered paper has fallen, while the percentage share of imported wood pulp, imported recovered paper and imported wood has risen sharply (Stafford 2007, 18).

**TABLE 2** Paper: Production for selected countries and the world, 2002 and 2007

Country	2002	2007	% change, 2002–07	% share of world total	
				2002	2007
Thousand metric tons					
United States	80,871	83,559	3	25	21
China	37,800	73,500	94	11	19
Japan	30,674	31,266	2	9	8
Germany	18,526	23,180	25	6	6
Canada	20,078	17,371	-13	6	4
Finland	12,776	14,335	12	4	4
All countries, except China	292,904	320,760	10	89	81
World	330,704	394,260	19	100	100

Sources: *Pulp & Paper International* 2003; RISI, Inc. 2008.

The shift in these shares signifies that China's paper producers have become increasingly dependent upon imports of the raw materials used to make paper.<sup>7</sup>

## New Suppliers of Wood Chips, Pulp Logs, and Pulp

New suppliers of wood chips, pulp logs, and pulp have emerged in recent years as paper producers in developed countries have looked for alternative and cheaper sources of fiber. China's growing demand for fiber has also stimulated the development of new sources of fiber. A few countries took advantage of their natural forests to expand their exports of

<sup>7</sup> To reduce its dependence on imported wood fiber, China has established fast-growing tree plantations in four regions of the country. By 2015, these plantations are planned to cover almost 6 million hectares of land. The wood from these plantations supplies several large wood pulp mills that have been built in China in the past several years. However, problems involved in the development of these plantations, including insufficient productive land, rising labor costs, and antiquated infrastructure, suggest that the goal of 6 million hectares is unattainable and that the relatively high cost of the wood from these plantations may place the Chinese wood pulp mills at a competitive disadvantage compared with imported pulp (Barr and Cossalter 2006).

wood chips, pulp logs, and pulp. In most cases though, new country suppliers developed vast tree plantations, the fiber from which is intended primarily for export markets in the form of wood chips and/or pulp. The development of tree plantations became a way for countries with plentiful land and a climate conducive to fast-growing tree species to become competitive suppliers of fiber. Harvesting tree plantations, rather than harvesting natural forests, also lessened the environmental pressures associated with forestry activities.

### ***Brazil***

With abundant land and an ideal climate, Brazil has developed large eucalyptus plantations and become a major exporter of pulp and, to a lesser extent, wood chips. Although eucalyptus farming began in Brazil in the early 20th century, up until the 1960s, the amount of land planted with eucalyptus was small and the wood was used for purposes other than pulp and paper.<sup>8</sup> In the mid-1960s, eucalyptus planting expanded rapidly due to Brazilian government tax incentives and increased awareness that eucalyptus was well suited for pulp and paper (Suzano Pulp and Paper 2009). Currently, eucalyptus plantations occupy approximately 3.9 million hectares and are located principally in the south and southeastern regions of the country (USDA 2007d, 3).<sup>9</sup> Annually, 500,000 hectares of eucalyptus are planted in Brazil (Patrick 2008, 15). Growth rates, and hence the productivity, of eucalyptus in Brazil far surpasses that of trees in many other areas of the world. For example, Brazilian eucalyptus grows roughly seven times faster than trees in Scandinavia (Stora Enso 2007, 65). It also grows much faster than the native species in Brazil (Aracruz Celulose 2009). Eucalyptus pulp imparts certain beneficial characteristics to paper that make it especially well suited for the production of printing and writing papers and tissue.

There are several large producers of eucalyptus pulp in Brazil. Their pulp mills are sizeable and rival or surpass pulp mills in North America and Europe, and most of their pulp output is exported. These producers source their eucalyptus primarily from their own eucalyptus plantations, which are immense and located in various Brazilian states. One firm has 231,000 hectares of eucalyptus plantations, and another has 286,000 hectares. These pulp producers also source some eucalyptus from small independent

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<sup>8</sup> Eucalyptus is native to Australia; it was brought to Brazil in 1825 as an ornamental plant (Suzano Pulp & Paper 2009).

<sup>9</sup> A large volume of eucalyptus from plantations continues to be used by various forest products industries in Brazil.

landowners who have contracted to grow eucalyptus on their land (Aracruz Celulose 2009; Suzano Pulp and Paper 2009; Votorantim Group 2009).

Foreign paper producers have invested in eucalyptus plantations and pulp mills in Brazil to access this fast-growing fiber. Stora Enso, a large Nordic pulp and paper producer, has a joint venture with a Brazilian pulp producer that involves a 50 percent ownership of a pulp mill and ownership of eucalyptus plantations (Stora Enso 2007, 61). Oji Paper Company, a Japanese pulp and paper producer, has an ownership interest in Brazilian eucalyptus plantations and a pulp mill (Oji Paper Co., Ltd. 2009).

