



Environmental Aspects of China's Papermaking Fiber Supply

Update

Jeremy Williams



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Jeremy Williams, ArborVitae Environmental Services Ltd.

An update based on a 2007 Forest Trends report written by Brian Stafford

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Executive Summary

In 2007, Forest Trends commissioned Brian Stafford of Brian Stafford & Associates Pty Ltd to provide an analysis of China's paper making industry's fiber supply. At that time, China accounted for over 50 percent of the world's overall growth in paper and paperboard production. It was deemed important to understand the structure of all of China's papermaking inputs: virgin pulp, pulpwood, and wastepaper -- both domestic and imported -- and to evaluate the potential risk that these fibers were being sourced from unsustainable or illegal harvesting operations.

The 2007 report found that imported secondary fiber, or wastepaper, had been the primary drive of Chinese expansion in the previous decade. Combined, imported and domestic wastepaper volumes constituted approximately 62.6% of China's fiber supply, 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 was primarily used cartons from US, Japan and Europe, where China's steady demand buoyed up the market price of wastepaper and catalyzed greater investment in paper recovery in supplying countries. China's demand for wastepaper prevented 65 million tonnes (Mt) from heading to the landfill in the US, Japan and Europe between 2002-2006, and saved an estimated 54.3 million metric green tons of trees from being harvested in 2006.

At the same time, however, China sourced substantial amounts of virgin wood pulp from countries where good forest management could not be assumed. The paper estimated that China's imported pulp presented the highest risk of having been harvested from unsustainable or illegal harvesting operations. While some of the pulp imports (an estimated 63.5%) were supplied by well-managed forests and plantations, a significant portion came from Eastern Russia and Indonesia where forest management capacity was low, and that paper manufacturers that were sourcing from these countries were running a high risk of including illegal logged wood in their product. Hardwood pulpwood from Indonesia was deemed especially high risk.

Between 2007 when the first paper was commissioned and 2013, the Chinese papermaking industry continued to expand and modernize rapidly. Numerous international campaigns, focusing on media and toy giants such as Disney and Mattel, as well as new technology to identify fiber sources, had caused a change in the purchasing policies of many important retailers in Europe and the US -- many of which had based their manufacturing processes in China. In late 2013, Forest Trends commissioned Jeremy Walford of the University of British Columbia to update the figures and charts created in the original publication, to see whether the sourcing of China's paper industry had significantly changed, and what that might imply in terms of risk of illegal or unsustainable sourcing.

As in 2007, the greatest challenge to ensuring the sustainability of China's fiber supply (as well as its exports to the environmentally sensitive markets in Europe and the US) will continue to ensure that the pulp and pulpwood imports from certain "high risk" countries can be verified as having come from sustainable and legal harvesting operations.

ABBREVIATIONS

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:	<i>Per annum</i> (per year)
% +/- pa:	Percent change per year

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Introduction: China's Papermaking Fiber Resources and Consumption

The Chinese government considers the forest sector important for the continued development of the country's economy, and since 2000 has put in place policies which have helped to fuel a dramatic increase in forest industry sectoral output across the board. The 2010-2012 Forest Industry Development Plan projected a 12% *per annum* (p.a.) increase in the value of sectoral output from ¥1.44 trillion (US\$235 million) in 2008 to ¥ 2.26 trillion (US\$369 million) by 2012 (Skilton 2010).¹ In fact, this target was exceeded: 2012 output was ¥3.69 trillion (US\$602 million)(ITTO 2013),² in spite the financial crisis in 2009.

Attaining these targets will be dependent on imports of fiber. The Chinese State Forest Agency projects that anticipated Chinese demand for wood of 467 million cubic meters (m³) per year by 2020 will far outstrip domestic timber supply which is estimated to hover near 300 million m³ p.a.³ (Skilton, 2010). The projected growth of the sector coupled with the country's inability to produce sufficient fiber to furnish the sector underlie many of the key structural characteristics and trends in China's pulp and paper industry today and in the future.

As China is expanding its forest products industry, it is simultaneously modernizing it. Between 2007 and 2012, China added 53 million tonnes of new, world-class pulp and paper capacity, and at least another 30 million tonnes has been announced for 2012-2016 (FAO 2012).⁴ During the 2007-2012 period, some 25 million tonnes of capacity (representing approximately 25% of published 2011 capacity) was closed, much of it older, small mills that used fibers such as bagasse, straw and reeds as fiber, and which were often heavy polluters as well. In this way, China's pulp and paper sector is being extensively rationalized.

Supported by government policy, China has become a very important player in the international forest products markets during the past ten years. In 2011, China surpassed Canada as the largest producer of paper and paperboard, as well as of wood-based panels, and has been the largest importer of industrial roundwood, sawnwood, pulp and wastepaper, and is the largest exporter of wood-based panels (ITTO, 2013).

It is estimated that China's total papermaking fiber resources have increased from 46.9 million metric tons (Mt) to 75.5 Mt over the ten years between 2002 and 2012 – an annual average increase of 4.9% *per annum*. Figure 1 shows the composition of China's papermaking resources, using FAO estimates for fiber sources (pulp, wastepaper and pulpwood imports) from 2002-2012. During this period, the rate of growth of China's fiber resources has slowed from an average of 5.8% p.a. between 2002 and 2007 to an average of 3.9% p.a. between 2007 and 2012, reflecting in part the growing size of its paper-making sector, as well as the gradual slowing of the growth rate of the Chinese economy, and possibly coupled with the effects greater reliance and storage of electronic records.

The growth in the virgin fiber supply in China's papermaking industry, uneven during the period, has been greatly overshadowed by the substantial increase in the use of imported wastepaper. Of the total increase from 2002 to 2012, the growth of imported wastepaper accounted for over 80%.

The composition of China's papermaking fiber resources is illustrative of a sector that is 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. In 2002, this was by far the largest market segment, using approximately 74% of total fiber resources by volume. By 2012, local small-scale industry consumed only 33% of the country's fiber resources. In contrast, imports of wastepaper, pulp and pulpwood are inputs to a modern, large-scale paper industry that produces various export-oriented goods. Roughly 30% 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.

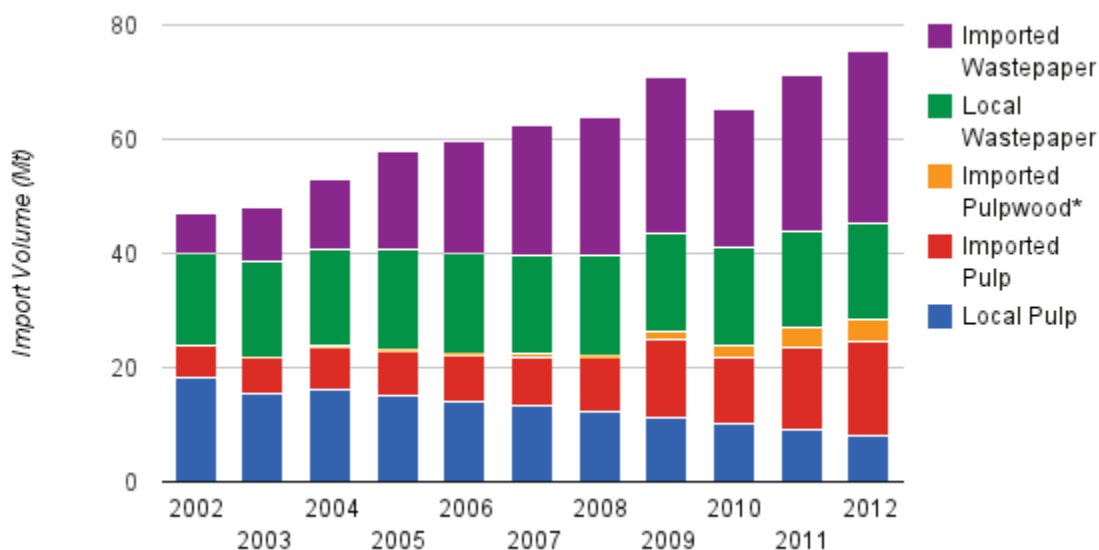
¹ Skilton, David. 2010. The Changing Landscape of China's Domestic Forestry Sector: Do Growing Supply-Demand Imbalances Set the Stage for Institutional Investment Opportunities? December 2010 market outlook newsletter, New Forests.

