Wood and Carbon Footprint

North American wood products reduce the carbon footprint of buildings

Although an important goal of environmental design is to increase the energy efficiency of buildings, it is just one element of a building's carbon footprint. Using North American wood from responsibly managed forests also reduces a building's carbon footprint in several ways.

- As trees grow, they absorb carbon dioxide (CO_2) from the atmosphere. They release oxygen (O_2) back into the air and use the carbon (C) to produce sugars and fiber for growth, incorporating it into their leaves, twigs, solid woody stems and surrounding soil.
- Wood products continue to store much of this carbon indefinitely. In the case of buildings, the carbon is kept out of the atmosphere for the lifetime of the structure—or longer if the wood is reclaimed and used to manufacture other products. Wood is about 50 percent carbon by dry weight.[1]
- Manufacturing wood into products requires far less energy than other construction materials, and most of the energy used comes from renewable biomass.

> **Another 8,440 metric tons of greenhouse gas emissions (CO_2e) were avoided by using wood instead of steel or concrete.[3]**

The impact of building material choice

From a carbon footprint perspective, life cycle assessment (LCA) studies show that wood buildings require less energy from resource extraction through manufacturing, distribution, use, and end-of-life disposal, and are responsible for far less greenhouse gas emissions than fossil fuel-intensive materials such as steel or concrete. For example:

- Constructing a wall using kiln-dried wood studs, oriented strand board (OSB) sheathing, and vinyl siding instead of concrete with an exterior stucco coating results in 15 pounds of avoided CO_2 emissions for every square foot of wall area.[2]
- Using engineered wood I-joists with an OSB sub-floor rather than steel joists and OSB sub-flooring results in 22 pounds of avoided CO_2 emissions for every square foot of floor area.[2]

These differences are significant and expanding this type of analysis to an entire building yields substantial results. For example, a condominium building with five stories of wood-frame construction was found to store 3,970 metric tons of CO_2e (carbon dioxide equivalent) in its lumber, panels and engineered wood products. Another 8,440 metric tons of greenhouse gas emissions (CO_2e) were avoided by using wood instead of steel or concrete.[3] Combined, this is equivalent to the annual greenhouse gas emissions generated by 2,300 passenger cars or in the operation of 1,000 average-sized U.S. homes.[4]

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Forest management and carbon sequestration

When a tree is harvested, some of the carbon stays in the forest and some is removed in the logs. Some carbon is released when the forest soil is disturbed during harvest, and as the roots, branches and leaves left behind begin to decompose. However, once the harvested area is regenerated, the forest once again begins to absorb and store carbon.

According to *The State of America's Forests* report, less than 2 percent of the standing tree inventory in the U.S. is harvested each year while net tree growth is close to 3 percent.[5] In Canada, less than 1 percent of the managed forest is harvested annually and the law requires regeneration.[6] In both countries, responsible forest management has resulted in more than 50 consecutive years of forest growth that exceeds annual forest removals.[7]

As a result of these trends, forests in both countries have sequestered fairly high levels of carbon in recent decades.

> **"Manufacturing wood into products requires far less energy than other construction materials."**

Summary

Using North American wood from responsibly managed forests helps to reduce a building's carbon footprint in several ways.

- Trees absorb carbon dioxide (CO_2) from the atmosphere, release oxygen (O_2), and use the carbon to produce sugars and fiber for growth.
- Wood products continue to store much of this carbon—while the regenerating forest once again begins the cycle of carbon absorption.
- Manufacturing wood into products requires far less energy than other materials, and most of the energy used comes from renewable biomass.

Photos (in order): APA - The Engineered Wood Association, Davis & Church, LLC, www.naturallywood.com

[1] FPInnovations – Forintek Division

[2] Lippke, B. and Edmonds, L., 2009, *Environmental Improvement Opportunities for Alternative Wall and Floor Design, CORRIM Phase II Research Report, Fact Sheet 6*; converted from kilograms

[3] Calculations are based on a building that includes five stories of wood-frame construction over a two story concrete podium deck. Carbon stored and avoided emissions were estimated using the Wood Carbon Calculator for Buildings, based on research by Sarthre, R. and J. O'Connor, 2010, *A Synthesis of Research on Wood Products and Greenhouse Gas Impacts,* FPInnovations.

[4] US EPA Greenhouse Gas Equivalencies Calculator

[5] *The State of America's Forests,* M. Alverez, 2007, Society of American Foresters

[6] Natural Resources Canada; Forest Products Association of Canada

[7] Natural Resources Canada; USDA Forest Service; *The State of America's Forests*, M. Alveriz, 2007, Society of American Foresters