

Environmental Benefits of Wood Products

Prepared by the
Oregon Forest
Resources Institute

Summary

To moderate society's environmental impact, including human-produced greenhouse gases, we must make informed choices about what building materials to use. Because of its ability to store carbon, its renewability and reusability, and its low embodied energy, wood offers unique environmental benefits over other materials. Oregon, as a top timber- and lumber-producing region, is well positioned to lead the nation in advancing the use of wood products.

The challenge of climate change

Climate change can mean long-term fluctuations in temperature, precipitation, wind and other aspects of Earth's climate and weather. While many factors influence climate, most scientists agree that increasing levels of greenhouse gases (GHGs) – notably, carbon dioxide as a byproduct of combusting fossil fuels – is having a pronounced effect on atmospheric greenhouse gas levels. Extreme weather events, uncharacteristic wildfires, forest insect epidemics and changes in species' distributions may be results of the new climate scenario.

Carbon dioxide is a compound that contains carbon, a chemical element and basic building block of life. Carbon is found in every living thing, from plants to trees to humans. As a part of the carbon cycle, plants and trees absorb carbon dioxide from the air. During photosynthesis, they convert the

CO² to sugars used for cellular growth. As part of that process, they store carbon and release oxygen.

According to the *2010 Oregon Forests Values and Beliefs Study* conducted by OFRI and the Oregon Department of Forestry, slightly more than half of Oregonians are concerned about the potential for global climate change to affect Oregon's forests. Oregonians do not like extremes – either stopping timber harvests or taking no action – to deal with the effects of global climate change, but they do favor government actions to increase carbon storage. Specifically, a majority favors government policies that encourage sustainable management of privately owned forests for wood products, because carbon continues to be stored in wood products after timber harvest, and the replanted forest once again sequesters carbon as it ages. In this regard, Oregonians mirror the view of the Intergovernmental Panel on Climate Change.



Reforestation is Oregon law.

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, fiber or energy from the forest, will generate the largest sustained mitigation benefit.

Intergovernmental Panel on Climate Change,
Fourth Assessment Report, 2007



Managing forests sustainably can enhance the role of forests and wood products as carbon storers.

Environmental benefits of forests, forest management and wood

Due to their high productivity, Oregon forests play a significant role in the local carbon cycle. They remove carbon from the atmosphere and store it in live trees or soil organic matter – a process known as sequestration – releasing it only when the trees are harvested, burn, or die and decompose. Harvested timber is converted into wood products such as lumber, wood panels and furniture that continue to mitigate greenhouse gases by storing carbon indefinitely, until such time as those products are allowed to decompose, are recycled or are burned.

Oregon has been at the forefront of sustainable forest management for decades. As the first state to enact a comprehensive forest practices act, Oregon's

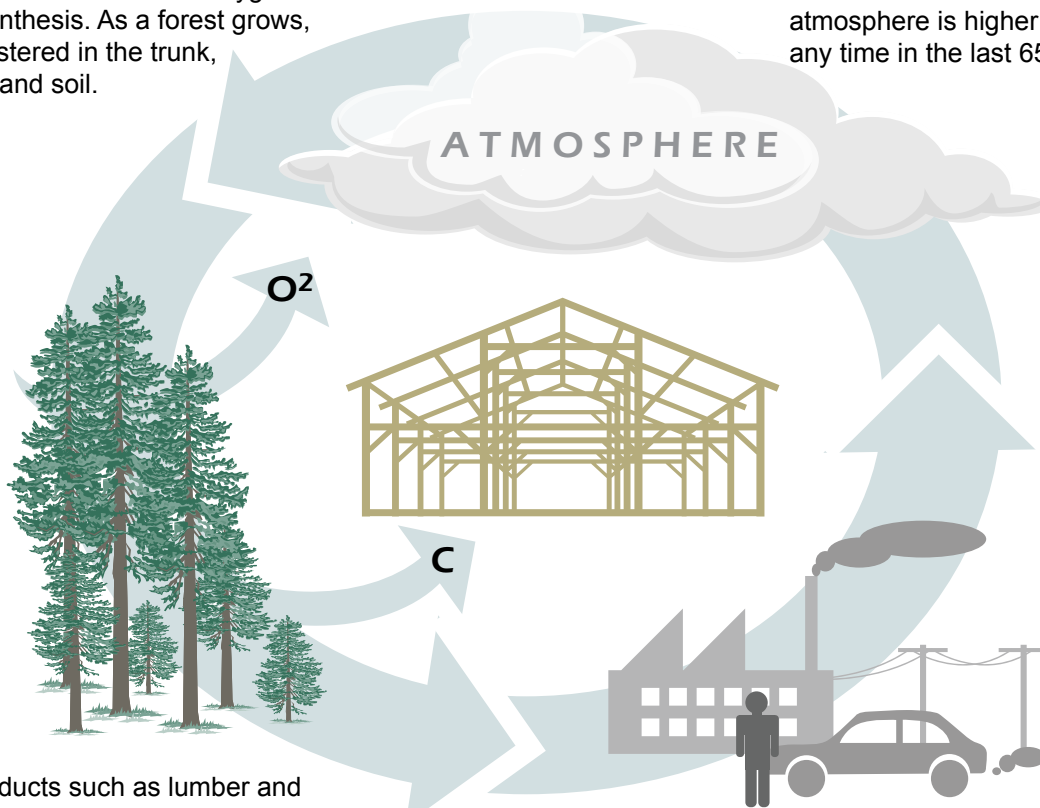
laws and regulations protect the environment and ensure long-term forest health on state and private land. Since its passage in 1971, the Oregon Forest Practices Act has been updated and strengthened based on sound science and changing social values. To assess Oregon forestry, in 2007 the Oregon Board of Forestry endorsed 19 indicators of sustainable forest management, adapted from international conversations on forest sustainability.

