

### IMPLICATIONS FOR FORESTS AND LIVELIHOODS 中国与亚太地区国家林产品贸易研究

ENVIRONMENTAL ASPECTS OF CHINA'S PAPERMAKING FIBER SUPPLY

**BRIAN STAFFORD** 





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# ENVIRONMENTAL ASPECTS OF CHINA'S PAPERMAKING FIBER SUPPLY

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#### ABBREVIATIONS

WTA: World Trade Atlas

APP: Asia Pulp & Paper Co. Ltd.

**APRIL:** Asia Pacific Resources International Holdings Ltd.

**CIF:** Cost, Insurance and Freight (international commerce term, refers to the selling price of goods includes the cost of goods, freight/transport and marine insurance)

FAO: Food & Agriculture Organization of the United Nations

ha: hectare

**kbdmt:** thousand bone-dry metric tons (1 bone-dry metric ton is the mass of wood that weighs 1 metric ton if all moisture content was removed; in contrast with green metric ton, below)

kt: kilotons (thousand metric tons)

Mt: million metric tons

Mgmt: million green metric tons (1 green metric ton equals 1,000 kilograms of undried biomass)

**pa:** *per annum* (per year)

% +/- pa: percent change per year

#### SUMMARY

In recent years, China's expanding pulp and paper sector has become a major influence on the global forests and forest product markets. Since 1990, China has accounted for over 50 per cent the world's overall growth in paper and paperboard production. To meet growing domestic demand, the government is promoting a new industry based on large, high-tech mills which process wood pulp into paper.

Past forecasts of China's pulp and paper consumption to 2010 vary widely, ranging from the FAO's 1997 estimate of 48 million metric tons (Mt),<sup>1</sup> to a baseline projection of 68.5 Mt by He and Barr (2004).<sup>2</sup> The latter forecast is an increase of 9.2 Mt on the 2006 data presented here, which would represent a 4.8% *per annum* (pa) growth over the 2006-2010 period.

This study employs trade data to outline the structure of all of China's papermaking inputs: virgin pulp, pulpwood, and wastepaper, both domestic and imported. It is estimated that the country's total papermaking fiber resources have increased from 46.9 Mt to 59.7 Mt over the four years since 2002 – an annual average rate of 6.2% pa.

Imported secondary fiber, or wastepaper, has been the primary driver of this expansion, recording a 29.8% annual average growth by volume in the period studied. This sector has grown from 6.9 Mt in 2002 to 19.6 Mt in 2006 and now comprises 33.1% of China's total fiber resources. Combined, imported and domestic wastepaper volumes constitute approximately 62.6% of China's fiber supply. This secondary fiber is used primarily in the manufacture of corrugated cardboard boxes to ship the great quantities of Chinese goods such as consumer electronics, clothing, and furniture to overseas markets. The source of this wastepaper is primarily used cartons from the U.S., Japan, and Europe, where China's steady demand has buoyed up the market price of wastepaper and catalyzed greater investment in paper recovery in supplying countries.

Domestic secondary fiber and pulp constitute the second and third largest inputs, although the available production data is limited. Domestic wastepaper usage, estimated at 15.5 Mt, accounts for 29.5% of fiber sources but only registered 1.8% growth in 2006. At 14.2 Mt, China's pulp production in 2006 was somewhat smaller. Much of China's domestic paper output is produced with vegetable (non-wood) pulp in small-scale traditional mills. As such, the recycled pulp it produces is generally not of export quality.

Imported pulp and pulpwood are the two smallest components of fiber consumption, at 13.5% and 0.7% respectively. These resources provide high-quality wood pulp, used to produce international quality printing and writing paper. This paper estimates that a total of 7.4 Mt, or at least 63.5% of China's imported pulp, can be regarded as having been drawn from sustainably managed forests.

<sup>&</sup>lt;sup>1</sup> Zhang et al. 1997. Trends and outlook for forest products consumption, production and trade in the Asia-Pacific region. Working paper no. APFSOS/WP/12, Forestry Policy and Planning Division, United Nations Food & Agriculture Organization. Rome.

<sup>&</sup>lt;sup>2</sup> He, D. and C. Barr. 2004. *China's pulp and paper sector: An analysis of supply-demand and medium term projections.* International Forestry Review, vol. 6(3-4).

While some of the pulp imports are supplied by well-managed forests and plantations, a significant portion comes from Eastern Russia and Indonesia, where forest governance capacity is low. Paper manufacturers that source from these countries are likely to be running a high risk of including illegally logged wood in their product. Hardwood pulpwood imported from Indonesia carries a similar reputational risk.

A decade ago the world trade in wastepaper was 17.7 Mt, of which exports from the United States constituted 5.8 Mt. In 2006, world exports to China alone, as indicated above, were 19.6 Mt and the United States provided 8.6 Mt-2.8 Mt more than its entire wastepaper trade a decade previously. China's imports of wastepaper have increased by a massive 16.5 Mt pa over the last decade, from 3.1 Mt in 1996 to 19.6 Mt in 2006. The sheer volume of this trade has had a very beneficial and stabilizing effect on the world market. From an environmental perspective, China's increasing demand for wastepaper has prevented an extra 65 Mt of wastepaper from heading to the landfill in the US, Japan and Europe between 2002-2006, and has saved an estimated 54.3 million metric green tons of trees from being harvested in 2006. At the same time, China sources substantial amounts of virgin wood pulp from countries where good forest management cannot be assured. The greatest environmental challenge related to China's fiber consumption is to ensure that their pulp and pulpwood imports from certain "high risk" countries originate from sustainable and legal harvesting operations.