² International Tropical Timber Organization (ITTO). 2013. Proceedings of the Workshop on Forest Products Statistics in China. Hainan, 1-3 April 2013. Sponsored by ITTO, APFnet and FAO.

³ International Tropical Timber Organization (ITTO). 2013. Proceedings of the Workshop on Forest Products Statistics in China. Hainan, 1-3 April 2013. Sponsored by ITTO, APFnet and FAO.

⁴ Food and Agriculture Organization of the U.N. (FAO). 2012. Forest Products Annual Market Review 2011-12. Geneva Timber and Forest Study Paper 30.

Figure 1: China's Total Papermaking Fiber Resources: 2002-2012 (Mt p.a.)



Note: Based on Table A1.

Table A1: China's Total Papermaking Fiber Resources

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% + / - pa
Local Pulp	18.4	15.6	16.2	15.2	14.2	13.2	12.2	11.2	10.2	9.2	8.2	-
Imported Pulp	5.3	6	7.3	7.6	8	8.5	9.5	13.7	11.4	14.4	16.5	-
Imported Pulpwood*	0	0.1	0.2	0.4	0.4	0.6	0.5	1.4	2.3	3.3	3.8	-
Total Virgin Fiber	23.7	21.7	23.7	23.2	22.6	22.3	22.2	26.3	23.9	26.9	28.5	1.9%
Local Wastepaper	16.3	17	16.9	17.6	17.5	17.4	17.3	17.2	17.1	17	16.9	-
Imported Wastepaper	6.9	9.4	12.3	17	19.6	22.6	24.2	27.5	24.4	27.3	30.1	-
Total Secondary Fiber	23.2	26.4	29.2	34.6	37.1	40	41.5	44.7	41.5	44.3	47	7.3%
Total Papermaking Furnish	46.9	48.1	52.9	57.8	59.7	62.8	63.7	71	65.4	71.2	75.5	4.9%

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

Imported Wastepaper: Domestic and imported wastepaper together are estimated to constitute 62% of China's total fiber supply, a figure that has remained quite stable over the last half of the review period. With its export-driven economy, China's greatest paper need is for packaging to contain its burgeoning light manufacturing exports. 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 23% is mechanical-grade wastepaper, usually made into newsprint and the coated mechanical paper used for magazines and advertising catalogues. Growing from 6.9 to 30.1 Mt between 2002 and 2012, imported wastepaper is now the largest source (40%) of fiber for the Chinese pulp and paper industry. Apart from imported pulpwood, which has grown from a very small base of less than 50,000 tons, this was the component with the highest average annual growth rate (15.9% p.a.) during this time.

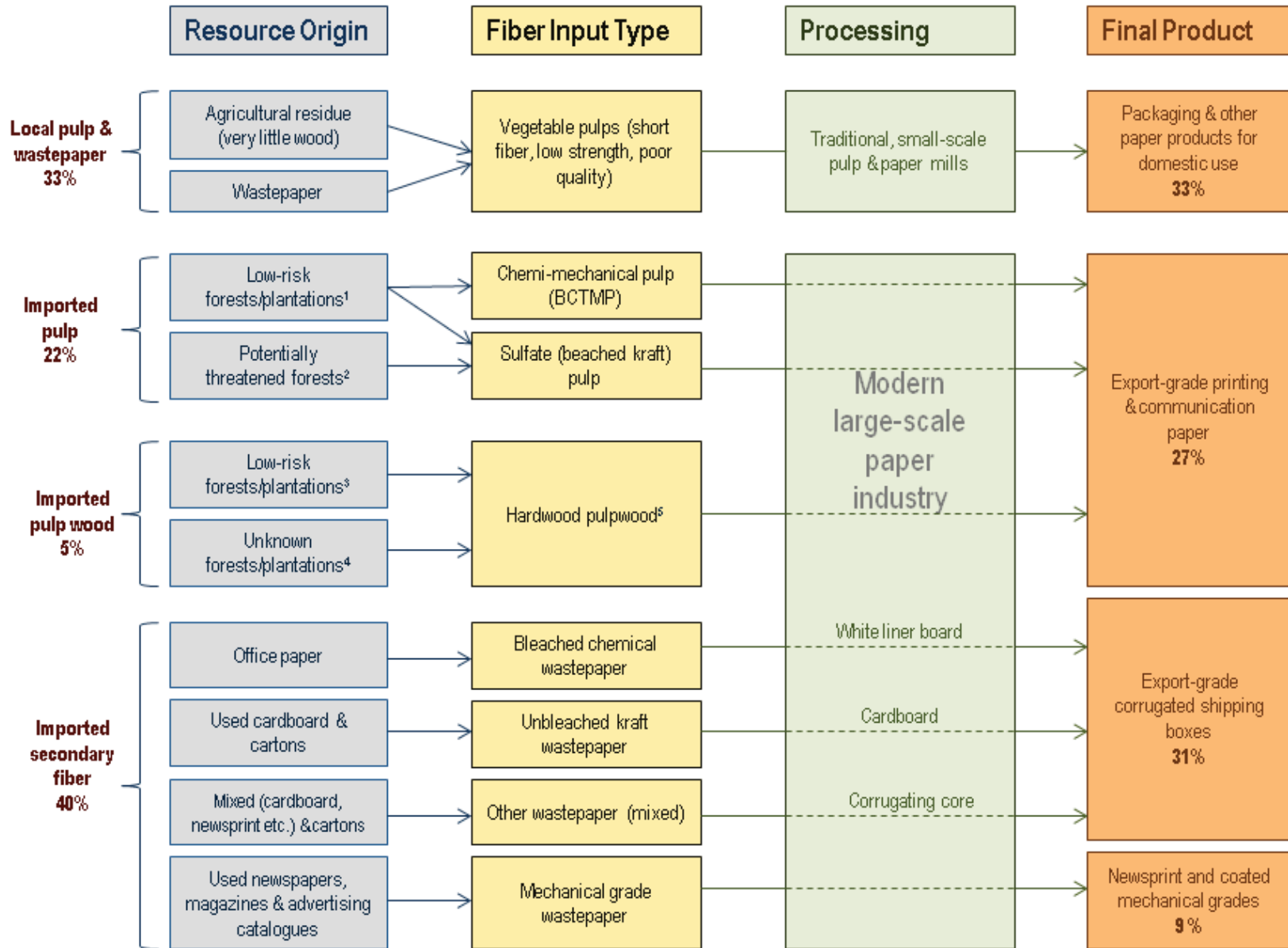
Local Wastepaper: Although domestic wastepaper production is still the second largest source of papermaking fiber in 2012, it has remained essentially static during the study period at 17 Mt/year. It has declined in importance, representing 22% of total fiber resource in 2012, versus 35% in 2002. Since most domestic paper is made from low-strength vegetable fiber, this wastepaper yields pulp that is generally of poor quality.

Local Pulp: Local pulp production has declined steadily throughout the review period, reaching a point where it accounts for 10.9% of fiber resources, compared with 39% in 2002. Much of this pulp is vegetable in origin, of poor quality and low strength (most vegetable pulps are short fiber, which limits paper strength) and the Chinese mills producing this 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.

Imported Pulp: Along with imported wastepaper (which is mainly destined for packaging of one form or another), imported wood pulp is the second significant source of high quality wood fiber. It has grown in importance, with the rate of increase in use accelerating as of the 2008-09 period so that it now constitutes 21.9% of total papermaking resources. It also tends to be the most expensive component 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 13.9 Mt, or at least 84%.1 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.

