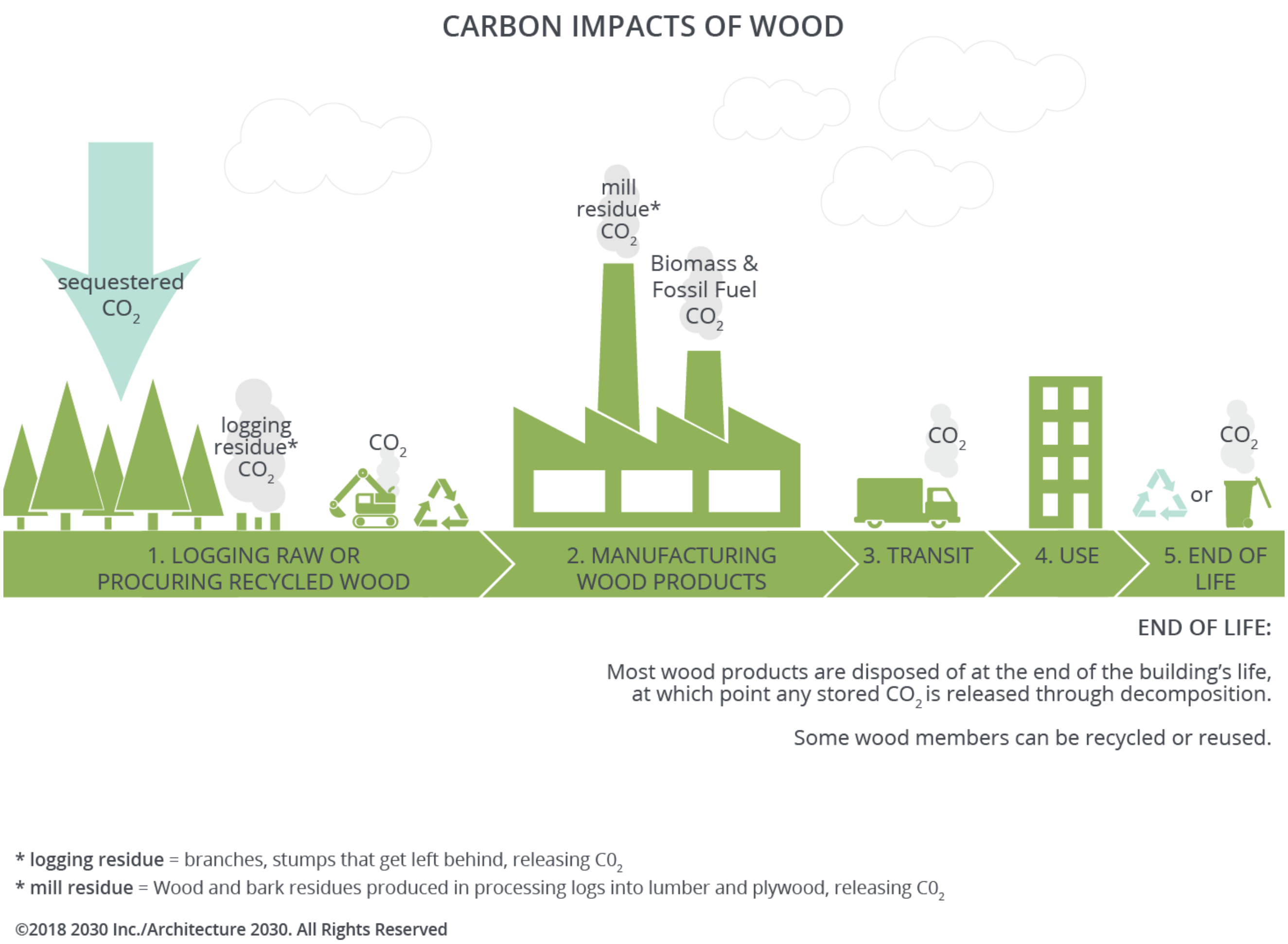
WOOD

materialspalette.org/wood



Carbon Impact of Wood

Trees sequester carbon during their life, pulling carbon dioxide (CO_2) from the atmosphere and storing it in their mass. For every kilogram of wood grown, 1.5 kg of CO_2 is removed from the atmosphere[1] and stored until the tree burns or decomposes, at which point the CO_2 is re-released into the atmosphere. Due to this natural carbon sequestration, forests play a significant role in our planet's ability to regulate warming and carbon emissions.

Global timber harvesting causes us to lose 32 million acres (13 million hectares) of forest each year, or about 60 acres per minute. Specifying wood from sustainably managed forests helps ensure that the trees we harvest are replaced, so our forests maintain a consistent level of carbon sequestration[2]. About 20% of anthropogenic greenhouse gas emissions are due to deforestation and forest degradation[3,4].

Using reclaimed wood and wood from sustainably managed forests are the best ways to reduce embodied carbon emissions from wood.

Carbon Smart Attributes

Specify reclaimed wood products

Wood will re-release the carbon it has sequestered at the end of its useful life through decomposition or burning. Use reclaimed, salvaged, or recycled wood products whenever possible to prolong this carbon storage.