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## INTRODUCTION: CHINA'S PAPERMAKING FIBER RESOURCES AND CONSUMPTION

It is estimated that China's total papermaking fiber resources have increased from 46.9 million metric tons (Mt) to 59.7 Mt over the four years since 2002– an annual average rate of 6.2% *per annum* (pa). Figure 1<sup>3</sup> shows estimates of China's total papermaking fiber resources<sup>4</sup> using FAO data to for pulp, wastepaper and pulpwood imports from 2002-2006. FAO data is used for domestic pulp and wastepaper up to 2003 and then estimates are calculated from 2004-2006.



Figure 1: China's Total Papermaking Fiber Resources: 2002–2006 (Mt pa)

\* = Estimated fiber equivalent at 50% fiber content of bone dry wood (50% of reported import volume). Note: From 2002-2006, the fiber equivalent of pulpwood imports grew from less than 50,000 tons to 700,000 tons.

Taken as a whole, the available statistics on China's papermaking fiber resources present a sector composed of four clusters of commodity chains, as defined by their inputs, processing facility, and end-use product. Domestic pulp and wastepaper, is processed by local small-scale industry and remain bound to Chinese markets due to the poor fiber quality. This is the largest segment, using approximately 53% of total fiber resources by volume. In contrast, imports of wastepaper, pulp and pulpwood are inputs to a modern, large-scale paper industry that produces various export-oriented goods. Roughly 22% of fiber supply is dedicated to the manufacture of cardboard boxes, with the remainder going towards different grades of export-quality paper. These chains are presented graphically in Figure 2. The types of papermaking fibers that fuel the sector are described below.

*Imported Wastepaper:* Domestic and imported wastepaper together are estimated to constitute 62.6% of China's total fiber supply. At this stage of its economic development, China's greatest paper need is for packaging to contain its burgeoning light manufacturing exports.

Source: FAO, WTA & BS&A estimates

<sup>&</sup>lt;sup>3</sup> Exact figures used in this and all other charts are contained in Annex 1.

<sup>&</sup>lt;sup>4</sup> In this analysis, references to "total papermaking fiber" are to locally produced and imported pulp and wastepaper, plus the estimated fiber equivalent of pulpwood imports.

Thus, about three-quarters of imported wastepaper grades (unbleached kraft, bleached chemical, and others) are almost exclusively processed into corrugated cardboard boxes and other shipping materials. The remaining 26% is mechanical-grade wastepaper, usually made into newsprint and the coated mechanical paper used for magazines and advertising catalogues.<sup>5</sup> Growing from 6.9 to 19.6 Mt between 2002 and 2006, imported wastepaper is now the largest source (33.1%) of fiber for the Chinese pulp and paper industry. Apart from imported pulpwood, which is growing from a very small base of less than 50,000 tons, this was the component with the highest growth rate (29.8%) during this time.

- Local Wastepaper. Although domestic wastepaper production is the second largest source of papermaking fiber, estimated at 17.5 Mt in 2007, it is estimated to be growing at only a third of the rate of wastepaper imports. Since most domestic paper is made from low-strength vegetable fiber, this wastepaper yields pulp that is generally of poor quality. It is important to note that the quality and scope of the data on China's own wastepaper production is relatively poor: for instance, the last FAO figures for domestic wastepaper collection were published in 2003. Due to the scanty information on domestic wastepaper production levels, this component sectors does not receive an in-depth treatment in this paper.
- Local Pulp: At an estimated 14.2 Mt, the next largest component of China's fiber supply (29.5%) is estimated to be domestic pulp production, yet there is little recent data available. The last actual figure from the FAO for domestic pulp production is 16.2 Mt in 2003; exports were negligible. What is known is that most is vegetable in origin, of poor quality and low strength (most vegetable pulps are short fiber, which limits paper strength) and that the Chinese mills producing pulp have been highly polluting. As a result, thousands of small vegetable fiber pulpmills, for which it would have been uneconomic to install effluent treatment plants, have been forced to close by the Chinese government in recent years. Small-scale local production of papermaking pulp has declined substantially, while larger mills are being encouraged to build joint treatment plants. As with domestic wastepaper, though, domestic pulp production is not thoroughly examined here given the limitations of readily available data.
- Imported Pulp: Aside from imported wastepaper (which is mainly destined for packaging of one form or another), the only significant source of high quality wood fiber is imported wood pulp. Although it constitutes only 13.5% of total papermaking resources, it is the most expensive element in the papermaking furnish and the one with the most significance for the future of the world's natural forests, given the likelihood of unsustainable management in certain supplying countries, particularly Indonesia and Russia. This paper estimates that a total of 7.4 Mt, or at least 63.5% of China's imported pulp, can be regarded as having been drawn from sustainably managed forests. This issue is taken up later in the analysis.

<sup>&</sup>lt;sup>5</sup> NB: Coated mechanical grade paper is not equivalent to high-gloss coated wood-free papers. Chinese government subsidization of the latter, but not the former, has prompted the U.S. Department of Commerce to rule that China is subject to countervailing duties on this product.