Imported Pulpwood: Along with the recent growth in the use of imported pulp, imports of pulpwood have risen sharply from negligible amounts in 2002 to 3.8 Mt in 2012, with an acceleration in growth coming during the 2008-09 period. As of 2012, pulpwood imports represented only 5.0% of China fiber resource; however it has shown the greatest proportional growth rate of all sources and is poised to become more significant. The same users of imported pulp tend to be the consumers of the imported pulpwood.

Figure 2: Chinese Papermaking Fiber Commodity Chains, 2012



¹ Canada, Brazil, USA, Chile, New Zealand & others
² Indonesia, & Russia

³ Vietnam, Australia & others
⁴ Indonesia

⁵ Most of the demand for pulpwood imports stems from two large paper mills owned by Asia Pulp & Paper (APP, in Hainan Province) and Asia Pacific Resources International (APRIL, in Rizhao, Shandong)

Imported Wastepaper

Dynamics of the Trade

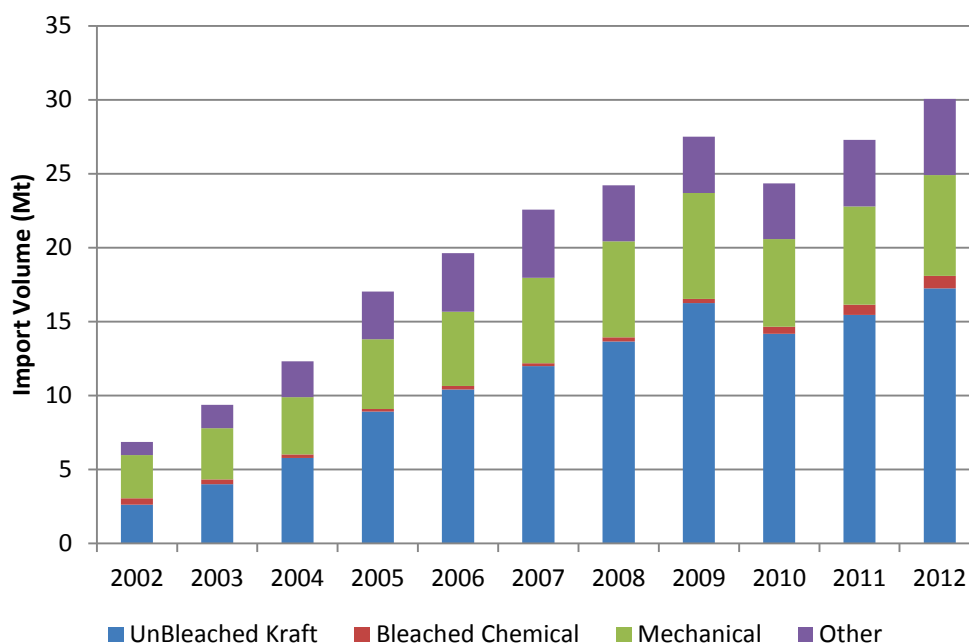
China's primary need in importing wastepaper is to recycle it into packaging grades (corrugated container materials primarily, but also cartonboard) to box up the vast volume of light manufactures exported to the rest of the world. China has long had a relative shortage of virgin fiber resources, especially the strong, long-fibered softwood necessary for packaging production, and this has been re-enforced by recent policy measures, in part following the disastrous 1998 floods of the Yangtze River to afforest steep slopes and poor agricultural lands and restrict harvesting of national forest and plantations. Therefore, the quickest, cheapest and most effective means of obtaining the required fiber is to import wastepaper (primarily used corrugated cartons, from the U.S., Europe and Japan), slush it up and run it 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 continues to import a significant 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 import volumes of this grade have levelled off since 2007, reflecting in part the loss of global capacity of this type of process, which is energy- and capital-intensive, producing costly pulp.

Imports by Grade

Figure 3: China's Imports of Wastepaper by Grade



Note: Based on Table A2.

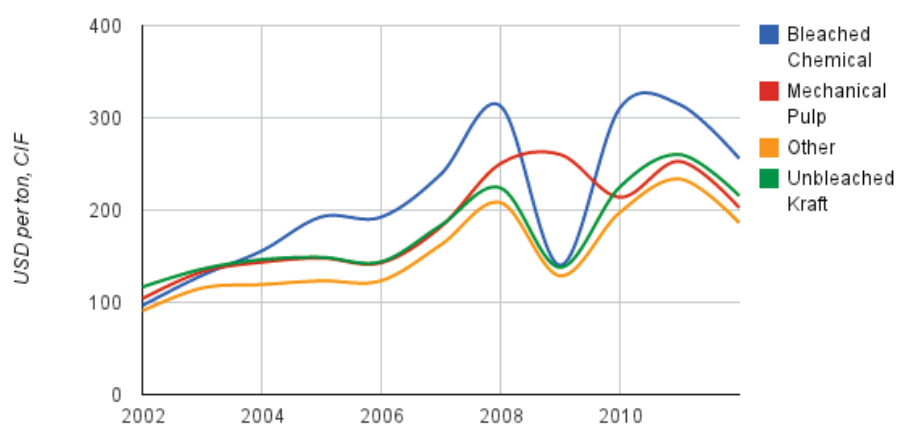
Table A2: China's 2012 Imports of Wastepaper by Grade (Mt pa)

Grade	Imports	Conversion Factor	Green Wood Equivalent
Unbleached Kraft	17.2	3.2	55
Bleached Chemical	0.8	4.5	3.6
Mechanical Pulp	6.8	2	13.6
Other	5.3	2.5	13.3
Total Wastepaper Imports	30.1	--	85.5

Source: UN comtrade.

Wastepaper Prices

Figure 4: China's Wastepaper Import Prices by Grade: 2002-2012 (USD/ton, CIF)



Note: Based on Table A3.

Table A3: China's Wastepaper Import Prices by Grade: 2002-2012 (USD/t)

Grade	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% + / - pa
Unbleached Kraft	116.54	136.05	146.37	148.35	143.92	183.44	223.99	137.96	225.11	260.2	215.52	6.34%
Bleached Chemical	96.49	129.17	155.66	192.73	192.36	238.75	312.83	140.24	310.54	314.53	255.85	10%
Mechanical Pulp	103.89	133.11	143.42	148	142.78	181.71	250.32	260.2	213.84	252.79	202.51	7%
Other	90.66	115.47	119.23	123.31	123.36	162.18	208.11	128.71	197.45	233.67	186.17	7%
Total Wastepaper Imports	106.54	131.23	140.32	144.23	140.03	179.14	229.56	138.02	219.82	255.43	208.66	7%

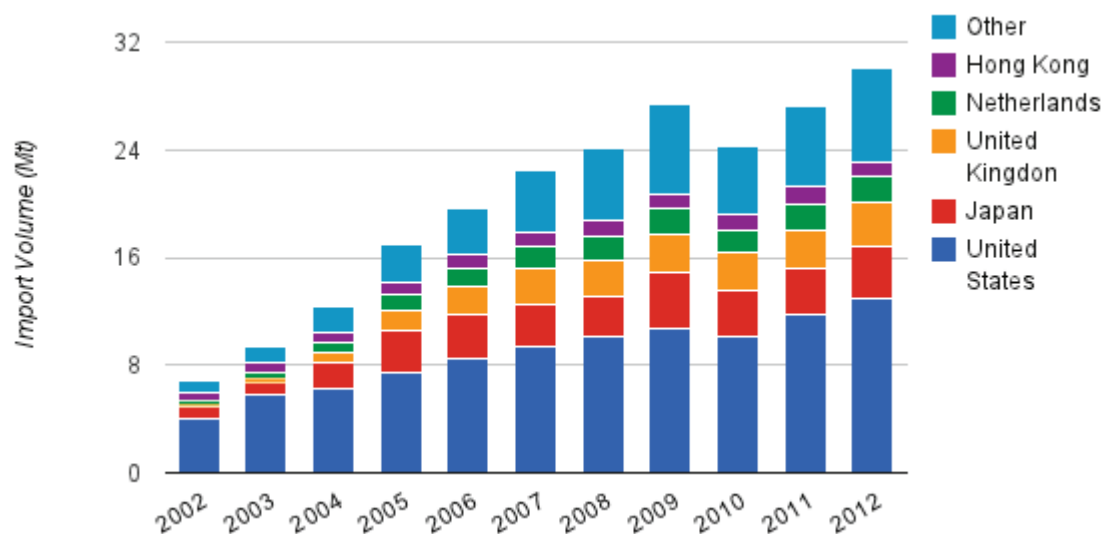
Source: UN comtrade.

