Using more wood for construction can slash global reliance on fossil fuels

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A Yale University-led study has found that using more wood and less steel and concrete in building and bridge construction would substantially reduce global carbon dioxide emissions and fossil fuel consumption.

Despite an established forest conservation theory holding that tree harvesting should be strictly minimized to prevent the loss of biodiversity and to maintain carbon storage capacity, the new study shows that sustainable management of wood resources can achieve both goals while also reducing fossil fuel burning. The results were published March 28 in the Journal of Sustainable Forestry.

In the comprehensive study, scientists from the Yale School of Forestry & Environmental Studies (F&ES) and the University of Washington's College of the Environment evaluated a range of scenarios, including leaving forests untouched, burning wood for energy, and using various solid wood products for construction.

The researchers calculated that the amount of wood harvested globally each year (3.4 billion cubic meters) is equivalent to only about 20 percent of annual wood growth (17 billion cubic meters), and much of that harvest is burned inefficiently for cooking. They found that increasing the wood harvest to the equivalent of 34% or more of annual wood growth would have profound and positive effects:

- Between 14% and 31% of global CO_2 emissions could be avoided by preventing emissions related to steel and concrete; by storing CO_2 in the cellulose and lignin of wood products; and other factors.

- About 12% to 19% of annual global fossil fuel consumption would be saved including savings achieved because scrap wood and unsellable materials could be burned for energy, replacing fossil fuel consumption.

Wood-based construction consumes much less energy than concrete or steel construction. Through efficient harvesting and product use, more CO_2 is saved through the avoided emissions, materials, and wood energy than is lost from the harvested forest.

"This study shows still another reason to appreciate forests — and another reason to not let them be permanently cleared for agriculture," said Chadwick Oliver, the Pinchot Professor of Forestry and Environmental Studies, director of the Global Institute of Sustainable Forestry at F&ES and lead author of the new study. "Forest harvest creates a temporary opening that is needed by forest species such as butterflies and some birds and deer before it regrows to large trees. But conversion to agriculture is a permanent loss of all forest biodiversity." The manufacture of steel, concrete, and brick accounts for about 16 percent of global fossil fuel consumption. When the transport and assembly of steel, concrete, and brick products is considered, its share of fossil fuel burning is closer to 20% to 30%, Oliver said.

Reductions in fossil fuel consumption and carbon emissions from construction will become increasingly critical as demand for new buildings, bridges and other infrastructure is expected to surge worldwide in the coming decades with economic development in Asia, Africa, and South America, according to a previous F&ES study. And innovative construction techniques are now making wood even more effective in bridges and mid-rise apartment buildings.

According to Oliver, carefully managed harvesting also reduces the likelihood of catastrophic wildfires. And maintaining a mix of forest habitats and densities in non-reserved forests — in addition to keeping some global forests in reserves — would help preserve biodiversity in ecosystems worldwide, Oliver said. About 12.5% of the world's forests are currently located in reserves.
"Forests historically have had a diversity of habitats that different species need," Oliver said. "This diversity can be maintained by harvesting some of the forest growth. And the harvested wood will save fossil fuel and CO2 and provide jobs — giving local people more reason to keep the forests."

The article, "Carbon, Fossil Fuel, and Biodiversity Mitigation with Woods and Forests," was co-authored by Nedal T. Nassar of the Yale School of Forestry & Environmental Studies and Bruce R. Lippke and James B. McCarter of the University of Washington.

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