- Local Pulpwood: Relative to its population and available substitutes, wood is a scarce resource in China. Consequently, the local industry has traditionally not manufactured paper using wood pulp, a trend which continues today. The Chinese central government envisions nearly 6 M hectares (ha) of new fast-growing, high-yield plantations by 2015, mostly to feed several large foreign pulp and paper companies who have established operations in China. However, the high land rents, unsuitable topography and competitive prices from other suppliers may impede this goal.<sup>6</sup> Compared to pulp imports, non-wood pulp, and wastepaper, the flow of pulpwood from domestic plantations will likely remain small.
- Imported Pulpwood: So far only a very small component of the papermaking furnish, imports of pulpwood are overwhelmingly composed of non-coniferous pulpwood. With its high water content (50%), under normal circumstances it is not economic to import pulpwood to make pulp since it cannot compete against the low wood cost of integrated pulpmills in South America, for example. As a result of a specific set of circumstances, much of the demand for this product in China comes from two large pulpmills built by Asia Pulp & Paper (APP) and Asian Pacific Resources International Limited (APRIL) which must import pulpwood to make up for excess operating capacity of their pulpmills in regions with inadequate local wood supply (Hainan Island and Rizhao, respectively). As integrated operations, these companies are presumably able to absorb the excess cost involved in shipping the pulpwood– hopefully a stop-gap measure until local pulpwood plantations come on-stream. Some environmental groups have expressed concern over the significant portion of Indonesian wood mixed in these imports, which runs a serious risk of being illegally or unsustainably sourced.

<sup>&</sup>lt;sup>6</sup> Barr, C. and C. Cossalter. 2004. China's development of a plantation-based wood pulp industry: Government policies, financial incentives, and investment trends. International Forestry Review 6(3-4), 267-281.



Figure 2: Chinese Papermaking Fiber Commodity Chains, 2006

#### **IMPORTED WASTEPAPER**

#### **DYNAMICS OF THE TRADE**

China's primary need in importing wastepaper is to recycle it into packaging grades (corrugated container materials primarily, but also cartonboard) to box up the vast volume of light manufactures exported to the rest of the world. Given the paucity of China's virgin fiber resources-- especially the strong, long-fibered softwood necessary for packaging production-- the quickest, cheapest and most effective means of fulfilling this need is to import wastepaper (primarily used corrugated cartons, from the U.S., Europe and Japan), slush them up and run them over a paper machine again. Because the U.S. has enormous softwood resources, it makes most of its packaging from virgin fiber. As a result, its waste stream is rich in high quality fiber.

The Chinese have built, and are continuing to build, some of the largest paper mills in the world, running the biggest and most modern packaging paper and paperboard machines ever built (e.g. 3 Mt of capacity on a single site.) To feed this very rapid increase in capacity, Chinese wastepaper buyers have been integrating themselves into wastepaper markets in the U.S., Europe and elsewhere. Originally, the material was purchased through brokers, but more recently there have been instances of Chinese mills contracting directly with large supermarket chains. The wastepaper trade provides one of the few backloads for the prodigious number of containers moving back to China from the rest of the world.

China also imports a huge volume of mechanical grade wastepaper (old newspapers, magazines and advertising catalogues) because it is also considerably cheaper and much quicker to use the West's wastepaper than to grow trees locally and pulp them. The latter process is time- and capital-intensive, producing costly pulp.

#### **IMPORTS BY GRADE**

Imports of the primary source material for recycled packaging grades– unbleached kraft, mainly from old corrugated containers– are the driver for China's wastepaper imports. As Figure 3 demonstrates, imports of unbleached kraft are both the largest and fastest-growing segment among wastepaper grades.

Shipments of this grade have been growing at a very substantial 41% annual average, increasing from 2.6 Mt in 2002 to 10.4 Mt in 2006. On the other hand, imports of white paper (most likely office waste), represented here by the grade 'Bleached Chemical,' are small and actually in decline despite the high prices presently being paid (see Fig. 4 below.) This material is most likely being used to provide a white liner on packaging material, rather than being recycled into printing and communication grade papers.



Figure 3: China's Imports of Wastepaper by Grade: 2002-2006 (Mt pa)



The 'Other' grade is also used primarily for packaging. It denotes mixed wastepaper (packaging material, old newspapers, magazines, etc.) which is used in the manufacture of corrugating medium, the centre core in the composite sheet material from which corrugated containers are made. The mechanical pulp in this mixture is stiff and adds crush resistance to the corrugated sheet. Imports of 'Other' wastepaper, although only about one-third those of unbleached kraft, have been growing even faster, at an average 45% pa.

Only the 'Mechanical<sup>7</sup>' category is used to produce a paper grade other than packaging. It is an ideal pulp for the manufacture of newsprint and the so-called coated mechanical grades, which are used mainly in magazines and advertising catalogues. While China's imports of this grade of wastepaper have increased from 2.9 Mt in 2002 to 5.0 Mt in 2006, the growth rate has been only about one third that of the packaging grades.

Imports of solely packaging grades (all those other than 'Mechanical' wastepaper) have grown by a massive 10.6 Mt over the four-year period. From 4.0 Mt in 2002 to 14.6 in 2006, their average annual rate of growth is 38.2%; these grades represented three quarters (74.4%) of China's wastepaper imports in 2006.

<sup>&</sup>lt;sup>7</sup> Mechanical wastepaper, as the term suggests, is made by the mechanical pulping process where the wood is torn apart, using (generally) two counter-rotating plates in a machine called a refiner. Wood is made up mainly of two components; cellulose (the fibers) and lignin (the glue that sticks the fibers together). In the mechanical pulping process much of the lignin goes into the pulp so the yield per ton of wood is much higher than in the chemical pulping process where only the fiber is used.

