



Building  
**Green** with  
Wood in **B.C.**

MODULE 10

# Forest Carbon

# Forests - Natural Carbon, Natural Energy and Carbon Storage

Forests play a critical role in filtering and renewing our air. Trees absorb carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O), and release oxygen (O<sub>2</sub>). The carbon absorbed is stored until the trees die and decay or are burned in a wildfire, at which point the carbon is released back into the atmosphere. Some of the carbon absorbed by trees is stored for a long period of time within the forest.

Less known is the fact that trees use carbon (C) to produce wood, and that products made from wood continue to store carbon for as long as they exist. In fact, one-half the weight of wood is carbon.

There is growing awareness among building designers that using wood can reduce a building's carbon footprint, provided it comes from a sustainably managed forest. At the core of wood's carbon benefit is the fact that as trees grow they absorb CO<sub>2</sub> from the atmosphere and incorporate the carbon into their

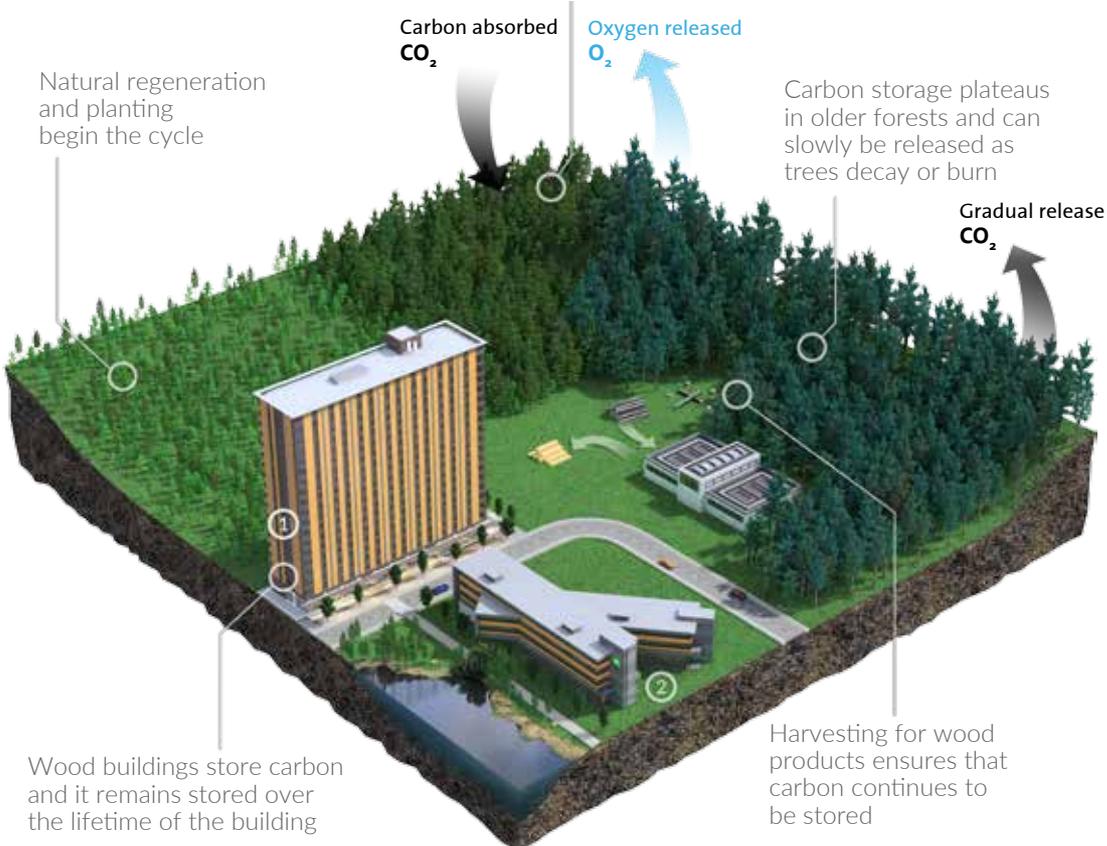
wood, leaves or needles, roots and surrounding soil. Over time, one of three things happens:

- When the trees get older, they start to decay and slowly release the stored carbon.
- The forest succumbs to wildfire, insects or disease and releases the carbon quickly.
- The trees are harvested and manufactured into products, which continue to store much of the carbon. In the case of wood buildings, the carbon is kept out of the atmosphere for the lifetime of the structure—or longer if the wood is reclaimed at the end of the building's service life and either re-used or remanufactured into other products.

The unique benefits of wood result from how it is made – within forests using solar energy. Solar energy drives the process of photosynthesis and wood formation. Transformation of wood into useful building materials takes relatively little additional energy.

## Carbon Cycle: Sustainable Forest Management and Wood Products

Growing forests absorb carbon dioxide and release oxygen



\*Estimated by the Wood Carbon Calculator for Buildings (WoodWorks US -<http://woodworks.org>), based on research by Sathre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations.