Brazil's pulp capacity and production have grown rapidly in the past decade. Pulp production almost doubled during this period, from 6.3 million metric tons in 1997 to 12.1 million metric tons in 2007 (*Pulp & Paper International* 1998; RISI, Inc. 2008). By virtue of this growth, Brazil has become an increasingly important global supplier of market pulp.<sup>10</sup>

To enhance this position in the future, Brazilian pulp firms have ambitious plans to continue to expand their production capacity and associated eucalyptus plantations.<sup>11</sup>

### ***Chile***

Chile's development into a sizeable pulp and wood chip exporter has similarities to that of Brazil, albeit on a smaller scale. Chile also has plentiful land and a climate conducive to fast-growing tree species. Originally, radiata pine plantations were developed because radiata pine grows much quicker in Chile than in northern hemisphere countries. Radiata pine matures in Chile within 20–24 years, compared with 30 years in Australia and 40–60 years in North America and Europe. On average, 70,000 hectares of radiata pine are planted each year. In the late 1980s, eucalyptus plantations were started in Chile as the Chilean climate and soil are also very conducive to this tree species. In the past few years, planting of eucalyptus has surpassed that of radiata pine. In Chile, eucalyptus can be harvested within 10 to 15 years. As of year end 2006, Chile had 2 million hectares of plantations in various regions of the country, consisting of 1.4

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<sup>10</sup> Roughly one-quarter of global wood pulp production is sold in the open market (market pulp); the remainder is consumed by producing firms in the production of their own paper (RISI, Inc. 2006, 89).

<sup>11</sup> Over the past decade, Brazil has also grown its eucalyptus wood chip industry and increased its exports of eucalyptus wood chips, primarily to pulp mills in Japan.

million hectares of radiata pine and 600,000 hectares of eucalyptus (USDA 2007c, 4; CMPC 2009).

Chile has two major pulp producers, each with multiple pulp mills. These mills are large and produce pulp from radiata pine and eucalyptus. Most of the pulp production is exported. The two firms source their wood primarily from their own radiata pine and eucalyptus plantations but also from the plantations of smaller landowners. One firm has 722,000 hectares of radiata pine and eucalyptus plantations in Chile; the other has 449,000 hectares of plantations. One of the producers also has plantations in Argentina, while the other producer maintains plantations in Argentina, Brazil, and Uruguay (CMPC 2009; Arauco 2009).

Chilean pulp capacity and production have expanded during the past decade. Pulp production more than doubled, from 2 million metric tons in 1997 to 4.7 million metric tons in 2007 (*Pulp & Paper International* 1998; RISI, Inc. 2008). This growth has enabled Chile to become a more important supplier of pulp to foreign markets such as China, Italy, South Korea, and the Netherlands. Both of the major Chilean pulp producers have the potential to increase pulp capacity and production in the coming years.

Chile's plantations are a source of wood chips not only for Chilean pulp mills, but also for export. Chile's wood chip production from radiata pine and eucalyptus has increased steadily over the past decade, and in 2006 nearly half of this production was exported. Chile has numerous wood chipping facilities, primarily located in the central part of the country. More than 90 percent of wood chip exports are eucalyptus, and virtually all wood chip exports go to Japan as raw material for pulp mills (USDA 2007c, 11). One large Japanese pulp and paper producer has invested in tree plantations in Chile as a means to procure wood chips for its mills (Nippon Paper Group 2009).<sup>12</sup>

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<sup>12</sup> Uruguay has begun to follow a path similar to that of Brazil and Chile. Fast-growing eucalyptus plantations have been developed in Uruguay, including plantations developed by Nordic pulp and paper producers. Some of the eucalyptus is exported in the form of wood chips. In late 2007, a new pulp mill with an annual capacity of 1 million tons of eucalyptus pulp began operations. Built at a cost of \$1.2 billion by a Finnish pulp producer, the mill sources eucalyptus from its own plantations and that of independent Uruguayan landowners. The mill's output is exported (Botnia 2009; Flynn 2008, 6).