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, the US has supplied approximately 43% of all China's wastepaper imports since 2005, while Japan and the United Kingdom are the other two largest suppliers,

providing a further 12.9 and 10.7%, respectively. The remainder comes from an expanding list of suppliers, including other EU countries (Netherlands, Italy and Belgium), traditional sources such as Hong Kong, and countries like Australia (1.04 Mt in 2012) and Canada (1.23 Mt in 2012) that are becoming more prominent suppliers.

Figure 5: China's Wastepaper Imports by Country 2002-2012 (Mt pa)



Note: Based on Table A4.

Table A4 - Total Wastepaper Imports by Country: 2002-2012 (Mt pa)

Country of Origin	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	%
United States	3.98	5.77	6.23	7.48	8.57	9.33	10.14	10.76	10.14	11.78	13.04	43%
Japan	0.97	0.95	1.92	3.06	3.24	3.17	2.96	4.12	3.5	3.38	3.87	13%
United Kingdom	0.17	0.36	0.74	1.55	2.11	2.72	2.78	2.81	2.75	2.91	3.23	11%
Netherlands	0.25	0.39	0.78	1.19	1.29	1.57	1.78	2	1.68	1.92	1.87	6%
Hong Kong	0.62	0.69	0.8	0.87	0.98	1.07	1.12	1.03	1.2	1.27	1.11	4%
Other	0.88	1.22	1.84	2.89	3.43	4.7	5.43	6.78	5.08	6.02	6.95	23%
Total	6.87	9.38	12.31	17.04	19.62	22.56	24.21	27.5	24.35	27.28	30.07	100%

Source: UN comtrade.

Domestic Pulp and Wastepaper Production

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 virgin wood fiber. In that year an estimated 9 million m³ 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, with domestically-grown pulpwood playing a minor and declining role in China's paper production. Imported pulpwood has been the fastest growing segment of China's fiber supply in recent years, however the absolute amount used is much less than the decline in consumption of domestically produced pulpwood.

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. 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, 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 large-scale 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. Investment funds, alerted by the high level of imports, have also begun examining plantation investments in China (Skilton 2010). 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.

China produces sizeable amounts of pulp from agricultural residues and other non-wood fibers for domestic use, but these sources are providing a smaller proportion of total pulp production. In 2012, non-wood pulp accounted for 13.7% of total domestic pulp production, down from 22% in 2007 and 35.4% in 2003 (CPA 2012).⁵ Once used, much of this paper is recuperated and re-pulped. However, given that the wood-based component of this locally-made virgin fiber pulp is very minor, the paper it produces has 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 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 gradually declining (see Table A2 in the Annex.) The utilization of secondary fiber, on the other hand, expanded at an average rate of 15.9% p.a. between 2002 and 2012, 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 most significant source of high quality wood fiber is imported wood pulp. It constitutes a significant and rapidly growing proportion of the papermaking resource, having risen sharply from 13.6% in 2007 to reach 21.9% of the total resource in 2012. It would also be the most expensive element in the papermaking furnish, although the appreciation of the yuan would have helped to mitigate the cost. It is also the fiber source with the most significance for the future of the world's natural forests, given the likelihood of unsustainable management in some 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, which 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 14.7 Mt, at least 82.3% of which can be regarded as having been drawn from sustainably managed wood resources.

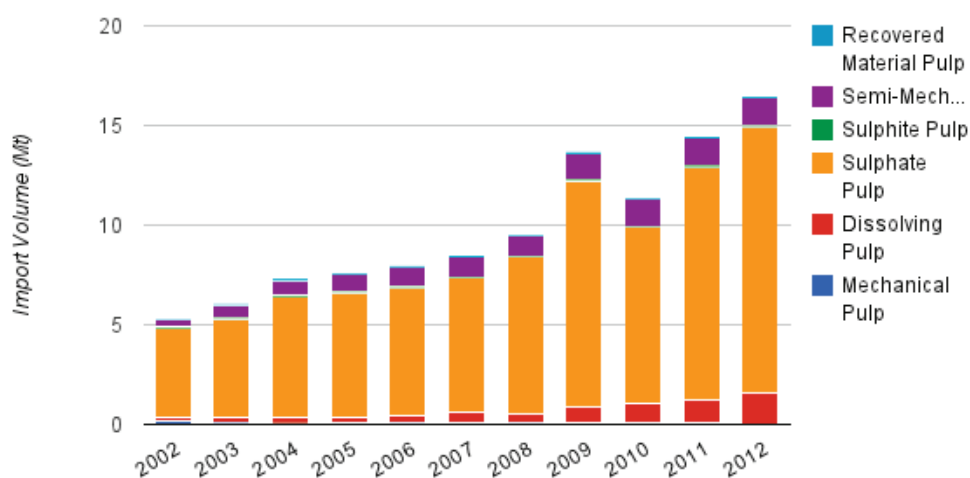
Import Structure

The overwhelming majority (81.1%) of China's pulp imports is sulfate pulp, (which, in turn, would be virtually all bleached kraft pulp) and supplies have been growing at an average of 11.5% p.a. between 2002 and 2012. The two other categories of

⁵ Chinese Papermaking Association (CPA). 2013. China Paper Industry 2012 Annual Report.

significance are dissolving pulp (9.6%) and chemi-mechanical pulp (8.5%). Dissolving pulp has shown explosive growth as a fiber source, rising from 499 kt in 2008 to 1579 kt in 2012, although in November 2013, the Chinese Ministry of Commerce issued instituted a 13% duty on dissolving pulp imported from Canada, the United States and Brazil based on a preliminary finding of dumping. These three categories, used in the production of printing and communication grade papers, constitute 93.1% of China's pulp imports. Figure 6 depicts China's pulp imports by grade for the last decade:

Figure 6: China's Pulp Imports: 2002-2012 (Mt pa)



Note: Based on Table A5.

Table A5: China's Pulp Imports: 2002-2012 (kt pa)

Grade	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% +/- pa	% (2012)
Mechanical Pulp	146	89	76	61	71	61	70	48	61	58	11	-23%	0.1%
Dissolving Pulp	200	268	290	294	396	526	499	851	963	1,145	1,579	23%	9.6%
Sulphate Pulp	4,475	4,938	6,031	6,258	6,397	6,768	7,812	11,331	8,873	11,705	13,345	12%	81.1%
Sulphite Pulp	54	49	67	41	51	44	40	59	35	93	40	-3%	0.2%
Semi-Mechanical Pulp	357	644	752	867	967	983	1,040	1,288	1,365	1,342	1,405	15%	8.5%
Recovered Material Pulp	32	45	103	72	77	87	58	97	70	91	83	10%	0.5%
Total	5,264	6,033	7,319	7,593	7,959	8,469	9,519	13,674	11,367	14,434	16,463	12%	100%

Source: UN comtrade.

Bleached Kraft Pulp

In 2012, China imported 34.4% of all the pulp and wastepaper traded in the world (by value)⁶. Figure 7 shows how China's sources of bleached kraft pulp are quite diverse with seven 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.

⁶ United Nations. 2013. 2012 International Trade Statistics Yearbook. Volume II - Trade by Commodity.