Oregon's abundant forests give the state a natural economic competitive advantage. Their beauty and accessibility draw tourists and recreationalists. They provide numerous ecosystem services including clean water, clean air, fish and wildlife habitat, carbon storage and forest products. For decades, the state has been the nation's number-one supplier of structural softwood lumber and plywood

Carbon released. Carbon absorbed. Carbon stored.

Trees absorb carbon and release oxygen through photosynthesis. As a forest grows, carbon is sequestered in the trunk, branches, roots and soil.

The amount of carbon in the atmosphere is higher now than at any time in the last 650,000 years.



Wood products such as lumber and furniture continue to store up to 50 percent of the carbon absorbed by trees.

Carbon is released into the atmosphere by power plants, factories and vehicles.

panels, used primarily in home construction. This pre-eminence as a wood supplier has been accomplished with almost no loss of forested land. Oregon forestlands in 2007 covered nearly 99 percent of the area they occupied in 1630. Statewide, between 2001 and 2005 (the most current data available), timber growth exceeded harvest by approximately 4.5 billion board feet annually (see graphic, next page).

Depending on age and other factors, forests vary in their ability to sequester carbon. For instance, a young planted forest emits more carbon through organic decay than it pulls from the atmosphere. As it matures, a vigorously growing “adolescent” forest sequesters more carbon than it emits and becomes a net carbon sink. Old forests store the most carbon, but as they age, their rate of sequestration slows. When forests die or burn, they become net carbon emitters.

However, when trees are converted into wood products, such as furniture and homes, about 50 percent of the carbon in the log is stored in those products indefinitely, keeping it out of the atmosphere, an attribute not shared by alternative materials such as steel, concrete and masonry. Of course, wood is not appropriate for all applications. For instance, to meet building codes, concrete and steel are the developer’s choice for commercial high-rise buildings. Even so, wood is often the structural and aesthetic material of choice for low- and mid-rise commercial and residential structures.

Oregonians are keenly aware of the benefits of wood. Nearly two-thirds of those participating in the *2010 Oregon Forests Values and Beliefs Study* said they “prefer wood products as alternatives to steel, plastic and cement because they are a better environmental choice.” Further, 69 percent said they “strongly” prefer wood products that come from trees harvested in Oregon.

Wood continues to store carbon and offers these other environmental advantages:

- It is naturally renewable.
- It requires less energy and water to produce than alternatives.
- It is abundant in Oregon and can be sourced and manufactured locally, minimizing transportation and fuel costs.

The case for wood – life cycle assessment

One way to compare the environmental benefits and tradeoffs of building materials is to consider all the environmental costs involved in their manufacture, use and disposal. A tool developed for this purpose is life cycle assessment (LCA), which measures the environmental aspects and potential impacts associated with a product, process or service over its life span. This analysis can provide information regarding which building materials have the lowest environmental impact.