### **Indonesia**

With vast natural forests and the development of tree plantations, Indonesia has become an increasingly important supplier of pulp and wood chips, particularly to other Asian countries. Mixed tropical hardwoods logged in Indonesia's natural forests traditionally had been the source for this wood fiber. In the past three decades, however, these forests have come under tremendous pressure from illegal logging, excessive logging by legitimate companies, and the conversion of forested areas into oil palm tree plantations. Deforestation occurred at an estimated rate of 1.6 to 2.0 million hectares per year (Barr 2007). In response, the Indonesian government, among other things, took steps to encourage the development of fast-growing tree plantations and thus reduce the pressure on the natural forests. Acacia, a hardwood species that matures in seven years, is the principal species on the plantations developed for pulp logs, though eucalyptus was also planted. The Indonesian government's plantation efforts have reportedly had some success. In October 2006, the Indonesian Ministry of Forestry announced that tree plantations for pulp logs covered an area of 1.8 million hectares. There is, however, some evidence suggesting that the actual commercial area of these plantations is considerably smaller (Barr 2007).

Indonesia has several major pulp producers with almost all of their pulp mills located on the island of Sumatra. Two of these producers account for more than 75 percent of total Indonesian pulp capacity (Barr 2007). Indonesian producers obtain their wood from government-granted land concessions, which consist of natural forests and plantations that the producers have developed on formerly forested land. They also obtain wood from joint ventures with other landowners (APRIL 2009). Indonesia's two largest pulp producers have increased pulp capacity faster than plantation development. Consequently, although they hope to eventually source all of their wood from plantations, they currently obtain much of it from natural forests (Barr 2007).

Pulp capacity and production in Indonesia have experienced strong growth during the past decade; pulp production almost doubled, from 3 million metric tons in 1997 to 5.8 million metric tons in 2007 (*Pulp & Paper International* 1998; RISI, Inc. 2008). Pulp is consumed domestically in the production of paper and also exported, principally to Asian countries.

Indonesia has recently expanded its capacity to export wood chips. In late 2008, a new export facility for acacia wood chips opened on the east coast of the province of Kalimantan (Flynn 2008, 6). Although the volume of

Indonesia's wood chip exports is considerably smaller than the wood chip exports of Chile and Australia, Indonesia's exports have increased in importance in some Asian countries. One large Japanese firm has invested in both acacia plantations and a pulp mill in Indonesia to take advantage of the country's forest resources (Marubeni Corporation 2009).

### **Australia**

By virtue of its large areas of natural forest and expanding tree plantations, Australia is the world's largest exporter of wood chips for pulp and papermaking. Unlike Brazil, Chile, and Indonesia, however, Australia has not developed a large export-oriented pulp industry. Australia has an estimated 163 million hectares of natural forest, over one half of which are located in the state of Queensland and the Northern Territory. Three quarters of the natural forest is on public land and one quarter is on private land. Three-quarters of the natural forest consists of eucalyptus (Australian Bureau of Statistics 2009).

The amount of land dedicated to tree plantations has risen steadily over the past three decades, and, at year end 2006, totaled 1.8 million hectares. Softwood trees, primarily radiata pine, accounted for 55 percent of this total; hardwood trees, primarily eucalyptus, comprised the remainder. The composition of these plantations has changed over time, with very little growth in softwood plantations over the past decade but a rapid increase in the land planted with hardwood trees. In 1999, the area of publicly-owned plantations and the area of privately-owned plantations were roughly equal. Since then, most of the investment in new plantations, particularly in hardwood plantations, was from the private sector. Although wood chips are obtained from both natural forest and plantations, the proportion sourced from plantations has increased in the past several years (Australian Bureau of Statistics 2009).

Japan's two largest paper producers, heavily dependent upon imported wood chips for their pulp mills, have turned to Australia as an important supplier. One of these producers obtains roughly one half of its hardwood and softwood chips from Australia. Both Japanese firms procure wood chips in Australia from unrelated wood chip suppliers and from their own plantations. One firm developed three tree plantations totaling 34,000 hectares, while the other developed several tree plantations totaling 78,000 hectares. Both producers have plans to expand their tree plantations in Australia (Oji Paper Co., Ltd. 2009; Nippon Paper Group 2009).

The pulp industry in Australia is small and its output is primarily for the country's own paper producers. Between 1997 and 2007, Australia's pulp production rose from 914,000 metric tons to 1.2 million metric tons, a gain of only 280,000 metric tons (*Pulp & Paper International* 1998; RISI, Inc. 2008). Although there have been some industry announcements of large new pulp mills planned for Australia in the past few years, none of these projects has moved beyond the planning stage. So for the immediate future, Australia's wood chips will continue to flow largely into export markets (Flynn 2008, 6).