In 2012, Canada was the single largest supplier of bleached kraft pulp providing 2.662 kt, equivalent to 19.9% of all China's requirements in that year. Canada's exports to China have been growing at an annual average rate of 13.9% p.a. between 2002 and 2012, with an especially big increase coming in 2011. The purchase or investment by Asian companies into financially distressed mills in Canada and the US has helped to increase Chinese imports of desirable virgin pulp from those countries (FAO 2012). Brazil is the second largest kraft pulp provider, supplying 2.316 kt or 17.4% of Chinese imports. Brazilian imports have increased rapidly at a rate of 21.0% p.a. since 2002, and Brazil is poised to become China's largest kraft pulp supplier by 2013 or 2014.

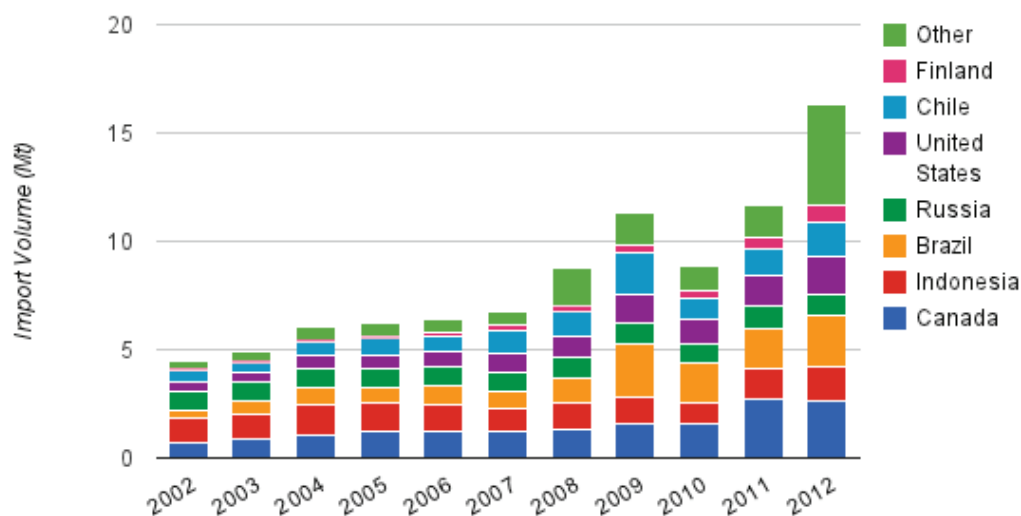
The United States, Chile and Indonesia each supplied 11-13% of Chinese kraft pulp imports in 2012. Between 2002 and 2012, these three countries have grown their exports to China at annual rates of 15.4, 11.3, and 3.4% p.a., respectively. Lastly, the most rapid increase in imports has come from Finland, which has the smallest level of imports of the individual countries shown in Figure 7, but with a 24.0% growth rate between 2002 and 2012, it may well overtake Russia by 2014. In 2012, "Other" countries supplied just over 12% of total imports – major countries in this category included Uruguay, Japan and Spain.

The wood supply for the pulp production of Canada and the United States can be relied upon to be drawn from sustainably managed natural forests. 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. 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.

The same could not be said of Indonesia or Russia. In Indonesia, mixed tropical hardwood is understood to still constitute a large proportion of the wood supply to the country's bleached kraft pulpmills while there is understood to be considerable illegal harvesting in eastern Russia. Interestingly, Indonesia and Russia have become less prominent suppliers of kraft pulp during the study period. For the 2007 report, it was estimated that 70% of the pulp sent to China from Russia had been verified as sustainable by the Forest Stewardship Council (FSC), with 69% coming from mills belonging to Ilim Pulp Corp., while Arkhangelsk PPM exported an additional 1%. While this report did not update these figures, it is noted that the Ilim Group successfully completed the annual surveillance audit confirming compliance of its chain of custody with the FSC standards in October 2013 for its location in the Irkutsk, Arkhangelsk, and Leningrad Oblasts

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 10.7 Mt, or 80% of China's imported bleached kraft pulp, has been legally drawn from sustainably managed forests.

Figure 7: China's Bleached Kraft Pulp Imports by Origin: 2002-2012 (Mt pa)



Notes: Based on Table A6.

Table A6: China's Bleached Kraft Pulp Imports by Country: 2002-2012 (kt pa)

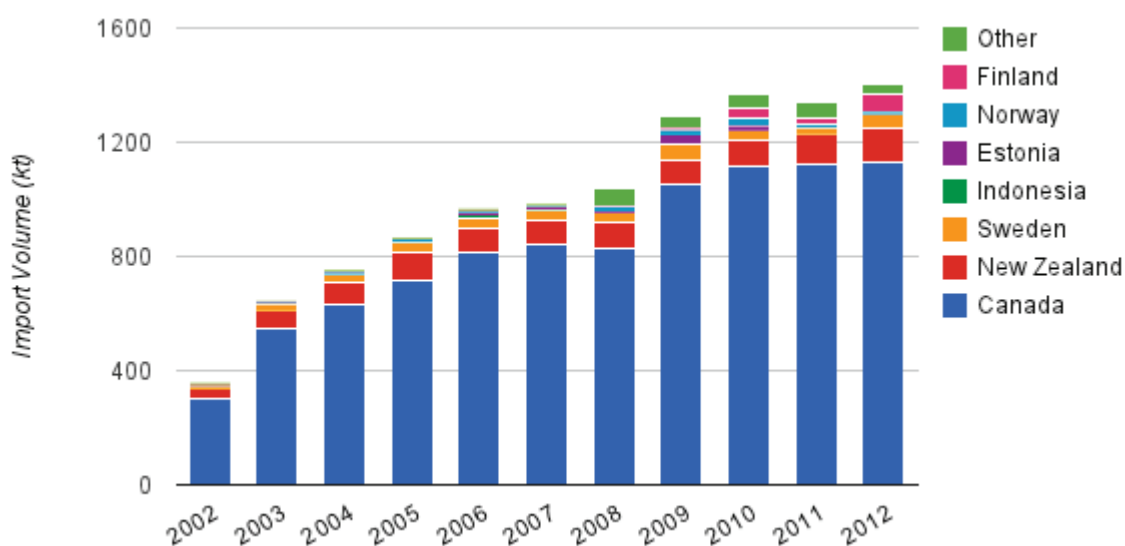
Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	%+/- pa	% (2012)
Canada	726	840	1,084	1,223	1,250	1,223	1,334	1,577	1,596	2,695	2,662	14%	19.9%
Indonesia	1,129	1,180	1,360	1,344	1,173	1,038	1,211	1,228	991	1,385	1,577	3%	11.8%
Brazil	344	602	792	638	915	801	1,178	2,473	1,769	1,889	2,316	21%	17.4%
Russia	897	856	852	892	882	896	953	964	869	1016	1030	1%	7.7%
United States	421	435	628	662	722	906	933	1,313	1,210	1,446	1,757	15%	13.2%
Chile	539	486	667	777	637	1,042	1,176	1,904	967	1257	1,576	11%	11.8%
Finland	91	103	97	84	201	202	257	339	331	585	786	24%	5.9%
Other	328	436	551	638	617	660	1,703	1,533	1,141	1,433	1,641	18%	12.3%
Total	4,475	4,938	6,031	6,258	6,397	6,768	7,812	11,331	8,874	11,706	13,345	12%	100%

Source: UN comtrade.

Semi-Chemical Pulp

Figure 8 shows the sources of China's semi-chemical pulp, often referred to as BCTMP (Bleached Chemi-Thermo-Mechanical Pulp). BCTMP requires a considerable amount of energy in its manufacture and is therefore generally only made in advanced western countries where energy is reasonably cheap. Canada dominates China's imports of this grade, responsible for 80.2% of supplies in 2012. New Zealand supplied 8.6% with Finland and Sweden adding a further 4.1% and 3.4%, respectively, to bring the total supplied by the four countries to 96.4%. The forests of Canada, Finland and Sweden 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.

Figure 8: China's Chemi-Mechanical (now Semi-Chemical) Pulp Imports by Origin: 2002-2012 (kt pa)



Note: Based on Table A7.

