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THOUGHT LEADERSHIP BRIEF

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Carbon Footprint and Climate Change Impacts from Chinese Consumption of Russian Timber Resources

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KEY POINTS

- China's National Forest Protection Program, first implemented in 1997, has resulted in a dramatic increase in harvested wood product (HWP) imports from Russia, for manufacturing goods mainly consumed within China.
- China's consumption of timber and wood products constitutes the importation of embodied carbon stocks that allows China's domestic forests to serve as atmospheric carbon sinks while inhibiting exporting countries' ability to contribute to the mitigation of climate change.
- Between 1997 and 2017, China imported HWP containing 0.26 Gt CO_2 equivalent from Russia. The retirement and decay of this material has emitted approximately 0.11 Gt CO_2 equivalent by the year 2020. These emissions would result in approximately 25,000 excess deaths, and up to 75,000 excess deaths, globally between 2020 and 2100.
- Bans on the importation of illegally extracted timber could reduce deforestation rates within Russia. Extending the usage life of HWP and keeping the material out of landfills upon disposal would also mitigate their greenhouse gas emissions.

ISSUE

Since 1998, China's National Forest Protection Program has restricted logging in most of its domestic forests due to historically severe deforestation and the resultant catastrophic floods. Forest conservation and reforestation in China caused the demand for crops, livestock, and wood to be displaced to other countries, including a rapid shift to importing timber from Russia, particularly remote forests in the Russian Far East (RFE). Timber logging dramatically increased in the RFE starting in the late 1990s, reversing the decline in harvested volumes from over the previous decade.

Today, China is the largest importer of wood pulp, unprocessed, and processed timber exported from Russia. Inexpensive labor, less restrictive environmental regulations, and the growth of the Chinese market have resulted in the development and global concentration of wood processing and manufacturing capacity in China. Manufactured goods such as flooring and furniture are both consumed domestically and exported to retailers in the US, EU, and Japan. However, China is not only the largest importer of Russian timber but also the largest foreign consumer of final products made from that timber, due to China's rapid economic growth and demand for building construction and furniture.

Consequently, China externalizes the environmental costs of logging, exerting an outsized ecological shadow upon Russia, to enhance its own environmental security. For example, due to the water intensive nature of tree growth, China's international trade in wood products constitutes a net virtual water import or domestic water saving of over 100 billion square meters, equivalent to 1.8% of China's total precipitation and 3.83% of China's total water resources. Similarly, due to forests' ability to sequester and store atmospheric carbon, China's consumption of timber and wood products constitutes the importation of embodied carbon stocks that allows China's domestic forests to serve as atmospheric carbon sinks while inhibiting exporting countries' ability to contribute to the mitigation of climate change. This brief examines the importation of wood products from Russia into China since the establishment of the National Forest Protection Program, and quantifies the atmospheric carbon embodied in and emitted from those products.