### **Vietnam**

Vietnam has emerged as an important producer of wood chips in the past several years. The country's pulp industry, though, is small, and consequently most of the wood chips are exported, primarily to Japan and China. The growth in exports was facilitated by the construction of wood chipping plants and port infrastructure (RISI, Inc. 2006, 86). Vietnam's natural forest area increased steadily between 2002 and 2006, from 9.9 million hectares to 10.4 million hectares; tree plantations grew at a faster pace during this period, from 1.9 million hectares to 2.5 million hectares. Tree plantations consist principally of acacia and eucalyptus. The Vietnamese government limits harvesting in the natural forest so plantations are the primary source for wood chips. In 2007, the government began to implement its Forestry Development Strategy, which envisions, among other goals, the continued development of tree plantations (USDA 2007b, 3, 10). Foreign investment in tree plantations in Vietnam may also occur in the future. One Japanese paper producer has developed a 10,000 hectare tree plantation in the country (Oji Paper Co., Ltd. 2009).

### **Russia**

In recent years, Russia has taken greater advantage of its vast forest resources by increasing its exports of pulp logs, wood chips, and pulp. With a total forest area of approximately 850 million hectares, Russian forests account for one-fifth of the world's forested area; however, much of the forested area is in inaccessible regions of the country. Russian forests contain many species of both softwood and hardwood trees. Although the annual volume of logging in Russia is large, it is still considerably below the government's total allowable annual volume of logging (USDA 2007a, 3).

Russia has expanded its exports of pulp logs and wood chips in the past decade to Scandinavia, the location of many pulp mills. These exports consisted primarily of pulp logs, which were processed into wood chips after importation. Two Finnish pulp and paper producers lease and

manage forested areas in Russia from which they source wood. One of the producers leases/manages 669,000 hectares of forest, while the other leases/manages 184,000 hectares (Stora Enso 2007, 61; UPM-Kymmene Corporation 2007, 33).

Russian pulp capacity and production have also risen during the past decade. Russian pulp production almost doubled between 1997 and 2007, from 3.9 million metric tons to 7.4 million metric tons (*Pulp & Paper International* 1998; RISI, Inc. 2008). Increased pulp production was exported and also consumed domestically by Russian paper mills. A U.S. pulp and paper producer recently expanded the pulp capacity at its existing mill in Russia, and two Finnish pulp and paper producers announced plans to invest in pulp capacity in Russia (International Paper 2007; Stora Enso 2009; UPM-Kymmene Corporation 2009).

In an effort to stimulate greater domestic and foreign investment in wood processing facilities in Russia, the Russian government in early 2007 announced export tax increases on softwood and hardwood logs. The export tax on softwood logs rose to 20 percent on July 1, 2007, to 25 percent on April 1, 2008, and was scheduled to increase again to 80 percent on January 1, 2009. Export taxes on certain hardwood logs were also scheduled to increase to 80 percent on January 1, 2009 (Van Leeuwen 2007, 1, 4-5). However, in November 2008, the Russian government, noting the global economic crisis and pressure from Scandinavian countries dependent on Russian log exports, announced that the scheduled export tax hike to 80 percent would be postponed for nine to 12 months. Industry observers speculated that the postponement was also due to the inability of the Russian wood processing sector to expand rapidly enough to process all the logs that would become available when the 80 percent export tax took effect (Random Lengths International 2008, 1). These export tax increases raised the cost of Russian pulp logs, and Scandinavian pulp and paper producers responded by sourcing more of their pulp logs domestically and from other countries (Stora Enso 2007, 8; UPM-Kymmene Corporation 2007, 32).

## **Increased Use of Recovered Paper in the Production of Paper**

In recent years, recovered paper that is repulped and made into new paper has become an important complement to virgin fiber for many papermakers throughout the world. Increasingly, paper is made from a combination of virgin fiber and secondary fiber or from secondary fiber alone. Many of the new paper machines built in Asia and Europe use at least some secondary fiber in the production of paper. Economic, political, and social developments have driven this trend, including greater environmental concern about harvesting trees, particularly in the developed countries, pressure to reduce the amount of material going into landfills, and governmental laws and regulations mandating a certain recycled fiber content in particular paper grades. Technological advances in repulping and deinking (removing the ink from the paper) have improved the quality of the secondary fiber. In many instances, secondary fiber is cheaper than virgin fiber, and secondary fiber is well suited for the production of major paper grades such as newsprint, tissue, linerboard and corrugating medium, and cartonboard. Finally, China's steadily growing demand for recovered paper has stimulated investment in the infrastructure to collect and process paper in many countries. Paper that heretofore would have ended up in a landfill is now being collected, processed, and exported to China (RISI, Inc. 2006, 119–121; Stafford 2007, 5–7).

The amount of paper collected and returned to paper mills to be repulped and made into new paper has risen significantly in many countries. In the United States, the volume of recovered paper has almost tripled in the past two decades, from 17.4 million metric tons to 49.3 million metric tons. Old corrugated containers (cardboard boxes) accounted for roughly one-half of this tonnage. Old newspapers and magazines and mixed papers accounted for most of the remainder (American Forest & Paper Association 2008, 50–51).<sup>13</sup> In 2007, 56 percent of the paper consumed in the United States was recovered for recycling (American Forest & Paper Association 2008, 1).