Table A7: China's Semi-Chemical Pulp Imports by Country: 2002-2012 (kt pa)

Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% +/- pa	% (2012)
Canada	302	545	630	717	816	841	826	1,054	1,114	1,121	1,128	14%	83%
New Zealand	33	64	80	100	82	87	90	84	90	106	121	14%	9%
Sweden	10	26	27	34	37	35	36	57	37	25	48	17%	3%
Indonesia	0	0	0	1	10	2	0	0	0	0	1	-	0%
Estonia	0	0	0	0	9	8	6	31	18	0	1	-	1%
Norway	1	5	9	10	5	4	18	18	25	10	8	23%	1%
Finland	6	3	2	1	3	1	2	6	36	23	58	26%	1%
Other	5	1	4	4	5	5	62	38	45	57	41	23%	2%
Total	357	644	752	867	967	983	1,040	1,288	1,365	1,342	1,406	15%	100%

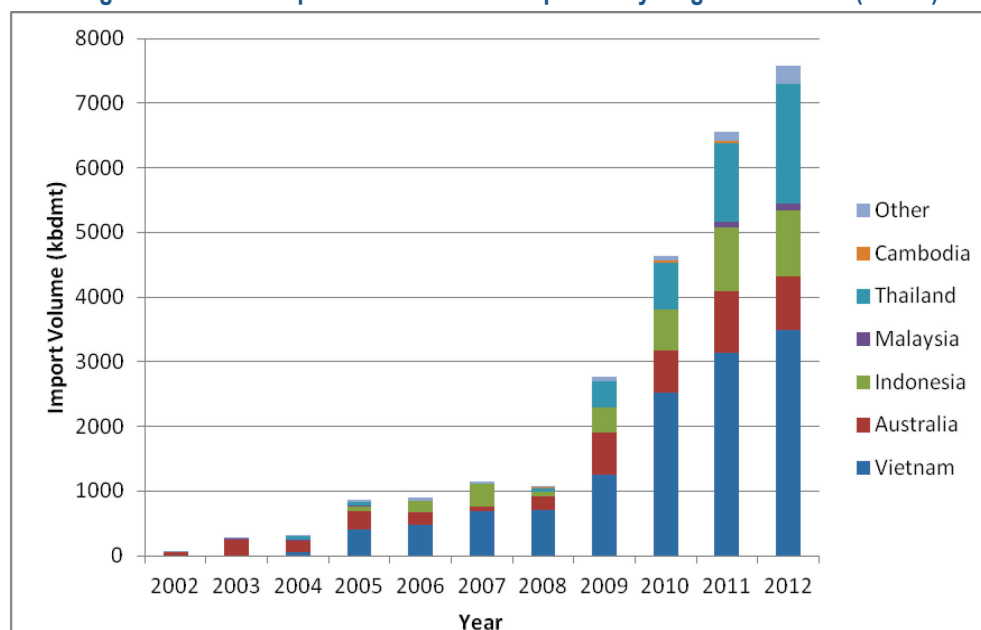
Source: UN comtrade.

Imported Pulpwood

The proportion of imported pulpwood to China's total papermaking fiber supply has been rising very quickly, so that it is now a modest proportion (5%) of overall supply. Imports of hardwood pulpwood have increased dramatically since 2002—increasing from 51 to 7580 kbdmt in 2012.

Figure 9 illustrates that most of China's imports of hardwood pulpwood (49% in 2012) are sourced from Vietnam where it is understood to be from eucalypt plantations. In 2012, Australia supplied 827 kbdmt, or 11% of imports, which would be drawn from relatively well managed forests. In contrast, it is not known whether the 14% 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.

Figure 9: China's Imports of Hardwood Pulpwood by Origin: 2002-2012 (kbdmt)



Note: Based on Table A8.

Table A8: China's Imports of Hardwood Pulpwood 2002-2012 (kbdmt)

Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% (2012)
Vietnam	0	0	53	405	469	685	706	1,245	2,528	3,141	3,497	46%
Australia	49	254	172	277	202	68	212	657	645	954	827	11%
Cambodia	0	0	0	0	3	0	3	4	35	30	14	1%
Thailand	0	0	60	60	0	0	8	9	4	91	94	24%
Indonesia	0	0	0	79	169	359	64	383	639	982	1,025	14%
Malaysia	1	3	17	8	0	0	8	9	4	91	94	1%
Other	2	23	1	42	52	28	4	67	73	156	275	3%
Total	52	280	303	871	895	1,140	1,056	2,766	4,632	6,565	7,580	100%

Source: UN comtrade.

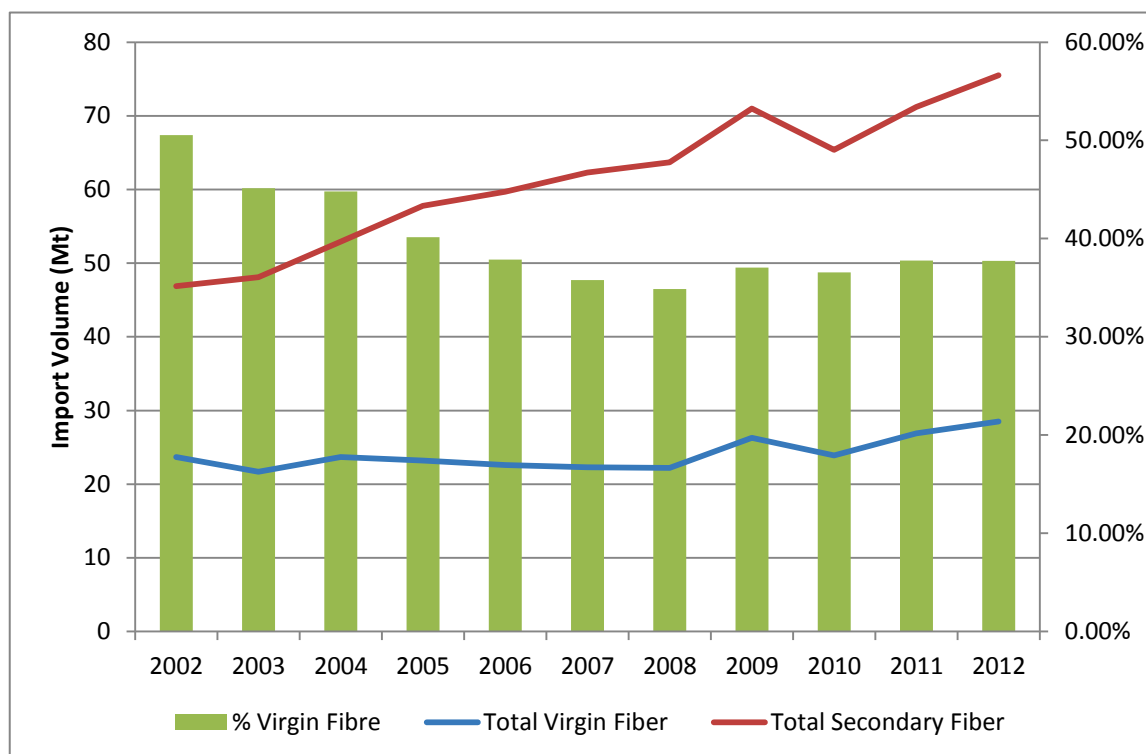
Under normal circumstances it is not economic to import pulpwood (which is 50% water) to make pulp and compete against the integrated low wood cost pulpmills of, for example, South America. China's pulpwood imports appear to be taking place in response to a specific set of circumstances. Both Asia Pulp & 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

Use of Virgin versus Secondary Fiber

Figure 10 depicts how the use of secondary fiber (local and imported wastepaper) has increased 15.9% p.a. between 2002 and 2012, mainly due to the success with which China has been able to exploit the secondary fiber supply from the US, Japan and Europe, and increasingly countries such as Canada and Australia. There has been a very gradual increase in the use of virgin fiber in China's paper making furnish (namely pulp, both domestically produced and imported, plus pulpwood imports). The average rate of increase was approximately 1.9% p.a. since 2002, although increases really only took hold in 2009 and later. The rates of change reflect a complex interaction between increasing imports of pulp and pulpwood and the decreasing production of pulp and paper from non-wood fiber; the overall impact has been a decrease in the proportion of virgin fiber from 50% to 40% during the study period.

