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COLUMN: Is wood a sustainable construction material? The answer is not clear-cut

By Colin Isaacs
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A recent article in the Journal of Sustainable Forestry illustrates the complexity of lifecycle analysis and similar tools when comparing the environmental impacts, in this case the greenhouse gas (GHG) impacts, of various technologies or systems.

The conclusion of the research is that, given the right approach, wood can be a more sustainable construction material than either steel or concrete. This finding, by researchers in the School of Forestry and Environmental Studies at Yale University and in the College of the Environment at the University of Washington in Seattle, flies in the face of many of the claims that have been made by the steel and cement industries and may be somewhat surprising to those who have promoted the environmental benefits of either of the two manufactured materials or who have come to believe that forests need to be saved.

The reasons for this finding include the following:

- using solid wood products avoids carbon dioxide (CO_2) emissions from substitute materials.
- storing wood in products so that it does not rot or burn serves as a carbon sink.
- using wood displaces the need for fossil fuels that are used in manufacture of other materials such as steel and cement.
- forests contribute more to carbon sequestration if they are appropriately harvested than if they are left in a natural state.

The study notes that any pathway for use of wood could lead to conditions where excess GHGs are emitted. For example, storing wood waste in landfills where it does not break down, serves as a carbon sink (sequestration); if the conditions are such that the wood does break down then it will form methane,

which is a powerful GHG. The method of use and subsequent recycling of the material is often as important as the selection of a material.

The study asks whether wood use in construction has meaningful enough GHG savings to warrant preferential policies. The answer appears to be that it does, that forests can regrow at a rate faster than the rate at which they are currently being used, particularly under sustainable management, but that clarification is needed on appropriate forest management techniques and carbon sequestration measures if GHG benefits of wood utilization are to be optimized.

In terms of availability of wood to provide for additional long-term uses, the study notes:

- that the world is currently harvesting about 20% of the forest's potential growth if managed with moderate intensity.
- that the additional wood that needs to be harvested to replace steel and concrete so that the world's fossil fuel energy consumption is reduced 10% annually through construction savings varies dramatically with efficiency of wood product use.
- that additional GHG savings could be gained if wood waste is used to displace fossil fuels as energy source.
- that young forest stands sequester energy more rapidly than old stands, so use of younger trees may be preferable.

The authors conclude that, globally, both enough extra wood can be harvested sustainably and enough infrastructure of buildings and bridges needs to be built to reduce annual CO_2 emissions by 14 to 31% and fossil fuel consumption by 12 to 19% if part of this infrastructure were made of wood.

No doubt this controversial study will face its share of contrary arguments. However, if nothing else, it serves to illustrate the range of factors that need to be considered when evaluating GHG implications of certain material uses and the complexity of policy decisions that must be made when planning for reduced GHG emissions. The principles applied in this paper may also be applicable to decisions regarding environmental and climate impacts of other materials. For example, using landfills as a means of sequestering fossil carbon resources, *e.g.* plastics, may be preferable to burning those resources for energy if energy needs can be achieved through non-carbon and low-carbon resources such as wind, solar, or hydro power. Recycling of resources, if carried out in a low energy utilizing system, may also be preferable to producing materials from new fossil resources.

The report also illustrates that placing boundaries around lifecycle analyses may lead to incorrect conclusions. Many of the impacts of product use arise from raw material production and end-of-life management. For example, if wood is burned at the end of its life the sequestration benefit is lost. If the burning displaces fossil fuel use then there is still a GHG benefit. If the burning serves to increase energy consumption, displace energy efficiency, or reduce the opportunity for low-carbon wind or solar power then burning of the wood is contributing additional and unnecessary CO_2 to the atmosphere. These are complex topics that require much more study before policy decisions having long-term consequences are made.

The full study report can be found at http://www.tandfonline.com/doi/pdf/10.1080/10549811.2013.839386.

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