



Food and Agriculture Organization
of the United Nations

Climate change mitigation and harvested wood products:

Lessons learned from three case studies in Asia and the Pacific



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KEY MESSAGES

- Harvested wood products (HWP) from sustainably managed forests can store carbon, increase the availability of biomass for the production of biofuels and substitute for more resource-intensive products.
- Sustainable production of HWPs can contribute to multiple Sustainable Development Goals (SDGs).
- The length of time carbon is stored in HWPs can be increased through re-use and recycling.
- Modeled scenarios suggest that increased re-use and recycling of sawnwood and paper could substantially increase carbon stocks.
- Carbon stocks in HWPs can also be increased through production of longer-lived products.
- Modeled scenarios, using data from India, suggest that, without changing harvest levels, HWPs in India can store an additional 151 million tonnes of carbon (i.e., an increase of 12 percent) if wood use was shifted from wood pulp based products to solid wood products.
- Scenarios run using data from Papua New Guinea suggest a potential increase in carbon stocks of up to 23.1 percent from a 30 percent increase in sustainable production of HWPs.
- Increased data precision can support improved estimates of the carbon stocks in HWPs.
- Computer simulations based on data from Viet Nam confirm the importance of high-quality data to inform effective decision-making.

Many countries have introduced wood use encouragement policies, typically designed to promote increased use of wood products in construction, although they may promote increased use of wood products in general.¹ Many wood use encouragement policies focus on public procurement but may also include wood solutions to heating and energy or even infrastructure such as bridges. These types of policies are common in countries with economically important forestry sectors such as Australia, Finland, Japan and New Zealand. One of the most prominent examples of a fully-fledged wood use encouragement policy is the Wood First Act of British Columbia, Canada, implemented in 2009.

Estimating the contributions of HWPs to climate change mitigation plays a role in many decision-making processes. These include: 1) country-level accounting of greenhouse gas emissions and sinks under the United Nations Framework Convention on Climate Change (UNFCCC), 2) assessing forest carbon credits used in regional or national emission control policies, 3) guiding the development of sustainable forest management plans, 4) issuing environmental product declarations (EPDs), 5) guiding the development and deployment of new wood products and related industries, and 6) designing effective wood encouragement policies.

Carbon stored in the pool of HWPs produced from sustainably managed forests can, for example, be reported by countries as part of their nationally determined contributions (NDCs), containing each country's climate change mitigation target towards the Paris agreement goals. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for disseminating information related to climate change. FAO is the custodian of the forest product statistics database discussed by the IPCC for use in estimating carbon storage in HWPs.²

A clearer understanding of the role of HWPs in climate change mitigation can also support reporting on the Sustainable Development Goals (SDGs). Harvested wood products from sustainably managed forests can contribute to the achievement of multiple SDGs including the promotion of sustainable economic growth (SDG 8), responsible consumption and production (SDG 12) combating climate change and its impacts (SDG 13), and the protection, restoration and promotion of the sustainable use of terrestrial ecosystems (SDG 15).

Trees sequester carbon during photosynthesis, storing carbon in their leaves, branches, trunks and roots. When a tree is harvested, the carbon remains stored in the wood and, eventually, in the harvested wood products (HWPs) made from the wood of the tree. In 2017, the Food and Agriculture Organization of the United Nations (FAO)³ synthesized opportunities for integrating forest and wood products into climate change mitigation strategies, concluding that increased use of wood offers important climate change mitigation potential and, further, that the potential of particular mitigation options varies considerably by country.

HWPs can directly influence energy and greenhouse gas balances in three ways. First, wood products can physically store carbon and thus expand carbon storage outside of the forest. Second, by-products associated with wood production can increase the availability of biomass for the production of biofuels which can replace non-renewable energy sources. Third, HWPs can substitute for more energy-intensive and non-renewable materials such as cement, steel and plastic. Most, but not all, global studies to date, have indicated that the production of sustainably sourced HWPs can reduce carbon emissions in both the long and short term.⁴

Estimating carbon stocks in harvested wood products

This information brief describes simulations, based on FAOSTAT data and calculation methods from the IPCC, to explore potential impacts of shifts to longer-lived HWPs, increased recycling and improved data quality. Increased total sustainable production and consumption of longer-lived HWPs, e.g. sawnwood and wood-based panels, may contribute to increasing carbon stocks. Recycling and re-use of paper and wood may have similar positive impacts by increasing carbon storage times. Improved data quality may enable increased precision in estimated benefits.