#### WASTEPAPER PRICES

Prices in wastepaper markets, both domestic and international, have traditionally been very cyclical, following the international pulp price cycle but with increased amplitude. As a result the trade was badly organized in relation to marginal material with collectors and dealers moving in when prices were high and out when prices fell– at which time marginal resources went into landfills.

A decade ago the world trade in wastepaper was 17.7 Mt, of which exports from the US constituted 5.8 Mt. In 2006, world exports to China alone stood at 19.6 Mt, while the US provided 8.6 Mt– more than 2.8 Mt above its entire wastepaper trade ten years prior. China's imports of wastepaper have increased by a massive 16.5 Mt pa over the last decade, from 3.1 Mt in 1996 to 19.6 Mt in 2006. The sheer volume of this trade has had a very beneficial and stabilizing effect on the world market.



Figure 4: China's Wastepaper Import Prices by Grade: 2002–2006 (USD/ton, CIF)

Notes: CIF is an abbreviation of the international commerce term "Cost, Insurance and Freight," meaning the selling price of a good includes the cost of goods, plus freight/ transport fees and marine insurance.

Figure 4 shows how China's demand has been instrumental, not only in bringing price stability to the market, but also in lifting those prices substantially. Between 2002 and 2005, for example, the average price of wastepaper imported into China increased 35% (prices fell slightly in 2006). Between 2002 and 2006, however the average annual rate of price increase for all grades was still 7% pa.

#### SOURCES OF WASTEPAPER IMPORTS

Constant demand from China and the very strong pricing environment it has created have led to substantial investment in collection and processing facilities around the world. Previously marginal or uneconomic waste streams are now included in the trade which has been boosted in many supplying countries. As depicted in Figure 5, 44% of all China's wastepaper imports come from the US while Japan supplies a further 17%. Most of the remainder comes from the EU (UK, Netherlands, Germany and Belgium.) Other suppliers include Canada and Hong Kong. Each country's contribution is more or less even across the different grades.

Source: WTA



Figure 5: China's Wastepaper Imports by Country 2002-2006 (Mt pa)

Source: WTA

#### DOMESTIC PULP AND WASTEPAPER PRODUCTION

Recent data on domestic pulp and wastepaper production are not readily available. The last actual figures reported by the FAO for domestic pulp production was 16.2 Mt and 16.9 Mt in 2003. It can only therefore be estimated that domestic wastepaper production is the second largest source of Chinese fiber supply, estimated at 17.5 Mt while domestic pulp production is estimated to be the 3<sup>rd</sup> largest component of the fiber resource at 14.2 Mt in 2006.

As a nation, China is relatively wood-poor, and wood pulp has not been a historically important component of China's paper production. As late as 1999, 51% of China's paper making furnish was drawn from vegetable sources (mainly cereal straw, reed and bagasse), 43% from wastepaper and only 6% from wood fiber. In that year an estimated 9 M m<sup>3</sup> of wood, or 3% of the country's wood consumption, was used for domestic pulp and paper production. This trend has continued to the present day, and domestically-grown pulpwood plays only a minor role in China's paper production. Yet this may soon change.

To meet growing domestic demand, the government is promoting a new industry based on large, high-tech mills which process wood pulp into paper. He and Barr (2004) address the government's efforts to build this capacity, as well as some of the serious challenges it faces.<sup>8</sup> China has provided significant capital investment to 13 high-priority domestic pulp and paper projects, and it is subsidizing the development of up to 5.8 million ha of fast-growing pulpwood plantations. These, it is hoped, will provide the new mills with a sustainable supply of fiber. But despite the massive investments, He and Barr (2004) have identified a number of obstacles to the industry. First,

<sup>&</sup>lt;sup>8</sup> He, D. and C. Barr. 2004. China's pulp and paper sector: An analysis of supply-demand and medium term projections. International Forestry Review, vol. 6(3-4).

establishing plantations can be a slow and complex business due to shortages of adequate land (most of the suitable land is held by households and communities) and the price-competitiveness of local pulp versus exports from Brazil, Indonesia, Canada and others – thus reducing the incentive for private-sector investment. There are concerns about the way in which pulp producers in some parts of China are developing large-scale mills before securing a sustainable supply of fiber. This rapid expansion is partially driven by subsidies. It is also a matter for concern that the risks and social impacts associated with fast-growing plantation development in China have yet to be fully evaluated. Several large foreign pulp and paper companies have begun to establish plantations in China to meet the capacity of their paper mills in China. However, compared to pulp imports, non-wood pulp, and wastepaper, the flow of pulpwood from domestic plantations will likely remain small, and may not be economically viable in the long term.

However, China produces copious amounts of pulp from agricultural residues and other non-wood fibers for domestic use, approximately 1.75 times its virgin wood pulp imports. Once used, much of this paper is recuperated and re-pulped, providing almost as much wastepaper as China imports (17.5 Mt vs. 19.6 Mt). However, given that the wood-based component of this locally-made virgin fiber pulp is very minor, the paper it produces is insufficient strength for international export, it is instead destined for domestic shipping.

It is well known that the mills processing local pulp and wastepaper have been highly polluting, venting their effluents untreated into the nation's river systems. The Chinese government has sought to combat the problem by forcing many (between four and five thousand) small mills (for which it would be uneconomic to install effluent treatment plants) to close and encouraging the larger ones to band together to build joint treatment plants. Due mainly to these reforms, the utilization of virgin (non-wood) fiber in China's papermaking furnish has been declining at 1.2% pa (see Table A2 in the Annex.) The utilization of secondary fiber, on the other hand, is expanding at an average rate of 12.5% pa, mainly because of the success with which China has been able to exploit the secondary fiber supply as described in the previous section.