Figure 10: Virgin vs. Secondary Fiber, 2002-2012 (Mt)



Note: Based on Table A1.

Wastepaper's Impact on Paper to Landfill

In 2002, the wastepaper trade with China was only 6.9 Mt. Had China had not entered a period of rapid economic development and continued to import at the rate of 6.9 Mt pa over the next decade, the total wastepaper inflow would have been 69 Mt during those years. Instead, between 2003 and 2012, China imported a total of 214.4 Mt. It can thus be said that, in the absence of China's dramatic expansion in demand for wastepaper, some 145 Mt of wastepaper would have ended up in landfill over the period worldwide, instead of being re-used for paper production. In fact, the overall impact is probably somewhat greater than the quick estimate generated above, since the rise in wastepaper prices that was stimulated over this period (See Figure 4) has undoubtedly encouraged greater collection efforts.⁷

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 85.5 million green metric tons of wood (Mgmt) from being harvested in 2012. 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.

⁷ The amount of wastepaper diverted from landfill by China's increased appetite should also take into account the lost pulp and paper production capacity in other countries (which would have consumed some recycled fiber) that was displaced by Chinese production growth.

Table 1: Wood Equivalent of China's Wastepaper Trade, 2012 (Mgmt)

Grade	Imports	Conversion Factor	Green Wood Equivalent
Unbleached Kraft	17.2	3.2	55
Bleached Chemical	0.8	4.5	3.6
Mechanical Pulp	6.8	2	13.6
Other	5.3	2.5	13.3
Total Wastepaper Imports	30.1	--	85.5

Source: UN comtrade.

Note: Equivalent to Table A2

This estimate will err by the extent that fiber is on a second or subsequent time around the cycle – the more times a fiber is re-used, the greater the reduction in virgin fiber use. A common range for the number of pulping cycles a fiber can withstand is between four and seven times⁸. Although the majority of wastepaper exports from the U.S. (43% of China's imports in 2012) are used cartons produced from high quality virgin fiber, it is likely that a large number of Chinese export cardboard cartons are now flowing back to China. If only half of the total fiber flow is regarded as utilized in lieu of new wood, then the figure, at 42.75 Mgmt, is still very significant. It should be borne in mind that this figure is for a single year (2012.)

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).

Impacts of China's Capacity Growth

As outlined in the Introduction, China's forest sector has grown to become among the largest, if not the largest, producing country for many forest products. The Twelfth Five-Year Plan (2011-2015) for the Forest Sector calls for continued expansion of the sector, as well as improving the image of Chinese forest industries in domestic and international markets (FAO 2013). The State Forest Agency projects that domestic annual timber supply will be 300 million m³ by 2020, far less than the anticipated demand for wood, which is 467 million m³ (Skilton, 2010). While this deficit applies across the entire forest sector, it implies import growth will be needed to maintain the fiber supply for the pulp and paper sector.

Where might these imports come from? Some of the import growth will likely come from countries with growing wood supplies, such as New Zealand, Australia, and some South American countries. However, it is also expected that pulp and paper making capacity in North America and Europe will be continue to be displaced by Chinese growth, potentially freeing up wood supply from those regions. CEPI⁹ reports that European pulp production capacity declined by approximately 10% from 2005 to 2012, while the UNECE/FAO TIMBER database (2012) shows a decline of a similar magnitude between 2007 and 2010.

On the other hand, a 2012 analysis by RISI suggests that the Chinese pulp and paper sector is economically unsustainable.¹⁰ RISI reports that wood costs in China are already among the highest anywhere, despite having some of the newest and largest pulp lines in the world. The study conclusion is that "wood growing costs in southern China will probably outpace growing costs in Brazil by a wide margin over the next decade, and this suggests that large-scale paper-grade market pulp production in China is not a sustainable business over time".

It is also worth considering the demand destruction that is taking place for newsprint and printing and writing paper. RISI (Mahlburg 2012)¹¹ reported that global newsprint demand has declined every year since 2007, including a stunning 14% decline in 2009. North American demand for printing and writing paper declined from 27.7 million tonnes in 2007 to 21.7

⁸ Ray, C Claireborne. 2010. Through the Mill. New York Times, December 20, 2010. http://www.nytimes.com/2010/12/21/science/21qna.html?_r=0

⁹ Confederation of European Paper Industries (CEPI). 2013. Key Statistics European Pulp and Paper Industry – 2012..

¹⁰ A summary of this study is provided at <http://www.risiinfo.com/pages/abo/news/latest/China-wood-pulp-production-to-continue-at-aggressive-pace-but-market-pulp-business-unsustainable-over-time.html>.

¹¹ Mahlburg, Derek. 2012. Global Newsprint Outlook. October 2012. RISI.

million tonnes in 2012, a 22% decline (Maine 2012).¹² It is to be expected that demand will start to decline in China before too long, as cost reduction pressures and technological change impacts prevail over the growth stimulating impacts of expanding wealth. If that trend takes hold soon and sharply, it will shock the Chinese sector as well as global markets.

Sustainability of China's Imported Pulp Supply

Increasingly, a high percentage of China's pulp imports are thought to be sourced from sustainably managed forests. This paper estimates that a total of 13.9 Mt, or at least 84% 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 13.3 Mt of bleached kraft pulp imported by China in 2012, it seems likely that at least 10.7 Mt, or 80%, 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 dwindling but still significant portion comes from Eastern Russia and Indonesia, where forest governance capacity is widely considered to be low. Some doubt must be expressed in relation to the almost 20% sourced from Russia and Indonesia. This corresponds well with the estimate by Robbins and Perez-Garcia (2012)¹³ that between 12 and 29% of total log imports are illegal.

China imported 1.58 Mt of bleached kraft exports from Indonesia in 2012, making that country China's fourth largest supplier (tied with Chile) of that grade. It is understood that mixed tropical hardwood still constitutes a large proportion of the wood supply to Indonesia's bleached kraft pulpmills. However, there is evidence that Indonesian producers may be starting to more responsibly, highlighted by APP's February 2013 commitment to end all deforestation of natural forests. APP has been at the center of a decades-long campaign against its logging activities, and it is closely connected with China – in October 2013, the China Development Bank (CDB) agreed to lend US\$1.8 billion of the total US\$2.6 billion required to construct what will be Indonesia's largest pulp mill. Until there has been a credible verification of the supply of these mills, it is reasonable to suspect that a portion of the fiber obtained from Indonesia comes from unsustainably managed forests and/or illegal harvesting. For example, a recent report alleges that PT Triomas, a wood supplier for APRIL, and recently certified under Indonesia's legal timber verification scheme, SVLK, has cleared 2500 ha of natural forest, including stands of endangered ramin trees, between May and October 2013, and drained peat swamps on its concessions.

Russia, China's sixth largest source of bleached kraft (1.03 Mt in 2012) also has a questionable track record in forest management, although some 70% of its 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 has grown rapidly to become a meaningful component of China's papermaking furnish, driven in part by APP and APRIL's pulpmills. Plantations and sustainably managed natural forests in Vietnam, Australia, and Chile supply 86% of this material (See Table A8 in the Annex). Some 14% is being sourced from Indonesia, and this amount has grown steadily during the last five years – increasing ten-fold since 2005. Currently, there is no way of 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 the new APP mill just funded by the CDB suggests this could happen again 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

¹² Maine, John. 2012. Printing and Writing Paper Market Outlook 2012. April 2012, RISI.

¹³ Robbins, A.S.T. and John Perez-Garcia. 2012. Impacts of illegal Logging restrictions on China's Forest Products Trade. Paper presented at China and the World Economy, March 16-18, 2012, Seattle.

to sustain the mill. Thus, with imported pulpwood constituting 5% of China's total papermaking fiber supply, and as the most rapidly growing source, it has the potential to create major 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.