In simulations for all three country case studies, carbon stocks were estimated using a first-order decay equation to describe changes in carbon stocks over time and three categories of HWPs from the FAOSTAT database: sawnwood; boards and panels; paper and paperboard. The half-life parameter in the equation describes how long the carbon is stored in the product. Initialization of the inherited stock of carbon in HWPs was based on average values for the first five years of production data. This approach reflects relatively new guidance from the IPCC.²

Increasing paper production in India: Simulating potential climate change mitigation

Background information

In India, the share of long-lived products (e.g. sawnwood) in overall production of HWPs has decreased over time and there has been an increasing shift towards short-lived products (e.g. paper and paperboard). Much of the paper made in India is used to make books and schoolbooks for a rapidly growing and urbanizing population, and to make cardboard boxes and other types of packaging for the expanding manufacturing sector. Annual newspaper and magazine sales also soared from 40 million copies in 2006 to nearly 63 million copies in 2016.⁵

In India only 20 percent of wastepaper is collected and the rest ends up in landfills. Indian mills have come to rely heavily on imported paper waste with an import bill that increased from USD 5.1 million in 1980 to USD 1 billion in 2011.⁶

Potential for increased use of long-lived products may arise in the hospitality industry (e.g. the furniture manufacturing sector) and/or with an increase in overall construction activities such as large residential complexes.

The potential impact on carbon stocks from a shift in production to longer-lived products and from increased recycling rates are explored in the following analyses.



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Modeling scenarios

Scenario 1: Shift in production to longer-lived products. Using observed annual total production, shares of sawnwood, wood-based panels and paper and paperboard from 1997 to 2019 were re-estimated to mirror those of 1960 to 1996.

Scenarios 2a and 2b: Increases in recycling and re-use. To simulate the effects of increased recycling rates on the length of time carbon is stored, calculations were re-run using (a) a half-life for paper and paperboard of four years, which is twice that of the IPCC default and (b) a half-life of 45 years for sawnwood instead of the IPCC default of 35 years.

Results

All simulation experiments resulted in a considerable increase in the total carbon stored in HWPs. Scenario 1 yielded 151.7 million tonnes of carbon by 2018, an increase in total carbon stored in 2018 of 12.0 percent compared to estimates from observed data.

The doubling of the half-life of paper and paperboard from two years

to four years (Scenario 2a) provided an estimated total stock of 143.5 million tonnes of carbon by 2018, an increase of 7.0 percent carbon compared to estimates from observed data. Under this scenario, the share of carbon stocks in paper and paperboard also increased from 10.4 percent (13.9 million tonnes) to 16.8 percent (24 million tonnes). Scenario 2b, describing increased re-use of sawnwood, yielded 151.7 million tonnes of carbon by 2018, an increase of 12.0 percent compared to the estimate using IPCC default values of 133.4 million tonnes of carbon.

Overall, these simulations support the expectation that increasing the share of production used to build longer-lived products and increasing recycling and re-use may increase the carbon storage potential of HWPs as, effectively, both changes increase the storage time of carbon in HWPs.

FAO has new data to track production of post-consumer wood and recovered paper (see <https://www.fao.org/faostat/en/#data/FO>) which could contribute to monitoring these trends.



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Estimating the carbon storage impact of increased sustainable domestic production of HWPs in Papua New Guinea

Background information

Encompassing about 46 million hectares, Papua New Guinea (PNG) remains 78 percent forested and, for many local communities, products from forests may be an important source of cash income. Globally, PNG forests have significant value for the conservation of tropical forest biodiversity, maintenance of freshwater flows and carbon storage. Nevertheless, forests in PNG are under increasing pressure from logging, both commercial and small scale, as well as from agriculture and mining.

PNG's national REDD+ Forest Reference Level Assessment (2017)⁷ indicated that 9.9 percent of PNG's forests are disturbed by large-scale logging and 0.2 percent are disturbed by small-scale logging using portable sawmills. Small-scale, temporary gardening was responsible for 8.2 percent of forest disturbance.

PNG is working to eliminate illegal logging via a timber legality and timber verification system and an export monitoring system. With these processes in place, domestic processing of sustainable feedstock for producing HWPs may increase in the future. Currently, PNG exports high shares of feedstock of industrial roundwood (> 80 percent since 1995). There is comparatively little domestic production of sawnwood and wood-based panels, and virtually no domestic paper and paperboard production.

PNG was chosen as a case study because of the potential for additional domestic production of value-added HWPs. Simulation experiments investigated the potential influence on national carbon stocks in HWPs of a shift towards increased domestic HWP production.