#### **IMPORTED WOOD PULP**

Aside from imported wastepaper, which is mainly destined for packaging of one form or another, the only significant source of high quality wood fiber is imported wood pulp. Although it constitutes only 13.5% of the papermaking resource, it would be the most expensive element in the papermaking furnish and the one with the most significance for the future of the world's natural forests, given the likelihood of unsustainable management in certain supplying countries, particularly Indonesia and Russia.

Much of the paper made by the traditional industry in China is of poor quality and could not be sold on the world market. Only paper made from imported pulp can compete on the world market. In this context China made 11.8 Mt of printing and writing papers and exported 1.3 Mt in 2005. The latter would be overwhelmingly made from imported pulp. Bleached kraft and chemi-mechanical pulp, the two grades used in printing and communication grade manufacture, produces a total furnish of 7.4 Mt, at least 63.5% of which can be regarded as having been drawn from sustainably managed wood resources.

#### IMPORT STRUCTURE

The overwhelming majority (80.4%) of China's pulp imports is sulfate pulp, (which, in turn, would be virtually all bleached kraft pulp) and supplies have been growing at 9% annual average. The only other category of significance is chemi-mechanical pulp (12.1%). These two categories, both used in the production of printing and communication grade papers, constitute 92.5% of China's pulp imports. Figure 6 depicts China's pulp imports by grade for the last five years:





#### **BLEACHED KRAFT PULP**

In 2006, China imported 12.5% of all the pulp traded in the world. Figure 7 shows how China's sources of bleached kraft pulp are quite diverse with six countries having quite significant market shares. Several countries (e.g. Canada, US) are known to have relatively well managed forests; others such as Indonesia and Russia are usually listed as "high risk" countries in terms of the potential for illegal or unsustainable management and harvesting practices.

In 2006, Canada was the single largest supplier of bleached kraft pulp providing 1.251 Mt, 19.5% of all China's requirements in that year. Canada's exports to China have been growing at an annual average rate of 15% pa and it has recently usurped the role of largest supplier from Indonesia (1.173 Mt) whose shipments over the five years, at 6.2 Mt, have been 1 Mt larger than those from Canada. While the wood supply for Canada's pulp production can be relied upon to be drawn from

Source: WTA

sustainably managed natural forests, the same could not be said of Indonesia, where mixed tropical hardwood is understood to still constitute a large proportion of the wood supply to the country's bleached kraft pulpmills.



Figure 7: China's Bleached Kraft Pulp Imports by Origin: 2002–06 (Mt pa)

The third largest supplier is Brazil (923 kilotons), whose shipments have grown the fastest of all of the seven largest suppliers (at 28% annual average). Brazil's market bleached kraft pulpmills all draw their wood supply from plantations so the wood supply is considered to be relatively environmentally sustainable, as is that of Chile, China's sixth largest supplier, with 637 kilotons (kt) of shipments in 2006.

Russia was ranked fourth with 882 kt in 2006 and some doubt must be expressed as to the environmental sustainability of the management of much of its vast forest base. However, at least 70% of the pulp sent to China from Russia has reportedly been verified as sustainable by the Forest Stewardship Council (FSC.) 69% comes from mills belonging to Ilim Pulp Corp., while Arkhangelsk PPM exports an additional 1%. Both companies have obtained FSC certification for all their Russian pulpwood forests.

The US ranked fifth with 722 kt, and it is generally assumed that the natural forests underlying these shipments are being managed in a sustainable manner. Finland was the seventh largest supplier with only 201 kt, a considerably smaller volume than the preceding six. It is possible that some of the pulpwood used in Finnish pulp exports to China includes some supply from western Russia, which may not be as environmentally sustainable as domestic Finnish sources.

While not all sources have been examined, based on the volumes by supplying country and a simplistic judgment of the implementation of good forest governance, it seems likely that at least 3.7 Mt, or 58% of China's imported bleached kraft pulp, have been drawn from legal or sustainably managed forests.

Source: WTA.

#### CHEMI-MECHANICAL PULP

Figure 8 shows the source of China's chemi-mechanical pulp, often referred to as BCTMP (Bleached Chemi-Thermo-Mechanical Pulp). It requires a considerable amount of mechanical energy in its manufacture and is therefore generally only made in advanced western countries where energy is reasonably cheap. Canada and New Zealand dominate China's imports of this grade, responsible for 92.7% of supplies, with Sweden adding a further 3.8% to bring the total supplied by the three countries to 96.5%. Canada and Sweden's forests are assumed to be managed sustainably and the pulp from New Zealand would be made from plantation radiata pine. The amount of pulp arriving from Indonesia is extremely small and may even be a misclassification.





#### **IMPORTED PULPWOOD**

The proportion of imported pulpwood to China's total papermaking fiber supply (at less than 1%) is very small, but it has the potential to expand rapidly. Imports of hardwood pulpwood have increased dramatically since 2002– increasing from 51 to 894 kbdmt during that time.