ANNEX: DATA

Table A1: China's Total Papermaking Fiber Resources

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% + / - pa
Local Pulp	18.4	15.6	16.2	15.2	14.2	13.2	12.2	11.2	10.2	9.2	8.2	-
Imported Pulp	5.3	6	7.3	7.6	8	8.5	9.5	13.7	11.4	14.4	16.5	-
Imported Pulpwood	0	0.1	0.2	0.4	0.4	0.6	0.5	1.4	2.3	3.3	3.8	-
Total Virgin Fiber	23.7	21.7	23.7	23.2	22.6	22.3	22.2	26.3	23.9	26.9	28.5	1.9%
Local Wastepaper	16.3	17	16.9	17.6	17.5	17.4	17.3	17.2	17.1	17	16.9	-
Imported Wastepaper	6.9	9.4	12.3	17	19.6	22.6	24.2	27.5	24.4	27.3	30.1	-
Total Secondary Fiber	23.2	26.4	29.2	34.6	37.1	40	41.5	44.7	41.5	44.3	47	7.3%
Total Papermaking Furnish	46.9	48.1	52.9	57.8	59.7	62.8	63.7	71	65.4	71.2	75.5	4.9%

Source: UN comtrade.

Table A2: China's 2012 Imports of Wastepaper by Grade (Mt pa)

Grade	Imports	Conversion Factor	Green Wood Equivalent
Unbleached Kraft	17.2	3.2	55
Bleached Chemical	0.8	4.5	3.6
Mechanical Pulp	6.8	2	13.6
Other	5.3	2.5	13.3
Total Wastepaper Imports	30.1	--	85.5

Source: UN comtrade.

Table A3: China's Wastepaper Import Prices by Grade: 2002-2012 (USD/t)

Grade	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% + / - pa
Unbleached Kraft	116.54	136.05	146.37	148.35	143.92	183.44	223.99	137.96	225.11	260.2	215.52	6.34%
Bleached Chemical	96.49	129.17	155.66	192.73	192.36	238.75	312.83	140.24	310.54	314.53	255.85	10%
Mechanical Pulp	103.89	133.11	143.42	148	142.78	181.71	250.32	260.2	213.84	252.79	202.51	7%
Other	90.66	115.47	119.23	123.31	123.36	162.18	208.11	128.71	197.45	233.67	186.17	7%
Total Wastepaper Imports	106.54	131.23	140.32	144.23	140.03	179.14	229.56	138.02	219.82	255.43	208.66	7%

Source: UN comtrade.

Table A4: Total Wastepaper Imports by Country: 2002-2012 (Mt pa)

Country of Origin	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	%
United States	3.98	5.77	6.23	748	8.57	9.33	10.14	10.76	10.14	11.78	13.04	43%
Japan	0.97	0.95	1.92	3.06	3.24	3.17	2.96	4.12	3.5	3.38	3.87	13%
United Kingdom	0.17	0.36	0.74	1.55	2.11	2.72	2.78	2.81	2.75	2.91	3.23	11%
Netherlands	0.25	0.39	0.78	1.19	1.29	1.57	1.78	2	1.68	1.92	1.87	6%
Hong Kong	0.62	0.69	0.8	0.87	0.98	1.07	1.12	1.03	1.2	1.27	1.11	4%
Other	0.88	1.22	1.84	2.89	3.43	4.7	5.43	6.78	5.08	6.02	6.95	23%
Total	6.87	9.38	12.31	17.04	19.62	22.56	24.21	27.5	24.35	27.28	30.07	100%

Source: UN comtrade.

Table A5: China's Pulp Imports: 2002-2012 (kt pa)

Grade	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% +/- pa	% (2012)
Mechanical Pulp	146	89	76	61	71	61	70	48	61	58	11	-23%	0.1%
Dissolving Pulp	200	268	290	294	396	526	499	851	963	1,145	1,579	23%	9.6%
Sulphate Pulp	4,475	4,938	6,031	6,258	6,397	6,768	7,812	11,331	8,873	11,705	13,345	12%	81.1%
Sulphite Pulp	54	49	67	41	51	44	40	59	35	93	40	-3%	0.2%
Semi-Mechanical Pulp	357	644	752	867	967	983	1,040	1,288	1365	1,342	1,405	15%	8.5%
Recovered Material Pulp	32	45	103	72	77	87	58	97	70	91	83	10%	0.5%
Total	5,264	6,033	7,319	7,593	7,959	8,469	9,519	13,674	11,367	14,434	16,463	12%	100%

Source: UN comtrade.

Table A6: China's Bleached Kraft Pulp Imports by Country: 2002-2012 (kt pa)

Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	%+/- pa	% (2012)
Canada	726	840	1,084	1,223	1,250	1,223	1,334	1,577	1,596	2,695	2,662	14%	19.9%
Indonesia	1,129	1,180	1,360	1,344	1,173	1,038	1,211	1,228	991	1,385	1,577	3%	11.8%
Brazil	344	602	792	638	915	801	1,178	2,473	1,769	1,889	2,316	21%	17.4%
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United States	421	435	628	662	722	906	933	1,313	1,210	1,446	1,757	15%	13.2%
Chile	539	486	667	777	637	1,042	1,176	1,904	967	1257	1,576	11%	11.8%
Finland	91	103	97	84	201	202	257	339	331	585	786	24%	5.9%
Other	328	436	551	638	617	660	1,703	1,533	1,141	1,433	1,641	18%	12.3%
Total	4,475	4,938	6,031	6,258	6,397	6,768	7,812	11,331	8,874	11,706	13,345	12%	100%

Source: UN comtrade.

Table A7: China's Semi-Chemical Pulp Imports by Country: 2002-2012 (kt pa)

Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% +/- pa	% (2012)
Canada	302	545	630	717	816	841	826	1,054	1,114	1,121	1,128	14%	83%
New Zealand	33	64	80	100	82	87	90	84	90	106	121	14%	9%
Sweden	10	26	27	34	37	35	36	57	37	25	48	17%	3%
Indonesia	0	0	0	1	10	2	0	0	0	0	1	-	0%
Estonia	0	0	0	0	9	8	6	31	18	0	1	-	1%
Norway	1	5	9	10	5	4	18	18	25	10	8	23%	1%
Finland	6	3	2	1	3	1	2	6	36	23	58	26%	1%
Other	5	1	4	4	5	5	62	38	45	57	41	23%	2%
Total	357	644	752	867	967	983	1,040	1,288	1,365	1,342	1,406	15%	100%

Source: UN comtrade.

Table A8: China's Imports of Hardwood Pulpwood 2002-2012 (kdbmt)

Origin Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% (2012)
Vietnam	0	0	53	405	469	685	706	1,245	2,528	3,141	3,497	46%
Australia	49	254	172	277	202	68	212	657	645	954	827	11%
Cambodia	0	0	0	0	3	0	3	4	35	30	14	1%
Thailand	0	0	60	60	0	0	8	9	4	91	94	24%
Indonesia	0	0	0	79	169	359	64	383	639	982	1,025	14%
Malaysia	1	3	17	8	0	0	8	9	4	91	94	1%
Other	2	23	1	42	52	28	4	67	73	156	275	3%
Total	52	280	303	871	895	1,140	1,056	2,766	4,632	6,565	7,580	100%

Source: UN comtrade.



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A global platform for transparent information on ecosystem service payments and markets

Water Initiative

Protecting watershed services through markets and incentives that complement conventional management

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BBOP

Business and Biodiversity Offsets Program, developing, testing and supporting best practice in biodiversity offsets

the katoomba group

Building capacity for local communities and governments to engage in emerging environmental markets

Communities and Markets

Supporting local communities to make informed decisions regarding their participation in environmental markets, strengthening their territorial rights



Using innovative financing to promote the conservation of coastal and marine ecosystem services

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