Modeling scenarios

Trends in carbon stocks within HWPs were calculated for both current production rates and for increases in domestic production of sawnwood and wood-based panels of 10 percent, 20 percent and 30 percent.

Results

The baseline scenario for 2018 indicated 1.7 million tonnes of carbon stored in HWPs. The higher amounts of domestic processing of roundwood into sawnwood and wood-based panels would lead to an estimated 9.1 percent, 16.7 percent and 23.1 percent increase in carbon stored in HWPs, respectively. An increase in production did not translate into a linear increase in

carbon stocks. Increased production of sawnwood had a much higher impact on estimated carbon storage than increased production of wood-based panels, mainly due to the longer half-lives and currently greater domestic production.

Potential increases in carbon stocks should be considered in context. If increased domestic production is associated with increased forest harvest, carbon stocks and sinks in forests would likely decline. Moreover, a shift to increased domestic production of HWPs should have a positive effect on carbon stocks in HWPs for PNG, but not necessarily for the overall global carbon balance.



Wooden furniture parts for sale in timber market. ©FAO/Ashley Steel

Quantifying the value of high-quality data on production of HWPs in Viet Nam

Background information

Viet Nam underwent a forest transition in the early 1990s, with a national shift from forest-area loss to forest-area gain. In 1943, Viet Nam had 14.3 million ha of natural forests, covering 43 percent of the total land area of the country; however, by 1990, the forest area had declined to 9.2 million ha. The government introduced a range of policies to develop and expand the forest industry, greatly restricting logging quotas, winding down inefficient state-owned enterprises, banning low-value-added exports and heavily investing in plantation establishment. New datasets were developed for setting logging quotas and for directing tree planting campaigns.⁸ Since 1995, the forest area has increased because of forest rehabilitation and plantation programmes. By the end of 2006, the forest area in Viet Nam was 12.9 million ha of which 10.4 million ha were natural forest and 2.5 million ha were plantation forest.

In 2018, FAO conducted a capacity development workshop in Viet Nam to support the country's interest in improved quality and quantity of information on national production and trade of forest products. In this case study, the influence of increased precision in input data on the precision of estimated carbon stocks in HWPs is considered.



Production of wooden beams. ©FAO/Ashley Steel.

	Low precision	Medium precision	High precision
Input HWP data	±30%	±20%	±10%
Output carbon stock estimate	±23.1%	±16.7%	±9.1%

Modeling scenarios

The scenarios explored how estimates of carbon stored are affected by the precision of the national estimates of HWP production. Simulations were run to quantify the influence of low precision (high error, wide differences between possible values), medium precision and high precision (low error, narrow differences between possible values) input data on the precision of estimates of carbon stored in HWPs.

Results

As expected, if estimates of national production of HWPs are not precise, there will also be uncertainty in the estimates of carbon stored in HWPs. Increasing the precision of the data inputs led to greater certainty in the estimates of carbon stocks.

Errors in the output estimates of carbon stored in HWPs might range from 9.1 percent to 23.1 percent, given reasonable estimates of input errors. Absolute errors will generally be higher where production of HWPs is higher; therefore, it becomes more important to have high quality input data with greater production. As the production of wood products has steadily increased in recent years, it is advisable to support incentives to produce better overall data quality on wood product production.

Implications for forest management

The production of HWPs is inextricably linked to on-the-ground management of forests. As decisions and policies are crafted for the sustainable production of HWPs and in hopes of harnessing their carbon storage potential, three additional goals of forest planning must also be considered: 1) increasing the total forest area, 2) avoiding forest degradation and 3) enhancing the resilience of global forest resources. Successful policies will balance short-term and long-term goals, including the protection of biodiversity and the provision of important ecosystem services.⁹



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IMPLICATIONS

- Governments and stakeholders can leverage the climate change mitigation benefits of wood via awareness raising, policy development and data collection.
- A shift in production to longer-lived products could further increase the amount of carbon stored in HWPs without increasing current levels of harvests.
- Recycling and re-use is good for the global, circular sustainable bioeconomy and can contribute to climate change mitigation through increased carbon storage times in HWPs.
- Increasing the quality and quantity of forest product statistics can strengthen the evidence base for the climate change mitigation potential of HWPs.
- FAO data on post-consumer wood and recovered paper can be leveraged to monitor progress in increasing rates of recycling.
- National policies and industry decisions may have a strong impact on the amount of carbon stored in HWPs.
- Policies and decision-making related to production of HWPs must also consider increasing forest area, reducing forest degradation and maintaining biodiversity as well as other ecosystem services from forests.

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