The Consortium for Research on Renewable Industrial Materials (CORRIM) has conducted studies on the impacts of forests and wood products on carbon emissions and sequestration. A nonprofit research collaborative, CORRIM was formed in 1996 to update and expand a 1976 report by the National Academy of Sciences regarding the impacts of producing and using renewable materials. Northwest university participation in CORRIM includes Oregon State University and the University of Washington.

CORRIM's study used LCA to compare homes framed with wood or steel in Minneapolis and homes framed with wood or concrete in Atlanta – the framing types most common to each city.

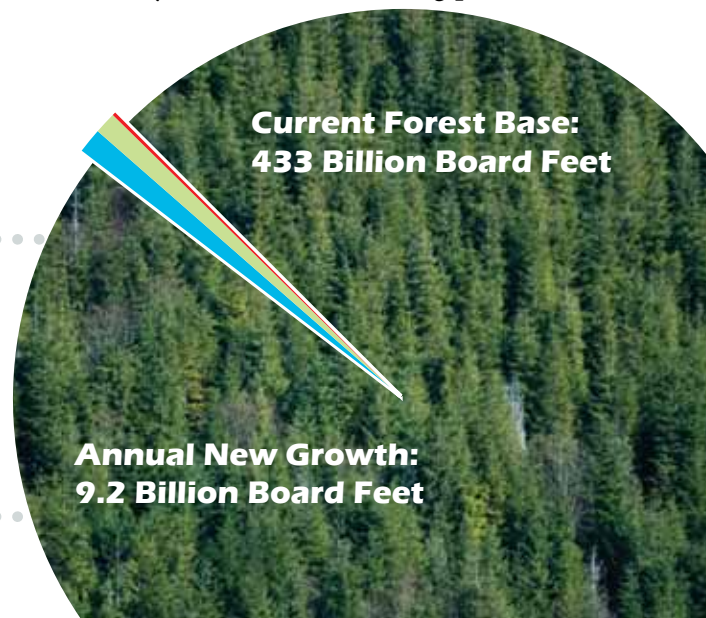
Because the Douglas-fir dominated forests of the Pacific Northwest and the pine-dominated forests of the Southeast are the nation's major suppliers of structural lumber, the researchers chose Northwest lumber for the Minneapolis house and Southeast lumber for the Atlanta house. In almost every category, wood performed better than the alternatives.

Using wood products can benefit the environment

One reason wood products outperform other materials on an environmental basis is their low embodied energy. This refers to the amount of energy needed to harvest, mine, manufacture and transport a material or product to where it will be used. Wood has a low level of embodied energy relative to other building products, giving it a distinct advantage relative to carbon-dioxide emissions. A contributing factor is that bioenergy – that is, non-fossil-fuel energy – accounts for much of the energy used in the modern manufacture of wood products. According to the *Forest Products Journal*, the U.S. wood-products industry is the nation's leading producer

How much forest is there in Oregon?

- The Oregon forest base equals 433 billion board feet (bbf)
Oregon forests add 9.2 bbf of new volume annually
- Every year, on average, about 625 million board feet dies, blows over or catches fire and burns
- In 2001-05, average harvest removed about 4 bbf annually
- Just over 4.5 bbf of new growth is added to the forest base each year



According to CORRIM, the homes framed in steel and concrete required 17 and 16 percent more energy, respectively, than the wood-frame homes. The carbon footprint was also 26 percent higher for the steel-frame houses and 31 percent higher for the concrete-frame homes than the houses framed in wood.

“Tackle Climate Change – Use Wood,” 2009

and consumer of bioenergy, accounting for about 60 percent of the nation’s current renewable energy production.

There are benefits to using wood products other than to mitigate the effects of climate change. Every consumer purchase of a sustainably produced wood product is an economic “vote” for continuing forest as a land cover, and sustainable forest management as its stewardship approach. Because of Oregon’s unrivaled position as a wood-products supplier to the nation – and, potentially, the world – forest management and wood manufacturing are part of the solution to Oregon’s future economic success.

Oregonians participating in the *2010 Oregon Forests Values and Beliefs Study* have major concerns about the future of Oregon’s forests, including forests being converted to non-forest uses. One of the best free-market means of keeping private forestlands in forest use is to provide a strong market for wood prod-

ucts, while at the same time ensuring an adequate and appropriate level of regulations and enforcement to protect environmental and social values.