Recycling rates are also high in Canada, Europe, and Japan. The amount of recovered paper in Canada, the world's fifth largest paper producer, has more than doubled in the last two decades (RISI, Inc. 2006, 127). The

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<sup>13</sup> AbitibiBowater Inc., a large North American producer of newsprint and coated printing and writing papers, alone purchases or collects 2.4 million metric tons of old newspapers and magazines annually to repulp and make into new paper (AbitibiBowater Inc. 2007, 8).

European paper industry has set aggressive targets for paper recycling and in 2007 recovered 60 million metric tons of paper, almost double the amount recovered in 1995. The recycling rate in Europe rose to 64.5 percent in 2007 (European Recovered Paper Council 2007, 3). Japan has one of the highest recycling rates in the world and uses a large volume of recovered paper in its production of new paper (Japan Paper Association 2009).

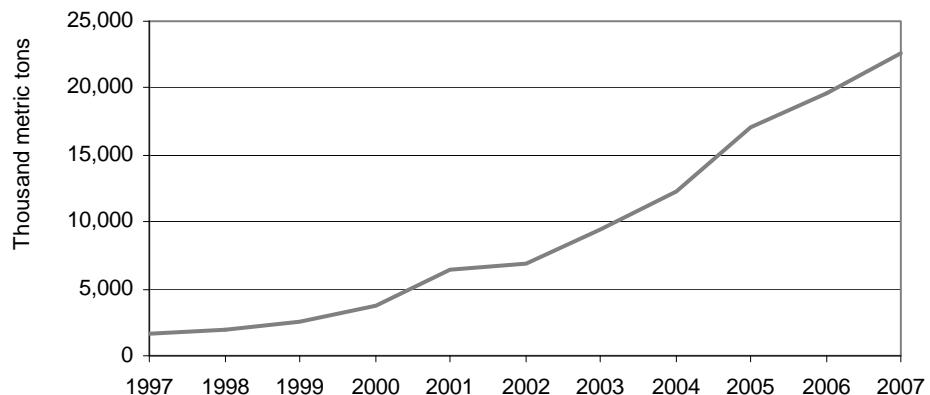
## **Trends in Trade Flows of Raw Materials for the Production of Paper**

### ***Recovered Paper***

With much of the papermaking capacity installed in China in the past decade dependent upon recovered paper as raw material, China has become the driving force in global recovered paper trade. Not only has the volume of this trade expanded significantly, most of it is directed toward China. China's imports of recovered paper have grown significantly, from 1.6 million metric tons in 1997 to 22.6 million metric tons in 2007, a fourteenfold increase (figure 1). China's demand for recovered paper is such that much of the increase in recovered paper in the developed world was exported to China rather than being consumed domestically. For example, in the United States in the past decade, virtually all of the increase in recovered paper has been exported, principally to China, rather than used by domestic paper mills. Even many countries not traditionally considered exporters of recovered paper have now become sources of supply for China.

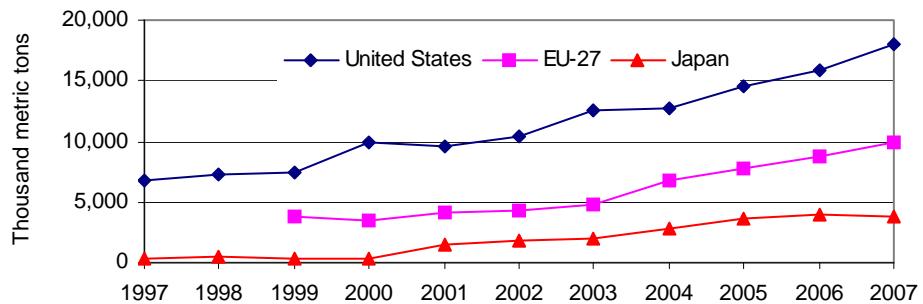
The United States, the EU-27, and Japan are the most important suppliers of recovered paper, accounting for the vast majority of global recovered paper exports. The growth in their recovered paper exports is shown in figure 2. Between 1997 and 2007, U.S. exports of recovered paper almost tripled from 6.8 million metric tons to 18.1 million metric tons, while Japan's exports increased by more than twelve times. The EU-27's exports of recovered paper more than doubled between 1999 and 2007. Exports of recovered paper to China rose even faster over the period, and China became the dominant export market for the United States, the EU-27, and Japan (figure 3).

