Climate change and carbon in wood products

What are the climate benefits of using wood products?

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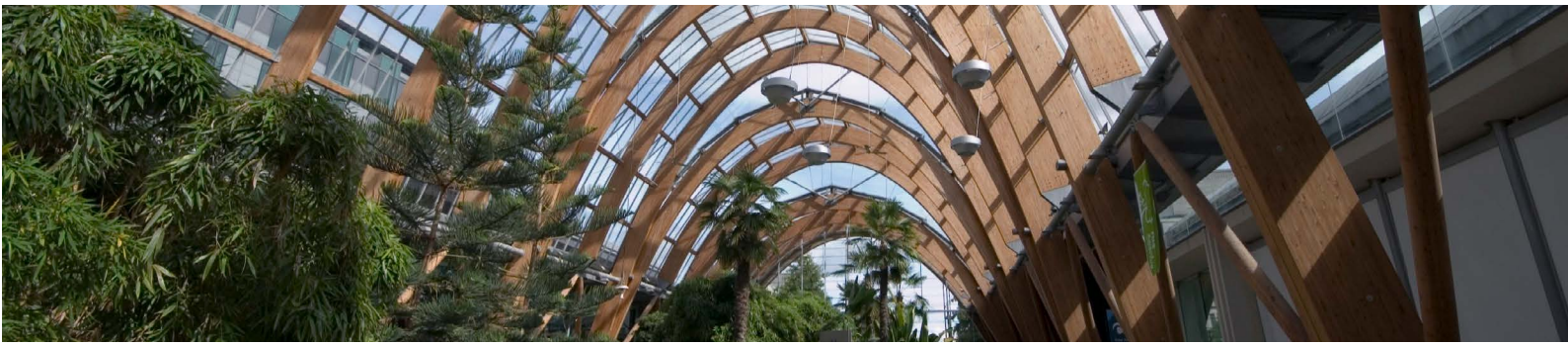

Wood products can contribute towards reducing net greenhouse gas (GHG) emissions by both storing carbon and replacing materials that result in the emission of more GHGs in their production. These mechanisms are known as carbon storage and substitution, respectively.

Storing carbon in wood products

Trees remove carbon dioxide from the air as they grow, storing the carbon in their tissues, or biomass. When they are harvested, the resulting wood products can retain the stored carbon for periods ranging from less than a year to centuries.

Some products, such as sawn timber, may be used for joists, floorboards, or furniture, and may remain in use for many decades (Table 1). Wood-based panel boards (such as MDF or particleboard) used in construction can have a similarly long service life. Lower quality wood used for pallets or other packing will have a shorter life. Paper and card can have a short life as office paper or newspaper, or a longer life as books.

It can be challenging to estimate accurately the service lives of wood products as there are variations between different products and countries.

The wood product carbon pool

The size of the total wood product carbon stock (or 'pool') at any given time is affected by the rate at which new wood products are created (inputs) and old products reach the end of their service life (outputs).

Inputs are influenced by harvesting rates and the demand for wood products. Data on inputs are taken from Official Statistics.

Outputs can be estimated by the average length of time that wood products remain in use, whether they are subsequently recycled, and how they are disposed of. The UK follows the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines to calculate outputs from the wood product carbon pool.

The total UK wood product carbon pool is difficult to assess, but it has been estimated to be approximately 500 million tonnes CO_2e.

Table 1 Typical half-lives of wood products. For example, after 25 years, half of the carbon in wood-based panels would have been recycled or moved to the waste sector.

Wood product categories	Default half-life (years)
Paper and paperboard	2
Wood-based panels	25
Sawnwood	35

Quick figures (2023)

- The UK harvested 10 million green tonnes of roundwood from woodlands.
- Apparent consumption (including imports, exports, and UK production):
  - Sawnwood: 8.9 million m^3 (6.2 million m^3 imported).
  - Wood-based panels: 5.8 million m^3 (3.1 million m^3 imported).
  - Pulp and paper: 5.2 million tonnes (2.7 million tonnes imported).
  - Wood fuel/biomass: approximately 16 million oven-dry tonnes (6.4 million tonnes imported as wood pellets for energy generation).
- Approximately 4.5 million tonnes of waste wood are generated in the UK each year, of which 24% is recycled into panel boards.
- From these various sources, the UK produced:
  - 2.9 million m^3 of sawnwood
  - 3.0 million m^3 of wood-based panels
  - 3.2 million tonnes of paper and paperboard
  - 4.6 million tonnes of wood fuel (including waste wood, firewood, wood pellets, and briquettes).

Wood product cascading

Depending on the quality of the wood at the point at which it is discarded, it can be:

- reused in its current form, but in another application;
- recycled into other products, such as panel board or paper;
- repurposed as animal bedding;
- used for fuel – such as firewood, woodchip, or wood pellets – for heating or electricity generation;
- disposed of through the waste stream to incineration with energy recovery, or landfill (the UK does not landfill much wood).

If waste wood is recycled, it will continue to store carbon and potentially substitute for more carbon-intensive products. This process, known as cascading, can substantially extend the time carbon is retained in wood products and contribute to its role in mitigating GHG emissions.

Substitution benefits of wood products

Timber can replace materials that require more energy from fossil fuels during their manufacture, such as concrete and steel. The GHG emissions avoided through substitution can even be larger than the carbon stored in the wood product itself. A recent review concluded that, across a wide range of wood products, the substitution benefits average 1.2 tCO_2 per tonne CO_2 in the product.

The net GHG emissions saving achieved through substitution depends on the total emissions to grow, harvest, transport, and manufacture the wood product, relative to the total for the alternative material. For current products and processes, emissions associated with producing wood products from sustainably managed forests are usually relatively small.

There is a growing interest in engineered wood products. These can help to diversify applications for wood and increase the proportion that can be utilised for long-life applications, such as structural use in buildings. Research is required to understand the GHG emissions mitigation benefits of these more innovative materials.

Wood can also be used as biomass for heat and/or power generation (bioenergy), substituting for fossil fuels. The substitution benefit in this case will depend on how the forest is managed, and how the bioenergy market influences management decisions. It is important that only low value or surplus material from sustainably managed woodlands is used for fuel, and not high-quality timber. UK Government schemes that support the use of biomass for energy generation (for example the Renewables Obligation) have sustainability requirements that must be met.

More information:

More detailed information on the topics covered in this Factsheet can be found online:

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