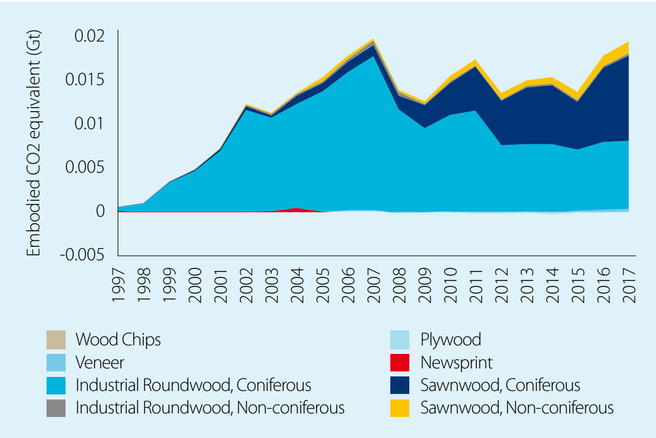
ASSESSMENT

This analysis utilizes harvested wood product (HWP) trade data between China and Russia provided by the Food and Agriculture Organization of the United Nations (FAO) from 1997, prior to the implementation of the National Forest Protection Program, to 2017, the latest year available. These include net traded quantities of coniferous industrial roundwood (i.e., unsawn logs), non-coniferous industrial roundwood, coniferous sawnwood, non-coniferous sawnwood, plywood, veneer, wood chips, and newsprint. Carbon content within each type of HWP, in terms of total CO_2 embodied in imported timber harvests, is calculated based on conversion factors described in the Intergovernmental Panel on Climate Change (IPCC) Guidelines for Greenhouse Gas Inventories. Because wood products store carbon while in use, this study also calculates the CO_2 embodied in HWP that are retired or removed from usage by the year 2020, using an exponential decay function. Because the retirement or removal rate differs by type of use, roundwood and sawnwood are differentiated by three usage categories: construction, furniture, and other sectors including the coal mining, vehicle and ship building, chemical, and chemical fiber industries. Estimates of usage proportions are taken from the China Forestry Development Reports from 2004 to 2017. Wood products also store carbon until they decay or are burned following disposal. This study calculates the total CO_2 emitted from disposed of HWP by the year 2020, also using an exponential decay function. Emission rates differ by type of disposal, so emission rates are differentiated by three disposal categories: combustion, landfill, and open dump. Proportions of disposal types are drawn from the China Circular Economy Yearbooks. Combusted material is assumed to emit its carbon in the same year of disposal. Following IPCC guidelines, this study also assumes that 55% of carbon decomposed within landfill is emitted as CO_2 and 45% as methane. Methane has 28 times the global warming potential as CO_2 over 100 years of residence time in the atmosphere. Half-life values used in this study are listed in Table 1. This study also estimates the consequences of emissions that have occurred from the decay of Sino-Russian traded timber by 2020, in terms of climate-mortality predicted to occur between 2020-2100, using the recently published estimates of $2.26*10^{-4}$ excess deaths (and up to $6.78*10^{-4}$ excess deaths) per metric ton of 2020 emissions.

Table 1. Half-life values for harvested wood products (HWP) in use and HWP disposed of in landfill and open dumps.

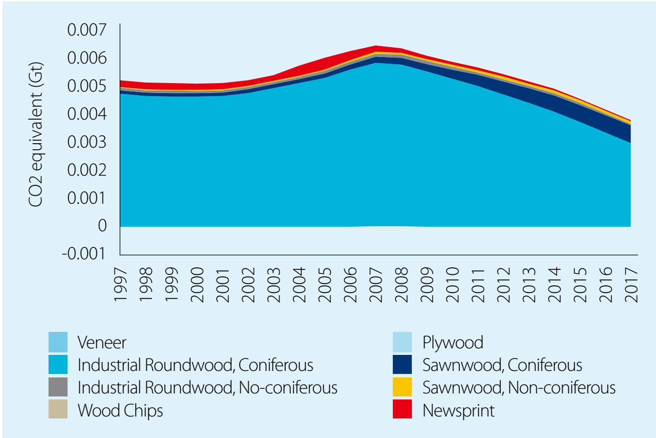
Half-life category	Product	Value (years)
Half-life in use	Construction material from roundwood and sawnwood	40
	Furniture material from roundwood and sawnwood	23
	Other roundwood and sawnwood	20
	Veneer and plywood	25
	Wood chips and paper products	2
Half-life in landfill	Solid HWP	29
	Paper products	15
Half-life in open dump	Solid HWP	16.25
	Paper products	8.25

Figure 1. Total CO_2 embodied in HWP imported from Russia to China, each year from 1997 to 2017.



Source: author's calculations based on FAO data.

Figure 2. Total CO_2 equivalent emitted by 2020 from the disposal and decay of HWP imported from Russia to China, each year from 1997 to 2017.



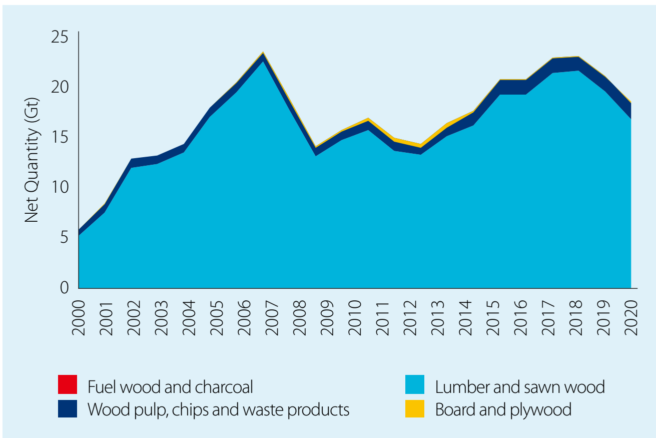
Source: author's calculations based on FAO data.