**Figure 1** China: Imports of recovered paper, 1997–2007



Source: Global Trade Atlas 2009.

**Figure 2** Total recovered paper exports of the United States, the EU-27, and Japan, 1997–2007



Sources: Global Trade Atlas 2009; compiled from official statistics of the U.S. Department of Commerce.

Note: Data for 1997–1998 for the EU-27 are not available.

A multitude of other countries have also become suppliers of recovered paper to China. In 1997, China imported recovered paper (24,000 metric tons) from only 13 countries other than the United States, the EU-27, and Japan. In 2007, imports had grown to nearly 2 million metric tons from 35 countries (Global Trade Atlas 2009).

## **Pulp**

The pulp exports of Brazil, Chile, Indonesia, and Russia have grown rapidly during the past decade. Brazilian, Chilean, and Indonesian exports more than doubled over this period, while Russian exports increased by 86 percent (figure 4).<sup>14</sup> On a quantity basis, the share of global exports of pulp accounted for by the pulp exports of these four countries increased from 21 percent in 1999 to 30 percent in 2007 (Global Trade Atlas 2009). Demand from China drove much of this growth.

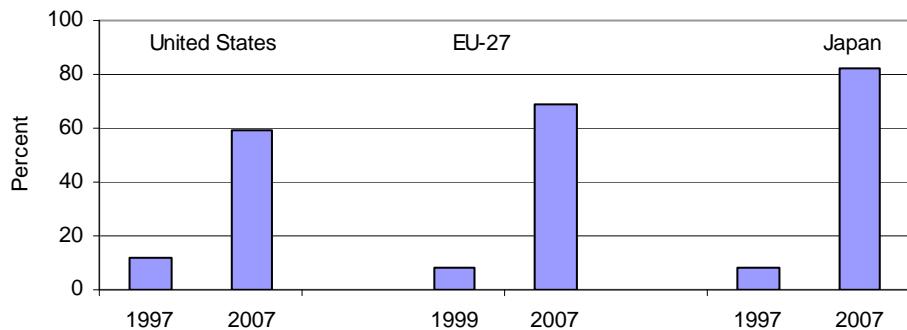
Lacking sufficient wood pulp capacity, many of China's paper producers must source pulp for their new paper machines from overseas suppliers. Consequently, China has become a significant importer of pulp over the past decade. Chinese pulp imports increased by more than five times between 1997 and 2007, from 1.5 million metric tons to 8.5 million metric tons (figure 5). In 2007, six major pulp exporting countries accounted for 86 percent of China's total pulp imports, with no one country accounting for more than 26 percent (figure 6). Canada was the largest supplier to China in 2007, followed by Indonesia and then Chile. Although these six countries export pulp to many other countries, China's importance as an export market has increased. Between 1997 and 2007, pulp exports to China as a percent of total pulp exports rose for each of the six countries, in some instances by a significant amount (table 3). These increases ranged from 9.8 percentage points for Brazil to 34.5 percentage points for Russia. By virtue of these increases, China became the largest pulp export market for the United States, Chile, Indonesia, and Russia, the second largest pulp export market for Canada, and the third largest for Brazil.

Besides China, Brazil, Chile, and Indonesia have developed additional export markets, which lack sufficient pulp capacity and/or are attracted to these new sources of high quality, cost competitive pulp. Russia, on the other hand, has seen almost all of the increase in its pulp exports accounted for by China. Major export markets for Brazilian pulp, other than China, include the United States and certain European countries. Other than China, Chile has important pulp markets in Europe and Asia, and Indonesia exports pulp principally to India, Italy, Japan, South Korea, and Taiwan (table 4).

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<sup>14</sup> By contrast, pulp exports of the United States and Canada, longtime pulp exporters, have been flat since 1997.

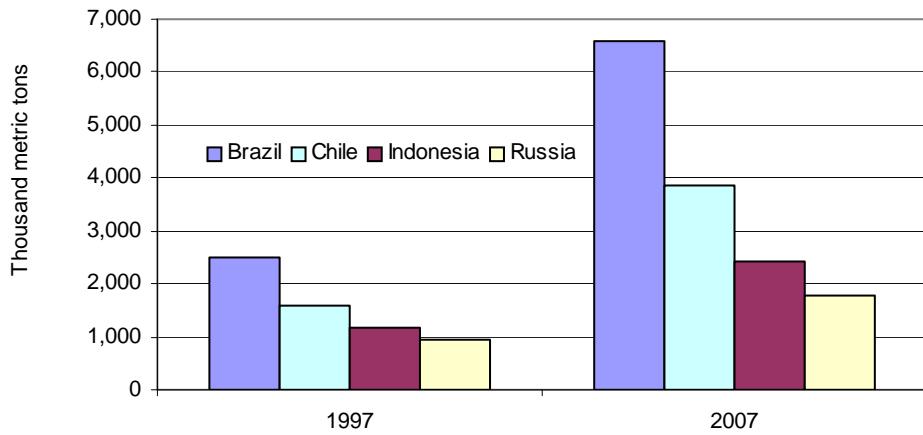
**Figure 3** Recovered paper: Exports to China as a percent of total exports for the United States, the EU-27, and Japan, 1997 and 2007



Sources: Global Trade Atlas 2009; compiled from official statistics of the U.S. Department of Commerce.