Note: CO<sub>2</sub> on this chart refers to CO<sub>2</sub> equivalent. Figures calculated May 2016.

\*\*US Environmental Protection Agency Equivalencies Calculator.

① Brock Commons Phase 1, University of British Columbia. 18-storey wood building, estimated completion in August 2017.

Carbon stored and avoided greenhouse gas emissions: 2,432 metric tons of CO<sub>2</sub>\* Equivalent to 511 cars off the road for a year.\*\*

② Mountain Equipment Co-op, Headquarters, Vancouver, British Columbia. Completed in 2014.

Carbon stored and avoided greenhouse gas emissions: 2,940 metric tons of CO<sub>2</sub>\* Equivalent to 618 cars off the road for a year.\*\*

“In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit.”<sup>1</sup>

<sup>1</sup> Intergovernmental Panel on Climate Change Fourth Assessment Report, 2007, <https://www.ipcc.ch>



Photo: Forest Products Association of Canada

## Forests - Natural Ecosystems, Wildlife Habitat, Renewable Products and Carbon Storage

Unlike mines and farms, forests are diverse ecosystems. As a result they provide many amenities. Forests provide a wide variety of habitats for wildlife species – from mammals and birds to reptiles and amphibians – and influence marine and fish habitats. They filter water for communities and local businesses. They offer areas for recreation, relaxation and enjoyment of nature – places for quality time with friends and families. And, they provide food, fiber and building products that support our quality of life.

Wood is also renewable. As long as forests are managed sustainably, trees can be grown, harvested, replenished, and then harvested again and again in an ongoing cycle of harvest, renewal, and growth.

A great deal of research has been undertaken to determine how forests can be managed to maximize their carbon benefits. According to a new report from the Society of American Foresters<sup>2</sup>, numerous studies of forest carbon relationships show that a policy of active and responsible forest management is more effective in capturing and storing atmospheric carbon than a policy of hands-off management that precludes periodic harvests and use of wood products.

While acknowledging that it is not appropriate to manage every forested acre with a sole focus on carbon mitigation, the report’s authors conclude (among other things), that:

- Wood products used in place of more energy-intensive materials, such as metals, concrete and plastic reduce carbon emissions, store carbon, and can provide additional biomass that can be substituted for fossil fuels to produce energy.
- Sustainably managed forests can provide greater carbon mitigation benefits than unmanaged forests, while delivering a wide range of environmental and social benefits including timber and biomass resources, jobs and economic opportunities, clean water, wildlife habitat, and recreation.

As with all aspects of forestry, choosing not to manage also has consequences, and this also impacts forest lands carbon. Young, healthy forests are carbon sinks because they’re actively absorbing carbon dioxide as they grow. As forests mature, they generally become carbon cycle-neutral because primary productivity declines. Many continue to store substantial amounts of carbon indefinitely— old growth forests in the U.S. and Canada represent significant carbon sinks—but the probability of massive carbon loss also increases. Where forests are killed by large-scale natural disturbances (such as wildfires and insect or disease infestations), they emit their stored carbon without providing the benefits available through product and energy substitution.

According to the Food and Agriculture Organization of the United Nations, “Several aspects of the forest industry’s activities are not adequately captured by looking at only the emissions and sequestration accomplished in the value chain. For example, the use of wood-based building materials avoids emissions of 483 million tonnes of CO<sub>2</sub> equivalent a year, via substitution effects. In addition, by displacing fossil fuels, the burning of used products at the end of the life cycle avoids the emission of more than 25 million tonnes of CO<sub>2</sub> equivalent per year, which could be increased to 135 million tonnes per year by diverting material from landfills.

“Wood products are manufactured from renewable raw material; they are reusable and biodegradable, and they continue to store carbon throughout their lifetime. These characteristics make wood an excellent alternative to many of the materials that are now widely used in construction and consumer goods, which leave a much larger ‘carbon footprint’ and include concrete, steel, aluminum and plastic. Increasing production and consumption of wood products will therefore be part of a sustainable future.”<sup>3</sup>

<sup>2</sup> Managing Forests because Carbon Matters: Integrating Energy, Products, and Land Management Policy, Journal of Forestry, 2011, American Society of Foresters, [www.safnet.org/documents/JOFSupplement.pdf](http://www.safnet.org/documents/JOFSupplement.pdf)

<sup>3</sup> State of the World’s Forests – 2012 United Nations Food and Agriculture Organization

Photo: Brudder



Canada has most of its original forest area. More than half of Canada's forest are naturally reforested, and this is supplemented by the planting of 600 million seedlings per year.



Photo: Brudder

## Green buildings

- Mitigate climate change
- Use less energy and water
- User fewer materials
- Reduce waste
- Are healthy for people and the planet

Cover photographer: Brudder

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