Figure 9 illustrates that most of China's imports of hardwood pulpwood (52% in 2006) are sourced from Vietnam where it is understood to be from eucalypt plantations. 202 kbdmt, or 23% of imports, came from Australia in 2006 where it would be drawn from relatively well managed forests. In contrast, it is not known whether the 19% that originated in Indonesia was harvested from plantations or natural forests, thus posing a possible reputational risk. In the past, Indonesian companies have greatly increased pulping capacity without securing an adequate wood supply. Should this happen in the future, it could lead to a vastly increased wood flow emanating from non-sustainable sources in Indonesia.

Source: WTA.



Figure 9: China's Imports of Hardwood Pulpwood by Origin: 2002–2006 (kbdmt)

Source: WTA. Note: Units give in thousands of bone-dry metric tons (kbdmt.)

Under normal circumstances it is not economic to import pulpwood (which is 50% water) to make pulp and compete against the integrated low wood cost pulpmills of, for example, South America. China's pulpwood imports appear to be taking place in response to a specific set of circumstances. Both Asia Pulp & Paper (APP) and Asian Pacific Resources International Limited (APRIL) have built pulpmills in China, in APP's case on Hainan Island and in APRIL's, at Rizhao. Typical of the development model employed by these companies, the pulpmills were constructed without an adequate local wood supply. The upshot has been that pulpwood has had to be imported, adding an extra cost. Presumably, being integrated operations (i.e., the pulp is made into higher products) the companies are able to absorb the excess cost involved in importing wood.

#### **CONCLUSIONS: ENVIRONMENTAL IMPACTS**

#### VIRGIN VERSUS SECONDARY FIBER

Figure 10 depicts how the use of virgin fiber in China's paper making furnish (namely pulp, both domestically produced and imported, plus pulpwood imports) has been declining at a rate of approximately 1.2% per year since 2002. This is mainly because of the necessity to reform China's traditional domestic pulp and paper industry due to domestic water pollution concerns. During the same period, the use of secondary fibers (local and imported wastepaper) has increased 12.5%, mainly due to the success with which China has been able to exploit the secondary fiber supply from the US and Europe.



Figure 10: Virgin vs. Secondary Fiber, 2002–2006 (Mt)

Source: WTA.

#### WASTEPAPER'S IMPACT ON PAPER TO LANDFILL

A decade ago (1996) the wastepaper trade with China was only 3.1 Mt, and for the five years up to and including 1996 imports had averaged only 2.3 Mt pa. Assuming China had not entered a period of rapid economic development and that it continued to import at the rate of 2.3 Mt pa over the next decade, the total wastepaper inflow would have been 23 Mt during those years. Yet in fact, in the ten years since 1996, China has imported a total of 87.6 Mt. It can thus be said that, in the absence of China's dramatic expansion in demand for wastepaper, around an extra 65 Mt of wastepaper would have ended up in landfill over the period worldwide.

#### WASTEPAPER'S IMPACT ON THE WORLD'S FORESTS

Table 1 assesses the extent to which China's involvement in the wastepaper trade has resulted in a reduction in the world wood harvest— in other words, below what might have been if China had resorted to virgin material for all its wood fiber needs. China's increasing demand for wastepaper imports can be estimated to have saved 54.3 million green metric tons of wood (Mgmt) from being harvested in 2006. The table explains this calculation, displaying China's imports of wastepaper by grade, the approximate conversion factor for each grade from green wood and the resulting log harvest that would have been necessary to supply that fiber from the world's forests.

Grade	Imports	Conversion Factor	Green Wood Equivalent
Unbleached Kraft	10.4	3.2	33.4
Bleached Chemical	0.2	4.5	1.0
Mechanical Pulp	5.0	2	10.1
Other	3.9	2.5	9.9
Total Wastepaper Imports	19.6	-	54.3

#### Table 1: Wood Equivalent of China's Wastepaper Trade, 2006 (Mgmt)

Source: WTA & BS&A estimates.

Note: Figures given in millions of green metric tons (Mgmt.)

This estimate will err by the extent that fiber is on a second or subsequent time around the cycle. There is debate about how many times, for example, strong softwood fibers could effectively be recycled before ultimately breaking down, but it is unlikely to be much more than twice. Also, the majority of wastepaper exports from the U.S. (44% of China's imports in 2006, mostly used cartons produced from high quality virgin fiber), for example, is likely to be on their first time around. Nevertheless, assuming that a large number of Chinese export cardboard cartons are now flowing back to China and only half of the total fiber flow is regarded as utilized in lieu of new wood, then the figure, at 27.2 Mgmt, is still very significant. It should be borne in mind that this figure is for a single year (2006.)

It should be emphasized, however, that market forces rather than environmental altruism have been driving the utilization of such a vast amount of wastepaper. The ready availability of wastepaper has enabled China to increase its output of packaging material with relatively small investments involved to utilize it (relative to that required to source virgin fiber from wood) and the lower price of the material itself relative to virgin pulp.

#### SUSTAINABILITY OF CHINA'S IMPORTED PULP SUPPLY

For the most part, China's pulp imports are thought to be sourced from sustainably managed forests. This paper estimates that a total of 7.4 Mt, or at least 63.5% of China's imported pulp, can be regarded as having been drawn from such sources. Not all sources of supply have been examined, but of the 6.4 Mt of bleached kraft pulp imported by China in 2006, it seems likely that at least 3.7 Mt, or 58%, was drawn from sustainably managed forest bases. Since bleached kraft pulp is principally used in the manufacture of export-grade printing and communication papers (including high grade 'glossy' papers), international buyers of Chinese-made paper should also be aware of these sourcing issues.

