Building Green with Wood

MODULE 13

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_2) and water (H_2O), and release oxygen (O_2). 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.

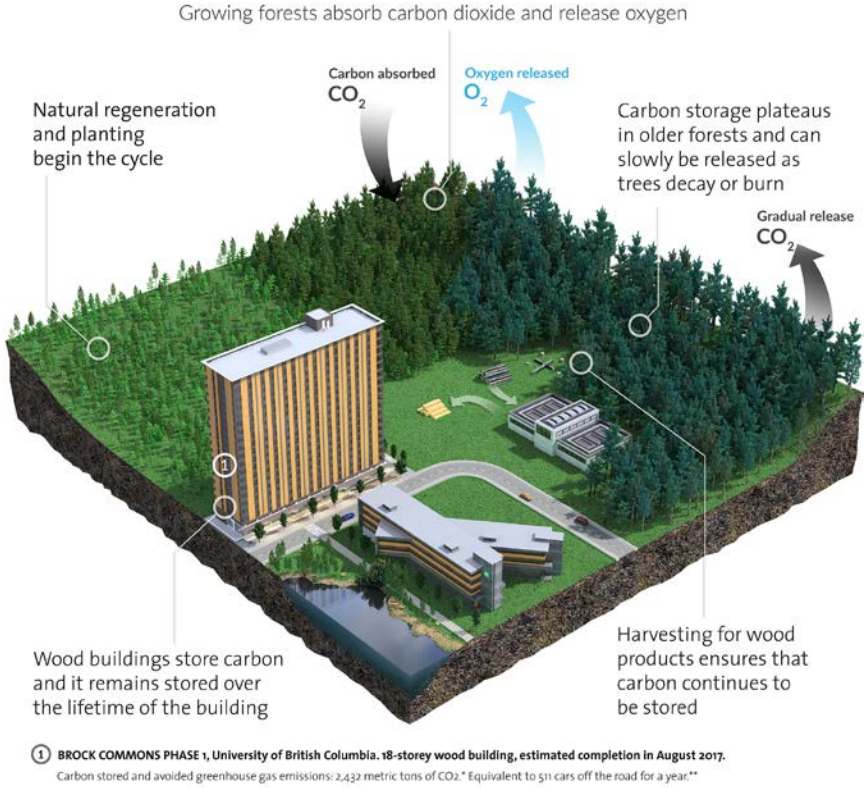
There is growing awareness among building designers that using wood can reduce a building's carbon footprint, provided it comes from a sustainably managed forest. At the core of wood's carbon benefit is the fact that as trees grow they absorb CO_2 from the atmosphere and incorporate the carbon into their 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



*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: C02 on this chart refers to C02 equivalent. Figures calculated May 2016.

**US Environmental Protection Agency Equivalencies Calculator.

Unless the forest area is converted to another use, such as urban development, agriculture or mining, the cycle begins again as the forest regenerates and young seedlings once again begin absorbing CO_2. The market for wood encourages landowners to keep land under forest, helping to avoid large-scale losses of carbon to the atmosphere via land use change.

"IPPC (Intergovernmental Panel on Climate Change) has stated that '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.' The analysis contained in the present report gives strong support to IPCC's assertion that sustainable management of production forests represents an important mitigation option over the long term."[2]

[2] Impact of the global forest industry on atmospheric greenhouse gases, 2010, UNFAO. http://www.fao.org/docrep/012/i1580e/i1580e00.htm

Photo courtesy of Plum Creek

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[1], 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_2 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_2 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."[2]

[1] 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

[2] State of the World's Forests – 2012 United Nations Food and Agriculture Organization

More than ninety percent of forests in the United States are naturally reforested. Additionally, more than 1.5 million acres of forest is replanted in the U.S. annually.

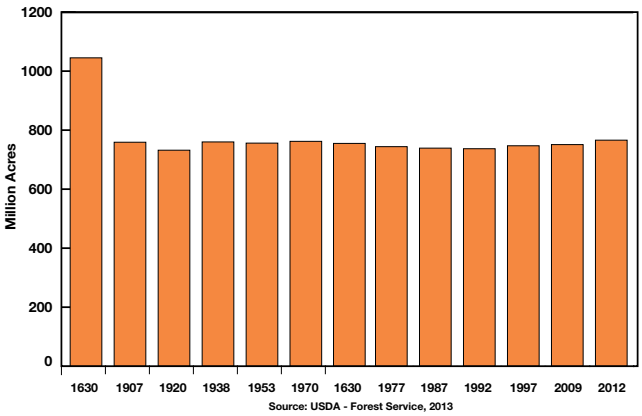
Managing Forest Carbon

The United States has over 750 million acres of forestland. Forests cover about one-third of the nation, and the total forest area in the United States has been stable for about 100 years.[3]

When a tree is cut down, 40 to 60 percent of the carbon stays in the forest, and the rest is removed in the logs, which are converted into forest products.[4] Some carbon is released when the forest soil is disturbed during harvesting, and the roots, branches and leaves left behind release carbon as they decompose.

The amount of carbon dioxide released through harvesting is small compared to what is typically experienced through forest fires and other natural disturbances, such as insect infestations and disease.

Trends in US Forestland Area 1630-2012



[3] National Report on Sustainable Forests - 2010, USDA Forest Service

[4] Does harvesting in Canada's forests contribute to climate change? Canadian Forest Service, 2007, www.sfmcanada.org/images/Publications/EN/CFS_DoesHarvestingContributeToClimateChange_EN.pdf

reTHINK WOOD®

Green buildings

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

On the cover:
Oregon Coos Bay
Photo courtesy of Plum Creek