Oregon building designers have generally positive views of wood as a structural building material and also have a desire to expand its application. According to a 2009 study of design professionals by three Oregon universities – University of Oregon, Oregon State University and Portland State University – designers agreed that the environmental profile of wood is superior to that of concrete and steel; however, they do have a concern about air emissions from formaldehyde-based adhesives used in composite wood products. The study’s authors conclude that “The wood products industry has an opportunity to respond and create new market share in non-residential construction markets by increasing the availability of certified wood products, offering composite wood products free from added formaldehyde, and working with professionals who have a desire to use wood.”

WoodWorks is an initiative of the Wood Products Council, which includes major North American wood associations. One of its publications, “Designing Wood Schools,” lists a number of benefits to using wood as both a structural and finish material:

- Wood is the only building material with third-party certification programs in place to verify that products being sold originate from a sustainably managed resource.
- Wood-frame buildings are energy-efficient and may result in lifetime operational savings.
- The natural warmth of wood provides an inviting and enriching learning environment.
- Wood construction is typically faster, and most communities have a large pool of trade workers



Lumber and furniture continue to store up to 50 percent of the carbon absorbed by trees. (Photo courtesy of The Joinery, Portland)



Local wood plays significant structural and aesthetic roles in the Beaverton library. (Photo courtesy of THA Architecture, Portland)

with wood framing and finishing experience.

- Wood offers design flexibility and structural versatility, a benefit when alterations are required.
- Wood surfaces provide good sound absorption.

Some may argue that wood is not as durable as concrete or steel. However, in a survey of buildings demolished between 2000 and 2003 in Minneapolis/St. Paul, Minnesota, wood buildings had the longest life span. The study concluded there is no significant relationship between the structural system used and the actual life of the building. More significant factors included changing land values, a building's lack of suitability for current needs, and lack of maintenance. Throughout the world, there are many examples of beautiful, long-lived wood structures.

Conclusion

Wood offers a number of environmental benefits over other building materials. It requires less energy to produce. It stores carbon. It's renewable, reusable, recyclable, durable and flexible. The responsible use of wood encourages sustainable forest management. A number of organizations already promote wood and proclaim its benefits. As one of the premier places on Earth to grow trees and produce wood, Oregon has an unparalleled opportunity to support and advance the responsible use of wood. 🌲

SOURCES

BC Forestry Climate Change Working Group and the California Forestry Association, in cooperation with WoodWorks, "Tackle Climate Change – Use Wood." 2009. www.bcclimatechange.ca.

BC Forestry Climate Change Working Group, "Wood as a Green Building Material." Sustainable Wood Products, 2008. www.bcclimatechange.ca.

Consortium for Research on Renewable Industrial Materials. www.corrim.org.

Donnegan, J.; S. Campbell, D. Azuma, tech. eds. "Oregon Forest Resources, 2001-2005: Five-year Forest Inventory and Analysis Report." U.S. Forest Service, Pacific Northwest Research Station. 2008.

Dovetail Partners, Inc., "Potential Game Changers in Green Building: New Developments Signal a Fundamental Shift and Perhaps Significant Opportunity for Building Materials Suppliers." 2010.

Falk, Bob. "Wood as a Sustainable Building Material." Forest Products Journal, September 2009.

Knowles, C.; C. Theodoropoulos, C. Griffin, J. Allen and B. Lockyear. "Oregon Design Professionals Views of Structural Building Products: Implications for Wood." Canadian Journal of Forest Research, 2011.

Oregon Forest Resources Institute, "Building to Benefit the Environment: The Role of Oregon Wood Products in the Green Building Movement." 2009.

Oregon Forest Resources Institute, "Forests, Carbon and Climate Change – A Synthesis of Science Findings." 2006.

Oregon Forest Resources Institute, "Oregon Forest Facts and Figures." 2011.

Oregon Forest Resources Institute, "Oregon Forests Values and Beliefs Study." 2010.

WoodWorks, "Designing Wood Schools." Wood Design and Building Series. 2009. www.woodworks.org.

Cover: The new Hallie Ford Center for Healthy Children and Families under construction at Oregon State University makes extensive use of wood products. (Photo courtesy of THA Architecture, Portland)

**OREGON FOREST
RESOURCES INSTITUTE**

Oregon Forest Resources Institute
317 SW Sixth Ave., Suite 400
Portland, Oregon 97204
971-673-2944
800-719-9195
Oregonforests.org

Paul Barnum, Executive Director
Mike Cloughesy, Director of Forestry
© 2011