While some of the pulp imports are supplied by well managed forests and plantations, a significant portion comes from Eastern Russia and Indonesia, where forest governance capacity is low. Some doubt must be expressed in relation to the almost one third (32.1%) sourced from Russia and Indonesia. China imported 1.173 Mt of bleached kraft exports from Indonesia in 2006, making that

country China's second largest supplier for that grade. However, it is understood that mixed tropical hardwood still constitutes a large proportion of the wood supply to Indonesia's bleached kraft pulpmills. Without efforts to verify the supply of these mills, it is reasonable to suspect that a portion of the pulp from this pulpwood is processed in Chinese mills. Russia, China's fourth largest source of bleached kraft (882 kt in 2006) also has a poor track record in forest management, although some 70% of it pulp exports are purportedly sourced from FSC-certified forests. The remaining 30% of these pulp imports warrant greater scrutiny if buyers wish to ensure a sustainable supply of Russian forest resources to match rising paper consumption in China. In addition, paper manufacturers that source from these countries are likely to be running a high risk of including illegally logged wood in their product.

#### **REPUTATIONAL RISKS IN CHINA'S PULPWOOD SOURCING**

Imported pulpwood accounts a very small (0.7%) component of China's papermaking furnish, driven in part by APP and APRIL's pulpmills. 80% of this comes from plantations or sustainably managed natural forests in Vietnam, Australia, and Chile (See Table A8 in the Annex). A minor (19%) but rapidly growing proportion is, however, being sourced from Indonesia. Currently, there is no way of knowing discerning whether the Indonesian supply is plantation-grown or tropical forest material, or if the harvest complies with management requirements. Considerable doubt has been expressed by the environmental community as to the extent that the plantations established to support these Indonesian pulpmills will be able to provide adequate volumes now or in the near future.

In the past, Indonesian companies have heavily augmented pulping capacity without an adequate wood supply and this could happen in future, leading to a vastly increased wood flow emanating from non-sustainable sources in Indonesia. Some large pulp mills in China, like those operated by APP and APRIL, are ostensibly importing pulpwood as a temporary measure until adequate local forest resources comes on-stream. However, there is no guarantee that they will succeed in establishing a local wood supply, or if they do that it will be sufficient to sustain the mill. Thus, while the imported pulpwood makes up less than 1% of China's total papermaking fiber supply, it has the potential to expand rapidly with deleterious environmental effects. Pulp and paper companies sourcing fiber from Indonesia, as well as importers of their paper, may be putting themselves at risk to allegations that they are rewarding the deforestation in Indonesia.

#### RECOMMENDATIONS REGARDING NON-ENVIRONMENTALLY SUSTAINABLE MATERIALS

The most obvious environmentally detrimental effects arising from this analysis involve the activities of those companies that are importing uncertified pulp or pulpwood from Russia and Indonesia, especially the latter. Some large companies appear to be shipping pulpwood and pulp sourced out of Indonesia to mills and paper machines in China. It is not known whether this imported material is plantation sourced or purchased from contractors who have obtained it illegally.

Some constructive recommendations that arise from this analysis should target actors in the wood products industry:

- *Establishing systems to track wood all along the supply chain.* Industry, possibly supported by governmental program, should be aware of where its forest products supplies come from and develop appropriate wood-tracking systems to continually verify their origin. Importers and processing enterprises in China could gain a better understanding about where the wood in their products comes from, and take steps to ensure that it is certified through credible programs or can be legally verified at every step along the supply chain. Specifically, in order to address the weakest components of China's pulp and paper making supply, this would include ensuring that:
  - All imported pulp is certified as to the sustainability of the wood supply from which is was manufactured; and
  - All pulpwood imported by similarly certified that it was harvested from sustainably managed forests.

Other proposals require the participation of the Chinese government:

- Actively promote certification, log-tracking, supply-chain management approaches, and adapt existing legislative approaches tackle underlying problems in both consumer and supply countries: Certification, verification of legality, independent monitoring and other related tools are now well recognized as useful in addressing illegal logging. All consuming and manufacturing governments (such as the US, China, Japan and members of the EU) should more actively encourage their trade, commerce and development assistance agencies to promote these instruments. In addition, these countries should take the lead in encouraging the relevant international organizations and private firms to embrace the adoption of these tools.
- Developing and harmonizing public procurement policies: While the EU and Japan have already
  embarked on various forms of public procurement policies, the US, China, and other major
  importers should develop similar programs. Expanding and harmonizing public
  procurement policies would increase the impact and leverage of forest markets, as well as
  reduce the transaction costs of industry to ensure that they are trading in legally-sourced
  paper products. China could start with a pilot program to ensure verified legal or sustainable
  sourcing for paper supplies related to the 2008 Beijing Olympics.
- Reviewing the costs and benefits of programs that promote large-scale pulp and paper industries. There is an urgent need to rethink the whole approach to encouraging large-scale industries in the pulp and paper sector. Our research indicates a serious imbalance between production capacity and planned local supply which, unless resolved, may place the remaining natural forests in the region at risk.

#### **ANNEX: DATA**

	2002	2003	2004	2005	2006	% +/- pa
Local Pulp	18.4	15.6	16.2	15.2	14.2	-
Imported Pulp	5.3	6.0	7.3	7.6	8.0	_
Imported Pulpwood*	0.0	0.1	0.2	0.4	0.4	-
Total Virgin Fiber	23.7	21.7	23.7	23.2	22.6	-1.2%
Local Wastepaper	16.3	17.0	16.9	17.6	17.5	-
Imported Wastepaper	6.9	9.4	12.3	17.0	19.6	-
Total Secondary Fiber	23.2	26.4	29.2	34.6	37.1	12.5%
Total Papermaking Furnish	46.9	48.1	52.9	57.8	59.7	6.2%

#### Table A1: China's Total Papermaking Fiber Resources: 2002 – 2006 (Mt pa)

Source: FAO, WTA & BS&A estimates. \* = Estimated fiber equivalent at 50% fiber content of bone-dry wood.