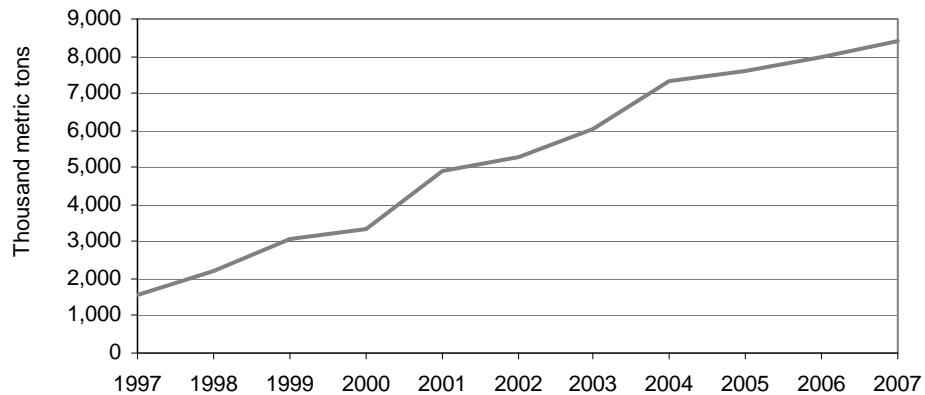
Note: Data for 1997–1998 for the EU-27 are not available.

**Figure 4** Brazil, Chile, Indonesia, and Russia: Total pulp exports, 1997 and 2007



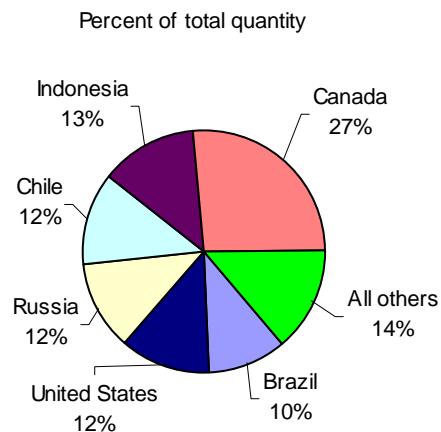
Source: Global Trade Atlas 2009.

**Figure 5** China: Imports of pulp, 1997–2007



Source: Global Trade Atlas 2009.

**Figure 6** China: Imports of pulp from major suppliers as a percent of total imports, 2007



Source: Global Trade Atlas 2009.

**TABLE 3** Major pulp-exporting countries: Quantity of pulp exports to China as a percent of total pulp exports in 1997 and 2007 (%)

Source	1997	2007
United States	3.1	15.1
Canada	4.2	20.2
Brazil	3.7	13.5
Chile	9.3	29.1
Indonesia	32.3	45.2
Russia	17.5	52.0

Sources: Global Trade Atlas 2009; compiled from official statistics of the U.S. Department of Commerce.

**TABLE 4** Pulp exports of Brazil, Chile, Indonesia, and Russia to major countries other than China, 1997 and 2007

Sources	1997	2007	% change
			1997–2007
Thousand metric tons			
Brazil exports to:			
Belgium	367	677	84.5
Italy	135	717	431.1
Netherlands	( <sup>a</sup> )	1,284	( <sup>b</sup> )
Switzerland	0	365	( <sup>c</sup> )
United States	605	1,381	128.3
Chile exports to:			
Belgium	232	180	-22.4
Italy	178	485	172.5
South Korea	83	337	306.0
Netherlands	0	278	( <sup>c</sup> )
Taiwan	169	199	17.8
Indonesia exports to:			
India	76	158	107.9
Italy	92	162	76.1
Japan	51	134	162.7
South Korea	236	480	103.4
Taiwan	73	105	43.8
Russia exports to:			
Germany	19	40	110.5
Hungary	109	71	-34.9
Indonesia	5	54	980.0
Poland	84	73	-13.1
Ukraine	10	67	570.0

Source: Global Trade Atlas 2009.

<sup>a</sup> Less than 1,000 metric tons.