The onset of the National Forest Protection Program in China was followed by a rapid increase in HWP imported from Russia, primarily coniferous logs (Figure 1). The importation of Russian logs, and HWP in general, peaked in 2007 due to an increase in the Russian export tax on unprocessed logs, with import quantities fluctuating in subsequent years. Motivated by the export tax increase, Chinese enterprises invested in wood processing in Russia and vertical integration of every node of the wood trading network. Hence, after 2007, the share of coniferous sawnwood in China's HWP imports from Russia increased substantially and eventually overtook the share of roundwood. By 2017, the combination of sawn and unsawn timber neared the previous peak from 2007. Due to long periods of utilization for HWP, as well as slow decay rates, atmospheric carbon in 2020 from HWP imported from Russia is largely from unprocessed logs (Figure 2). As more construction material and furniture is retired and disposed of in the coming decades, the share of carbon emissions from imported sawnwood will likely increase. Between 1997 and 2017, China imported HWP material containing 0.26 Gt of CO_2 equivalent from Russia. During the same time period, about a fifth of that material, containing 0.05 Gt of CO_2 equivalent, was retired from use and disposed of via combustion, landfill, or open dumps. However, the higher global warming potential of carbon released as landfill methane has resulted in greater actual climate forcing emissions, approximately 0.11 Gt CO_2 equivalent.

Although these quantities are relatively small compared to Russia's or China's overall emissions, 0.11 Gt CO_2 would nevertheless result in approximately 25,000 excess deaths, and up to 75,000 excess deaths, globally between 2020 and 2100. Moreover, this analysis does not consider the damages caused by the emissions' atmospheric residence time prior to 2020, emissions from these HWP occurring after 2020, nor does it consider emissions from the logging, processing, and transportation of HWP and emissions from deforestation and degradation of permafrost. Therefore, these mortality quantities likely underestimate the actual number of excess deaths.

More recent trade data from other databases indicate that since peaking again in 2018, the quantity of HWP imported from Russia to China has again decreased (Figure 3). However, as seen historically, this decrease could be temporary, especially as Russian timber becomes cheaper due to devaluation of the ruble and as Russia seeks additional sources of foreign exchange in the face of Western economic sanctions.

Figure 3. Total quantity of net HWP imports from Russia to China, each year from 2020 to 2020.



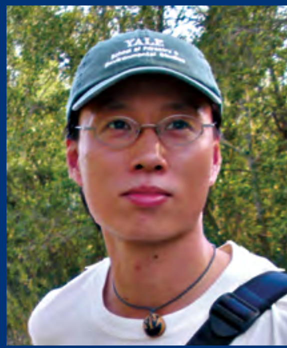
Source: Chatham House Resource Trade Database.

IMPLICATIONS AND RECOMMENDATIONS

The onset of China's National Forest Protection Program in 1997 and Russia's log export tax in 2007 both had observable effects on the quantities and composition of harvested wood products imported from Russia into China. Therefore, public policy instruments could be potentially useful tools for affecting the carbon emissions from such products.

Amidst the active transborder economies of the RFE and northeast China, the timber industry stands out as especially illicit and corrupt. The virtually open-access nature of forest resources encourages wasteful, destructive, and unsustainable timber extraction practices, since Russia lacks the social and financial infrastructure to discourage illegal logging. Approximately 20-30 percent of Russia's total timber production is illegally logged. China functions as a launderer for illegally logged timber, as manufacturers obscure its origins by mixing it with legal sources. Common violations, committed by Chinese firms with Russian complicity, include logging without a license or with a fake license; obtaining illegal licenses through bribes and intimidation; abuse of logging permits; logging outside concessions and within restricted or protected areas; violations of export laws; and falsification of customs documents. The importation of cheap illegal timber undercuts legitimate operators by driving down prices and hindering the viability of companies that adhere to forestry laws and sustainable forest management. Elimination of illegal logging alone, or a ban on the importation of illegally logged material, could increase the standing forest stock in Russia by more than 56 million cubic meters over ten years. Other jurisdictions such as the United States and the European Union already restrict the importation of goods produced from illegally logged material.

Other steps China could take to reduce the climate change impacts of HWP importation and usage include extending the utilization life of wood products, so that they store carbon for a longer period of time, as well as modifying disposal practices for retired wood products. Recycling retired HWP into other uses would allow them to keep carbon out of the atmosphere for a longer period of time. If the usage of a wood product has been exhausted, disposal options other than landfill, such as combustion, would also mitigate their greenhouse warming potential by reducing methane emissions. Additional climate benefits could be achieved if such combustion generates electricity that displaces traditional fossil fuel power generation.



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Dr. Chow holds a PhD from Yale University and Master of Environmental Management and Master of Forestry degrees from Duke University. His peer-reviewed publications have appeared in *Science, PLOS One, Land Economics, the Journal of Sustainable Forestry, Forest Policy and Economics, the Journal of Environmental Policy and Planning,* and elsewhere. His research focuses on land economics and policy, as well as on the role of natural capital in climate change adaptation.

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