#### Table A2: China's Imports of Wastepaper by Grade: 2002 – 2006 (Mt pa)

Grade	Imports	Conversion Factor	Green Wood Equivalent
Unbleached Kraft	10.4	3.2	33.4
Bleached Chemical	0.2	4.5	1.0
Mechanical Pulp	5.0	2	10.1
Other	3.9	2.5	9.9
Total Wastepaper Imports	19.6	-	54.3

Source: WTA.

Table A3: China's Wastepaper Import P	rices by Grade: 2002 – 2006 (USD/t Cif)
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Grade	2002	2003	2004	2005	2006	% +/- pa
Unbleached Kraft	116.53	136.20	146.39	148.87	143.98	5%
Bleached Chemical	96.50	129.23	155.71	192.83	192.84	19%
Mechanical Pulp	103.89	133.07	143.47	147.99	142.78	8%
Other	90.64	115.34	119.20	123.31	123.34	8%
Total Wastepaper Imports	106.54	131.26	140.34	144.24	140.07	7%

Source: WTA.

Country of Origin	2002	2003	2004	2005	2006	%
United States	3.98	5.77	6.23	7.47	8.56	44%
Japan	0.97	0.95	1.91	3.06	3.24	17%
United Kingdom	0.17	0.36	0.74	1.54	2.12	11%
Netherlands	0.25	0.39	0.78	1.19	1.29	7%
Hong Kong	0.62	0.69	0.80	0.87	0.98	5%
Other	0.88	1.23	1.84	2.89	3.44	18%
Total	6.87	9.38	12.30	17.03	19.62	100%

#### Table A4: Total Wastepaper Imports by Country: 2002-2006 (Mt pa)

Source: WTA.

#### Table A5: China's Pulp Imports: 2002 –2006 (kt pa)

Grade	2002	2003	2004	2005	2006	% +/- pa	% (2006)
Mechanical Pulp	146	89	76	60	71	-17%	0.9%
Dissolving Pulp	200	269	290	294	393	18%	4.9%
Sulfate Pulp	4,475	4,937	6,034	6,258	6,406	9%	80.4%
Sulfite Pulp	54	50	67	41	51	-1%	0.6%
Chemi-Mechanical Pulp	357	644	751	868	967	28%	12.1%
Recovered Material Pulp	32	45	102	72	77	24%	1.0%
Total	5,265	6,034	7,319	7,592	7,965	11%	100%

Source: WTA.

Table A6: China's Bleached Kraft P	ulp Imports by Coui	ntry: 2002 – 2006 (kt pa)
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Origin Country	2002	2003	2004	2005	2006	% +/- pa	% (2006)
Canada	726	840	1,084	1,223	1,251	15%	19.5%
Indonesia	1,129	1,180	1,365	1,344	1,173	1%	18.3%
Brazil	344	602	792	638	923	28%	14.4%
Russia	897	856	850	892	882	0%	13.8%
United States	421	435	628	662	722	14%	11.3%
Chile	539	486	667	777	637	4%	10.0%
Finland	91	103	97	84	201	22%	3.1%
Other	328	435	552	638	617	17%	9.6%
Total	4,475	4,937	6,034	6,258	6,406	9%	100%

Source: WTA.

Origin Country	2002	2003	2004	2005	2006	% +/- pa	% (2006)
Canada	302	545	630	718	816	28%	84.3%
New Zealand	33	64	80	100	82	25%	8.4%
Sweden	10	26	27	34	37	38%	3.8%
Indonesia	0	0	0	1	10	-	1.0%
Estonia	0	0	0	0	9	-	0.9%
Norway	1	5	9	10	5	42%	0.6%
Finland	6	3	2	1	3	-18%	0.3%
Other	4	1	3	4	6	7%	0.6%
Total	357	644	751	868	967	28%	100%

Table A7: China's Chemi-Mechanical Pulp Imports by Country: 2002 – 2006 (kt pa)

Source: WTA.

Table A8: China's Import	s of Pulpwood, Fiber	<sup>r</sup> Equivalent: 2002 ·	– 2006 (kbdmt)
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	2002	2003	2004	2005	2006	% +/- pa
Coniferous	1	1	0	0	1	5%
Non-coniferous	26	139	151	435	447	105%
Total Pulpwood Imports	26	140	151	436	448	103%

Source:  $WTA^* = Estimated$  fiber equivalent at 50% fiber content of bone-dry wood.

Table A9: China's Imports of Hardwood Pulpwood by Volume:	2002 – 20	)06
(kbdmt)		

Origin Country	2002	2003	2004	2005	2006	% (2006)
Vietnam	0	0	53	405	468	52%
Australia	49	254	172	277	202	23%
Cambodia	0	0	0	0	3	0%
Chile	0	0	0	20	46	5%
Indonesia	0	0	0	79	169	19%
Malaysia	1	3	17	8	0	0%
United States	0	0	0	19	5	1%
Other	0	22	61	61	1	0%
Total	51	279	302	870	894	100%

Source: WTA.