<sup>b</sup> More than 1,000 percent.

<sup>c</sup> Not calculable.

### **Wood Chips and Pulp Logs**

Australia, Brazil, Chile, Indonesia, Russia, and Vietnam have expanded their exports of wood chips since 1997, with some of these countries enjoying triple digit percentage gains. Wood chip exports from Australia, the largest exporter, increased by 57 percent during the period, while wood chips from Chile, the second largest supplier, grew by 9 percent (table 5). The primary markets for these wood chips were Japan, China, and Finland.

Japan has traditionally been the world's largest importer of wood chips, which are used as raw material for its pulp mills. Although Japan's imports of wood chips have been relatively stable over the past decade, imports from Australia, Brazil, Chile, and Vietnam have increased, thus displacing imports from other countries. The share of Japan's total imports of wood chips, by quantity, accounted for by imports from Australia, Brazil, Chile, and Vietnam rose from 43 percent in 1997 to 65 percent in 2007. In 2007, Japan accounted for 90 percent of Australia's wood chip exports on a quantity basis, 76 percent of Brazil's wood chip exports, 99 percent of Chile's exports, and a significant portion of Vietnam's exports (Global Trade Atlas 2009).

**TABLE 5** Wood chips: Exports by Australia, Brazil, Chile, Indonesia, and Russia, 1997 and 2007<sup>a</sup>

Sources	1997	2007	% change
			1997-2007
Thousand metric tons			
Australia	3,856	6,052	57.0
Brazil	352	1,419	303.1
Chile	2,779	3,030	9.0
Indonesia	32	486	( <sup>b</sup> )
Russia	358	850	137.4

Source: Global Trade Atlas 2009.

<sup>a</sup> Trade data for Vietnam are not available from Global Trade Atlas. A gauge of Vietnam's growth as an exporter of wood chips can be seen in the import statistics of wood chips for Japan and China, believed to be Vietnam's two largest export markets for wood chips. Between 1997 and 2007, Japan's imports of wood chips from Vietnam rose from 155,000 metric tons to 903,000 metric tons, and China's imports of wood chips from Vietnam increased from zero to 684,000 metric tons.

<sup>b</sup> More than 1,000 percent.

China has rapidly developed into a sizeable importer of wood chips during the past decade, although its demand remains considerably smaller than that of Japan. Between 1997 and 2007, China's imports of wood chips jumped from only 2,000 metric tons to 1.1 million metric tons. Large pulp mills constructed in China, which lack a sufficient source of domestic wood chips, accounted for this import growth (Stafford 2007, 13). Vietnam and Indonesia became the primary sources of these wood chips, accounting for 60 percent and 32 percent, respectively, of total Chinese imports of wood chips, by quantity, in 2007 (Global Trade Atlas 2009).

Russia has become an important supplier of wood chips and pulp logs to Scandinavia, particularly Finland. Finland is a major pulp producer and has looked to Russian wood to supplement its domestic wood. The quantity of Russia's exports of wood chips to Finland more than tripled between 1997 and 2007, and Russia was the largest supplier of wood chips to Finland during this period (Global Trade Atlas 2009). The quantity of Russia's exports of pulp logs to Finland has also increased during the past decade, and Russia was by far the largest supplier of pulp logs to Finland (Global Trade Atlas 2009).<sup>15</sup>

## Global Financial Crisis and Recession

The financial crisis that began in the United States in the fall of 2008 and the subsequent worldwide economic downturn have led to a sharp drop in demand for paper. Production and shipments of paper have declined, and many paper mills have curtailed production or ceased operations temporarily or permanently. Demand for pulp, recovered paper, and wood chips and pulp logs has likewise fallen. Some pulp mills have cut production and suspended operations, and some pulp mill capacity expansion plans have been put on hold. Moreover, recovered paper has piled up in warehouses and ports. Nevertheless, the developments discussed above—China's expanding paper industry and increased need for imported fiber, the availability of fiber from tree plantations, and the

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<sup>15</sup> Pulp logs are not specifically broken out in the published trade data for Russia and Finland. Nevertheless, an analysis of the various Harmonized System numbers which comprise softwood logs and hardwood logs for these two countries indicates that certain of these numbers are likely to consist primarily of pulp logs, rather than other types of logs, and consequently can serve as a reasonable approximation of trade in pulp logs.

advantages of recovered paper—will likely not be fundamentally altered in the long run by the worldwide recession. When economic recovery occurs and paper demand picks up, these developments, and the trade patterns discussed above, will likely intensify. One exception to this may be the Russian export tax on logs. If the tax does increase to 80 percent at some point in the future, the flow of pulp logs from Russia would likely be severely constrained.

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