Only specify timber from sustainably managed forests

Forest management practices can greatly influence the carbon footprint of a wood product, so specify wood and wood products from sustainably managed forests. Among other attributes, sustainably managed forests establish protected areas and conserve biodiversity, have a management plan and harvest accordingly, replant trees to replace the harvested trees, and use reduced-impact logging techniques, all of which reduce the embodied carbon impact of the timber[2].

Specify fast growing wood

Fast-growing trees store carbon faster than slow-growing trees. Specify wood from sustainably managed forests that support fast growing trees and plant new trees to replace harvested timber.

Specify wood products manufactured without fossil fuels or GHG-emitting biofuels

Many wood processing plants are powered by fossil fuels or wood chips, but wood chips (a form of biomass) are not necessarily carbon neutral. Burning wood immediately releases its sequestered carbon, and it takes decades for replacement trees to absorb and sequester that same amount of carbon. Whenever possible, specify wood products that are manufactured using renewable, non-CO_2 emitting energy sources.

Don’t specify wood harvested from old growth forests

The ecosystem- and carbon-impacts of harvesting old growth forests and rainforests are significant. To minimize these impacts, only specify wood from new growth, sustainably managed forests. A significant portion of carbon sequestered by trees is pushed into the soil around the tree. Harvesting old growth forests and rainforests greatly disturbs the ground, releasing much of that sequestered carbon. Additionally, old growth forests and rainforests provide diverse habitats for a wide range of species that have developed over multiple decades or centuries. Harvesting these forests can cause significant ecosystem disruptions.

Specify wood products with minimal processing

Typically, the more processing a wood product undergoes the higher the embodied carbon impact. For example, glulam timber and other engineered wood products emit more CO_2 than sawn lumber due to the added manufacturing processes, which often include the application of heat and pressure and the use of adhesives[1]. Additionally, most engineered wood products use virgin wood and are difficult to recycle, with the exception of glulams. However, while engineered wood typically has a higher embodied carbon impact per unit weight, some engineered wood products are stronger than sawn lumber thus requiring a smaller material quantity, which may reduce emissions overall – see Design Guidance.

Design & Construction Guidance

Design for durability

Ensure that the wood products used in the building are protected from heat and water, and will last the lifespan of that building.

Understand the right structural wood product for your building's needs

Even though engineered wood products typically have a higher carbon impact per unit weight than dimensional lumber, they are stronger and therefore require fewer members, which may reduce emissions overall. EPDs are available for many engineered wood products so it is possible to compare the carbon footprint of systems using engineered wood vs. dimensional lumber in order to select the system with the lowest overall embodied carbon footprint.

Look for low-carbon alternatives for the same application

Choose the lowest carbon wood product appropriate for each application. For example, oriented strand board (OSB) sheathing and plywood have comparable characteristics, but OSB has about double the carbon footprint of plywood sheathing[1]. Engineered wood products such as Laminated Veneer Lumber (LVL) and Parallel Strand Lumber (PSL) have a larger embodied carbon impact than sawn lumber, even accounting for their greater strength[1].

Use Optimal Value Engineering techniques (advanced framing)

Optimal Value Engineering techniques can reduce the amount of wood needed in a building or application. For example, space studs at 24" on center instead of 16", align studs with joists and rafters using a single top plate, align openings with stud spacing to eliminate or reduce header sizes at non-bearing walls, and eliminate unnecessary framing at wall intersections[1].

Plan for reuse

Wood will release the carbon it has sequestered at the end of its useful life through decomposition. Make a plan for reusing the project's wood products at the end of the building's life. Consider ancient wood joinery techniques or mechanical fastening to avoid adhesives that would prevent the materials from being reused.

Use wood trusses and pre-manufactured wall panels, where appropriate

Wood trusses and pre-manufactured wall panels have been shown to use 26% less wood than traditional framing techniques, while also reducing weight and allowing for longer floor and roof spans[5]. However, if using engineered wood products, ensure that the additional embodied carbon from manufacturing still results in an overall embodied carbon reduction.

RESOURCES

1 |ASCE. (2010). Sustainability Guidelines for the Structural Engineer. D. Kestner, P.E.; J. Goupil, P.E.; and Emily Lorenz, P.E.

2 | Rainforest Alliance: What is Sustainable Forestry?

3 | ASCE/SEI Sustainability Guidelines for the Structural Engineer (See Wood/Timber chapter)

4 | Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change, Law and Harmon 2011

5 | NRDC (Natural Resources Defense Council). (1998). Efficient wood use in residential construction: A practical guide to saving wood, money, and forests, New York.

Additional Resources:

ASCE/SEI Structural Materials and Global Climate (See Wood/Timber chapter)

Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy , Mary S Booth 2018 *Environ. Res. Lett.* **13** 035001

SEE ALSO

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The Carbon Smart Materials Palette® is a project of Architecture 2030. The Carbon Smart Materials Palette is a living resource that reflects the best available knowledge and resources at this time. The palette will be updated as new technology, research, and data becomes available. The extent to which any or all of these guidelines and recommendations are realized in practice depends in large measure on their application, local conditions, and the extent to which the designer succeeds in understanding and applying them.

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